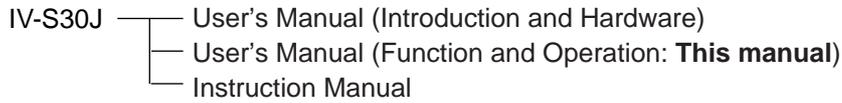**SHARP** ®

Compact image sensor camera

IV-S30J

User's Manual (Function and Operation)

Thank you for purchasing the SHARP IV-S30J compact image sensor camera. 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-S30J manuals as follows. Read them in conjunction with this manual.

IV-S30J ┬── User's Manual (Introduction and Hardware)
        ├── User's Manual (Function and Operation: **This manual**)
        └── Instruction Manual

Manual type	Major subjects	How to use
IV-S30J User's Manual (Introduction and Hardware)	- Outline of the IV-S30J (features and functions) - Description of the hardware - Startup method - General performance specifications. - Example of operation and instruction	- Become acquainted with the IV-S30J - Learn how to install the IV-S30J and wire it up - When mastering the outline of operation.
IV-S30J User's manual (Function and Operation)	- Detailed explanations of all the measurement functions. - How to make menu selections for each measurement - 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. - Lear 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.

Table of Contents

Chapter 1: Setting and Operating Outline

1-1 Setting and operating procedures

This paragraph describes the rough operation sequence of the IV-S30J.

① **System design**　　　　　　　　　　　　　　　　　　**(Ref. chapter)**

Plan your hardware environment to suit your use of the IV-S30J.　User's manual
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(Introduction and Hardware)

- Measurement program (positional deviation
  measurement, degree of match inspection, etc.) ------------ 1-3 Measurement programs
- Number of cameras, externally connected devices, ------------ 3-1 Basic system configuration
  system components
- Input/output (start measurement input, result ------------ 3-2 System configuration examples
  output, object type change, etc.)
- Lighting equipment, illumination, shutter speed, lens, etc. ---------- 5-1 Installation conditions

② **Installation/assembly**

Install the hardware you will be using.
- Connection of cameras and monitor to the controller
- Installation of the controller and camera body ------------ User's manual
- Connection of a power supply, input/output terminals 　(Introduction and Hardware)
  and external devices 　　　　　　　　　　　　　　　5-2 to 5-4 Installing, connecting,
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　and wiring methods

③ **Turning ON the power supply (controller and monitor)**

Supply power to each device.

④ **Environment settings**

Set IV-S30J parameters according to the actual hardware environment.
- Setting the Input/Output conditions ------------------------ Chapter 16
- Communication ------------------------ Chapter 17
- Computer link ------------------------ Chapter 18
- Gain/offset adjustment ------------------------ Page 2-15

⑤ **Enter measuring programs**

　　　　　　　　　　　　　　　　　　　　　　　User's Manual
　　　　　　　　　　　　　　　　　　　　　　　(Introduction and Hardware)
・**Entered using the**　・**Entered using the** ------------ Chapter 7: Setting Examples
　wizard　　　　　　　**menu tree**　　　　　　　　　　　Using the Set Wizard
　　　　　　　　　　　　　　　　　　　　　　　Chapter 8: Setting Examples
　　　　　　　　　　　　　　　　　　　　　　　　　　　Using the Menu Tree
　　　　　　　　　　　　　　　　　　　　　　　6-4 Operation chart

⑥ **Editing Operation screen** ------------ User's Manual
　　　　　　　　　　　　　　　　　　　　　　　(Introduction and Hardware)
　　　　　　　　　　　　　　　　　　　　　　　6-7 Editing operation screen

⑦ **Other settings**

　　　　　　　　　　　　　　　　　　　　　　　User's Manual
・**Initialization**　　　・**Self Diagnosis** ------------ (Introduction and Hardware)
　　　　　　　　　　　　　　　　　　　　　　　6-8 Option

⑧ **Operation**

⑨ **Test/inspection** ------------ Chapter 19: Troubleshooting

⑩ **Maintenance** ------------ Chapter 19: Troubleshooting

1

1-2 Method for selecting the menu configuration

(1) Set wizard

The IV-S30J has a "Set Wizard" function to assist beginners in setting the measurement conditions.

Select "SET WIZARD" from the "MAIN MENU" and the wizard will show the items
needed for each step. You only need to make selections according the instructions
on the screen. Using the wizard, you can establish the minimum required settings
for making measurements.

IVS30J
- SYS-CND
- OBJECT TYPE COND
- SET WIZARD
- EDIT MAIN OPS MENU
- OPTION

```
STEP1
SELECT THE MEASUREMENT
START INPUT I/F
①PARALLEL+SERIAL     ■
②TRIG CCD START      □

NEXT   DETAIL
```

```
STEP2
SELECT AN IMAGE CAPTURING
METHOD DURING OPERATION
①PARTIAL-IMG         ■
②ALL IMAGE           □
③NO CAPTURED         □
- - - - - - - - - - - - - - - - - - - -
ENTER A SHUTTER SPEED
(1/30~1/10000)
①SHUTTER SPEED    1/00060

RETURN   NEXT
```

…

```
STEP9
STORE THIS SETTING AS A
SAMPLE IN THE WIZARD?
①NO                  □
②YES                 ■

RETURN   END
```

The steps that the set wizard takes you through are displayed
as lists on the "operation chart." At any point you can return to
the previous step to make a change if you want to.

```
TYPE00
Start
STEP1:PARALLEL+SERIAL
STEP2:CAPTURE IMG/PARTIAL-IMG
STEP3:MEAS1/CAM1
STEP4:MEAS1/BIN-AREA
STEP5:MEAS1/WINDOW/MASK,1
STEP6:MEAS1/MEAS CND
STEP7:MEAS1/EVALUATION
STEP8:MEAS1/CALC
STEP9:MEAS1/OUT
STEP10:FINAL NUMERIC CALC
STEP11:FINAL OUTPUT COND
STEP12:SERIAL OUTPUT/ANY
STEP13:OPS MENU COND
STEP14:CALIBRATION/YES
STEP15:MOVE ALL WINDOW/YES
STEP16:TITLE/YES
End
```

Wizard

The "Wizard" is a program that helps users make settings for measurement operations easily and
without making mistakes. The controller asks you a series of questions at each step and you
simply answer these to complete the settings.
The wizard is convenient for making settings when beginners and inexperienced operators are
operating the machine. However, operators who are familiar with the operation may save a lot of
time by using other setting methods.

1

(2) Menu tree
The IV-S30J has a menu tree which is shown the hierarchy of choices on each screen. To return to the previous screen or go to next screen, select the corresponding item on the menu tree.

```
OBJECT TYPE COND
 ⊞ TYPE00
 ⊟ TYPE01
     ── TYPE RUN COND
     ── IMAGE-ADJ
     ⊟ MEA-CND(CAMERA1)
         ── MEAS0 (POSI-DEVIATION)
         ── POSI-CORRECT
         ⊞ MEAS01(MEAS-BIN-AREA)
         └─ MEAS(NEW)
     ⊞ MEA-CND(CAMERA2)
     ── FINAL NUM. CALC
     ── FINAL OUTPUT COND
     ── OBJ-TYPE I/0
     └─ OBJ-TYPE SYS.
 └ TYPE(NEW)
```
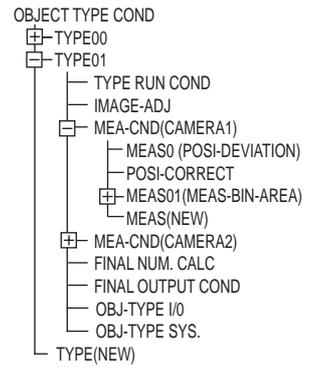
■ **How to enter the menu tree**
On the "MAIN MENU" select "OBJECT TYPE COND" to enter the menu tree.
⊞ and ⊟ mean that a sub men is available inside the menu.
Select ⊞ and press the SET key or the right arrow key, the next level of menu will be opened.
When ⊟ is shown, it means that the lower menu level is already open.

```
IVS30J
    ── SYS-CND
    ── OBJECT  TYPE  COND
    ── SET  WIZARD
    ── EDIT MAIN OPS  MENU
    └─ OPTION
```

```
                              OBJECT TYPE COND
                               ⊞ TYPE00
                               ⊟ TYPE01
                                   ── TYPE RUN COND
                                   ── IMAGE-ADJ
Sub menu is          ──────▶     ⊟ MEA-CND(CAMERA1)
displayed                            ── MEAS0 (POSI-DEVIATION)
                                     ── POSI-CORRECT
Have sub menus       ──────▶         ⊞ MEAS01(MEAS-BN-AREA)
not yet displayed                    └─ MEAS(NEW)
                            ▶      ⊞ MEA-CND(CAMERA2)
                                   ── FINAL NUM. CALC
                                   ── FINAL OUTPUT COND
                                   ── OBJ-TYPE I/0
                                   └─ OBJ-TYPE SYS.
                               └ TYPE(NEW)
```

1

[1] Menu configuration

```
— SYS-CND ———————————— I/O CONDITIONS
— OBJECT TYPE COND ————— COMM.SET
— SET WIZARD ———————————— COMPUTER LINK
— EDIT MAIN OPS MENU ——— GAIN.OFFSET
— OPTION ————————
```

```
              — TYPE00 ——— TYPE RUN COND
                          — IMAGE-ADJ                                    (*1)
                          — MEA-CND(CAMERA1) ——— MEAS0 (POSI-DEVIATION) —
                          — MEA-CND(CAMERA2)     — POSI-CORRECT
                          — FINAL NUM.CALC       — MEAS01
                          — FINAL OUTPUT COND    — MEAS02
                          — OBJ-TYPE I/O         — MEAS03  *2
                          — OBJ-TYPE SYS.        — MEAS04
 (Max. 16 object types)
                                                  — IMG PRE-PROC
                                                  — MEAS CND ——————— REG-COND (S)
                                                                     — REG-COND (E)
                                                  — EVALUATION COND
                                                  — DISTANCE & ANGLE COND ——— NUM-CALC
                                                                              — OUT-COND
              — TYPE15                            — NUM-CALC
                                                  — OUT-COND
              — ①CHG-TYPE
              — ②STANDARD WIZARD
              — ③OPERATION CHART

              — MAIN OPS MENU

              — ①INITIALIZATION
              — ②SELF DIAGNOSIS
```

*1: MEAS0 is only for making for "positional deviation measurements."
*2: MEAS01 to 04 can be set to make any type of measurement from "positional deviation
    measurements" to "multiple degree of match inspections."

[2] Configuration of the setting conditions

System conditions

- I/O conditions (16-1)
  Measurement start input I/F, parallel input X5, parallel input X6, strobe output
- Object type manual change (2-14)
- Communication setting (17-1)
  Communication standard, communication speed, data length, parity, stop bit, station number
- Computer link (18-1)
  Manufacturer, station number, top line of the written results
- Gain/offset (2-15)

Operating conditions

The numbers in parentheses ( ) are page numbers for your reference.

Output monitor (2-2), image capture (2-4), message display (2-5), pattern display (2-6), binary image display (2-7), θ angle correction image display (2-8), operation main display (2-9), evaluation change display (2-10), PC monitor screen (2-11), through display (2-11), extension functions (2-12).

Measuring conditions

Object type 00

Camera 1 and 2

Measuring program

Image pre-processing (3-20)

Measurement 0, camera 1

Measurement 0, camera 2

Measurement 1

Measurement 2

Measurement 3

Measurement 4

Input and output for each object type

System for each object

Positional deviation measurement ⇨ See Chapter 4

Positional deviation measurement, degree of match inspection, lead 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 inspection.

See ⇨ Chapters 4 to 12.

CCD trigger (16-18), shutter speed (3-36), serial output (16-24, 26), calibration setting (16-28).

Monitor light level (3-34), stop NG measurement (3-38), window group move (3-39)

Camera 1

Same for Camera 1 and 2. However, "Measurement 0, Camera 2" is not available.

Object type 01
.
.
Object type 15

Same for "Measurement 00."

1

[3] Configuration of Set Wizard

The Set Wizard has the following screen configuration.

```
┌─────────────────────────────────────────────────────┐
│ SET WIZARD SCREEN SAVE DEL              F  C1  BRT   │
├─────────────────────────────────┬───────────────────┤
│ [SAMPLE]                         │                   │
│ ①CHG-TYPE                        │                   │
│ ②STANDARD WIZARD                 │ TYPE00            │
│ ③OPERATION CHART                 │ Start             │
│                                  │ End               │
│                                  │                   │
│                                  │                   │
└─────────────────────────────────┴───────────────────┘
```

```
┌─────────────────────────────────┐
│ STEP1                            │
│                                  │
│ SELECT THE MEASUREMENT           │
│ START INPUT I/F                  │
│                                  │
│ ①PARALLEL+SERIAL+USB      ■      │
│                                  │
│ ②TRIG CCD START           □      │
│                                  │
│ NEXT   DETAIL ─────────────────────────┐
└─────────────────────────────────┘      │
          When "DETAIL" is selected.     ▼
```

```
┌────────────────────────────────────┐
│ COMM.SET      SCREEN COND SAVE      │
│                                     │
│ ①COMM.STANDARD  RS232C              │
│ ②BAUDRATE (kdps)  115.2             │
│ ③NO.OF DATA BITS  7BIT              │
│ ④PARITY CHECK     EVEN              │
│ ⑤NO.O STOP BITS   2BIT              │
│ ⑥STATION NO.      00(0~7F)          │
└────────────────────────────────────┘
```

```
┌─────────────────────────────────┐
│ STEP2                            │
│                                  │
│ SELECT AN IMAGE CAPTURING        │
│ METHOD DURING OPERATION          │
│ ①PARTIAL-IMG              ■      │
│ ②ALL IMAGE                □      │
│ ③NO CAPTURED              □      │
│ - - - - - - - - - - - - - - - -  │
│ ENTER ASHUTTER SPEED             │
│ (1/30~1/10000)                   │
│ ①SHUTTER SPEED   1/00060         │
│                                  │
│                                  │
│ RETURN  NEXT                     │
└─────────────────────────────────┘
```

```
┌─────────────────────────────────┐
│ STEP3                            │
│                                  │
│ CORRECT POSITION?                │
│ ①NO                       ■      │
│ ②CAM1                     □      │
│ ③CAM2                     □      │
│                                  │
│                                  │
│                                  │
│ RETURN  NEXT                     │
└─────────────────────────────────┘
```

```
┌─────────────────────────────────┐
│ STEP3                            │
│                                  │
│ SELECT A CAMERA TO SPECIFY       │
│ MEASUREMENT CONDITIONS           │
│ ①NO REGISTRATION          ■      │
│ ②CAM1                     ■      │
│ ③CAM2                     □      │
│                                  │
│                                  │
│ RETURN  NEXT                     │
└─────────────────────────────────┘
```

When "②CAM1" or "③CAM2" is selected.

When "①NO REGISTRATION" is selected.

```
┌─────────────────────────────────┐
│ STEP4                            │
│                                  │
│ SELECT AN IMAGE PROCESSING       │
│ METHOD                           │
│ ①GRAY-SRC PROCESS         ■      │
│ ②BINARY PROCESS           □      │
│ - - - - - - - - - - - - - - - -  │
│ ①MEAS POSI-DEVIAT         ■      │
│ ②MEAS MULTI-POSI          □      │
│ ③DETECT DEG-MAGCH LE      □      │
│ ④MEAS MALTI-MATCHES       □      │
│ ⑤INSPECT LEADS            □      │
│ ⑥MEASURE POINT DENSI      □      │
│                                  │
│ RETURN  NEXT                     │
└─────────────────────────────────┘
```

1-6

1

STEP4

SELECT TYPE OF CALCUATION
BETWEEN IMAGES
①COMPARE IMGS   NO
- -
SELECT WHETHER OR NOT TO
CONVERT IMGE DENSITY
①CHNG GRAY LEVELNO
- -
SELECT FILTER TYPE FOR
IMAGE DATA
①SPACE FILTER   NO

RETERN   NEXT   DETAIL

COMPARE IMGS   SCREEN   SAVE
_____

①CALC.TYPE   NO
②CALC.AREA   SET   (232,216)-(279,263)

①Displayed when the "CAM1" or "CAM1&2" is selected in item "①COMPARE IMGS"

STEP5

①REGISTER NO.(0~7) 0
- -
SELECT AN IMAGE PROCESSING
①NO   ☐
②GRAY-SRC   ■
③EDGE DTECT   ☐
④SCH-EDGE   ☐
- -
①NUM.OF DTECT   1P
- -
ENTER A RANGE AND UNITS FOR
ROTATION ANGLE DETECTION
①DTECT ANGL   NO

RETURN   NEXT   DETAIL

REG COND   SCREEN   COND SAVE DETAIL
_____

①REGISTER NO.   0(0~7)
②MEAS SHAPE(MDL0)   RECTANGLE
③REFIMG AARE(MDL0)   SET   (224,208)~(287,271)
④SEARCH ARE(MDL0)   SET   (216,200)~(295,279)

STEP6

SELECT INSPECTION PRECISION
①STANDARD(PIXEL) ■
②HIGH(SUB-PIXAEL) ☐

RETURN   NEXT

STEP7

COMPARE EVALUATION
CONDITIONS TO MEASUREMENT
RESULTS (YES/NO)
①NO   ☐
②YES   ■

RETURN   NEXT   DETAIL

EVALUAT COND   SCREEN COND SAVE EDIT SEL   F C1 BRT
_____

①REGISTER NO.   0(0~7)   [TEST RESULT]   [OUTPUT]
②CONDITION SET   AUTO(–10%)
③X COORD. (MDL0) 000.0~511.0   X0=   NO
④Y COORD. (MDL0) 000.0~479.0   Y0=   NO
⑤x DEVIATE (MDL0) -511.0~+511.0   x0=   NO
⑥y DEVIATE (MDL0) -479.0~+479.0   y0=   NO
⑦MATCH LVL(MDL0) -10000~+10000   M0=   NO

⑧TEST   EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)

1

STEP8

USE SETTING DISTANCE
ANGLE CONDITIONS (YES/NO)

①NO　　■
②YES　　□

RETURN　NEXT　DETAIL

Displayed when "②YES"
is selected

DEST&AGL COND SCREEN　COND　SAVE　　　　　　F　C1　BRT

①OBJ　　　　　DST
②DISTANCE　　00(0~15)
③DISTANCE　　NO

　　　　　　　　　　　　　　[TEST RESULT]　　　　[OUTPUT]

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

STEP8

COMPARE MEASUREMENT
SETTINGS TO MEASUREMENT
RESULTS (YES/NO)
①NO　　　　　　　■
②YES(MEAS)　　　□
　　　　　　DETAIL
③YES(DST&AGL)
　　　　　　DETAIL
RETURN　NEXT

Displayed when "②YES" or
"③YES" is selected

NUMERIC CALC SCREEN　COND　SAVE　　　　　　F　C1　BRT
【N00-N07】
CHG-CALC
①RUN A TEST　　　(SET　KEY)
　　　　　OBJEC FORMULA
NO0 ----- -------------------------------
NO1 ----- -------------------------------
NO2 ----- -------------------------------
NO3 ----- -------------------------------

STEP8

LADDER CIRCUIT AND RESULT
OUTPUT BASED ON MESUREMENT
AND CALCULATION RESULTS(
YES/NO)
①NO　　　　　　　■
②YES(MEAS)　　　□
　　　　　　DETAIL
③YES(DST&AGL)
　　　　　　DETAIL
RETURN　NEXT

Displayed when "②YES" or
"③YES" is selected

OUTPUT COND　SCREEN　COND　SAVE　　　　　　F　C1　BRT
INPUT00-07
　CHANGE INPUT

　　　　　　　0　1　2　3　4　5　6　7　OUT

INPUT00
LOGIC
INPUT02
LOGIC
INPUT03

STEP8

ADD MEASUREMENT CONDITIONS?
①NO　　　　　　　■
②YES　　　　　　□

RETURN　NEXT

STEP8

CALCULATE SETTINGS FOR ALL
MEASUREMENT RESULTS(YES/NO).
①NO　　　　　　　■
②YES　　　　　　□

RETURN　NEXT

1

STEP8

SET LADDER CIRCUIT RESULT
OUTPUT BASED ON ALL
MEASUREMENT AND CALCULATION
RESULTS (YES/NO)
①NO ■
②YES □

RETURN NEXT DETAIL

OUTPUT COND SCREEN COND SAVE F C1 BRT

INPUT00-07
  CHANGE INPUT

　　　　　　　 0 1 2 3 4 5 6 7 OUT
INPUT00
LOGIC
INPUT01
LOGIC
INPUT02
LOGIC
INPUT03

Displayed when "②YES"
or "③YES" is selected.

STEP8

SELECT AN INTERFACE FOR
OUTPUTTING RESULTS WHEN THE
INPUT IS THE PARALLEL I/F
①NO ■
②COMPUTER LINK □
③SERIAL I/F □

RETURN NEXT DETAIL

Displayed when "②COMPUTER LINK" is selected

COMPUTER LINK SCREEN COND SAVE

①PC MANUFACTURER SHARP(COMM PORT)
②STATION NO. 01
③WRITE TOP ADRS 09000

Displayed when
"②COMPUTER LINK" or
"③SERIAL I/F" is
selected.

Displayed when "③SERIAL I/F" is selected

COMM.SET SCREEN COND SAVE

①COMM.STANDARD RS232C
②BAUDRATE(kdps) 115.2
③NO.OF DATA BITS 7BIT
④PARITY CHECK EVEN
⑤NO.OF STOP BITS 2BIT
⑥STATION NO. 00(0~7F)

STEP9

CHANGE DISPLY CONTENTS OF
THE MAIN OPS MENU
①NO ■
②YES □

RETURN NEXT DETAIL

TYPE RUN COND SCREEN SAVE

①MONITOR OUTPUT CAM1
②CAPTURE IMG PARIAL-IMG
③MESSAGE DISPLAY YES(NUMERIC)
④PATTERN DISPLAY YES
⑤SHOW BINARY IMG YES
⑥SHOW FIX IMG YES
⑦OPS MAIN DISP YES
⑧DISP CHG-EVAL NO
⑨PC-MNTR NO
⑩THROUCH DISPLAY NO
⑪EXTENSION FUNC. NO

Displayed when "②YES" is
selected.

STEP9

STORE A TITLE FOR THIS
SETTING?
①NO □
②YES ■

RETURN NEXT DETAIL

STR OBJ TITLE SCREEN SAVE F C1 BRT

　　　　　 A B C D E F G H I J K L M
　　　　　 N O P Q R S T U V W X Y Z
AREA__ 0 1 2 3 4 5 6 7 8 9
　　　　　 - - ( ) < > SP
　　　　　 ← → DEL END

Displayed when "②YES" is
selected.

STEP9

STORE THIS SETTING AS A
SAMPLE IN THE WIZARD?
①NO □
②YES ■

RETURN END

1

1-3 Description of the Operation screen

When the IV-S30J is started, the operation screen shown below will appear.
Each area of the operation screen is described below.

① Object type number   ② Freeze/through screen
                                         ③ Camera currently selected

（TYPE00）   F   C1 BRT ── ④ Image brightness: bright/dark

⑥ Measuring time   V*.**

MEAS   0000ms
MEASURE 0 CAM1 NO   ⑤ Software version

⑦ Measurement
setting details

⑧ I/O relay   ⑨ READY output

X0~6□□□□□□□   Y0~7□□□□□□□   READY▉
⑩ Menu display   MNU-CHG MAIN-COND CHG-MEA COND-CHG CHGN-REG SCREEN-CHG CHGTYPE

① Displays the number of the currently selected object.

② Select whether to display captured images on the screen as freeze images or through images.

Display method	Description
Through image	- Displays the stream of images captured by the camera. - Used for adjusting the camera focus and image properties.
Freeze image	- Displays the single image captured at the start of making measurements. - Used to set each of the measurement conditions and operating conditions.

To switch the image between "Through" and "Freeze" modes, press the SEL key on the remote keypad, and then press the up and down arrow keys.

③ Indicates which camera is currently selected
C1: Camera 1 (the camera connected to the "CAMERA1" connector)
C2: Camera 2 (the camera connected to the "CAMERA2" connector)

④ The brightness of the captured image can be set to one of two levels.

Screen display	Description
Bright	Display the captured image without changing its brightness.
Dark	Display the captured image at 1/2 the actual brightness

How to select the brightness level
On any screen, except the operation screen, move the cursor to the "F" (freeze) or "T" (through) position on the upper part of the screen by pressing the SEL key. Then, press the left or right arrow key to move the cursor to the "BRT" (bright) or "DRK" (dark) indicator. Press the up or down arrow key to switch between bright and dark.

⑤ Displays the software version.

⑥ Displays the measurement time currently assigned.

| ← Actual measurement time → |
| (Only when changing the object type) |

Time to change object type	CCD exposure time (Shutter operation time)	CCD image capture time	Image processing time	Result output time
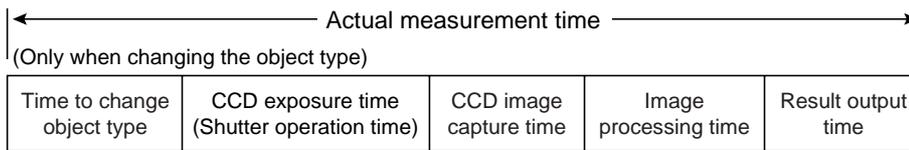
- Serial communication time is not included.
- Set the controller as follows to reduce the measurement time.
1. Increase the shutter speed.
2. Select the "partial" image capture feature for the CCD.
3. Select "NO" for the measurement results display (message display, pattern display, and binary image display).

⑦ Display setting details of each measurement.

MEASURE 0   CAM1   NO
    ↑   ↑   ↑
Measurement   Camera 1 or   Measurement
numbers from 0 to 4   camera 2   program name
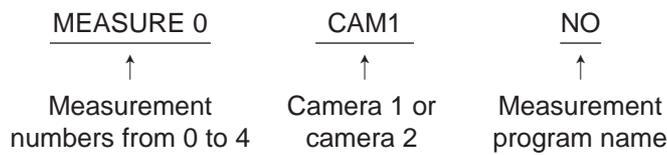
⑧ Displays the status of input relays X0 to X6: OFF [□], ON [■].
  Displays the status of output relays Y0 to Y7: OFF [□], ON [■].

⑨ Displays the status of the ready output: OFF [□], ON [■].

⑩ The menu bar at the bottom has two rows. When this menu is selected, the second row will appear.

| MNU-CHG | MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE |

↕

| MNU-CHG | CHG-C1 CHG-C2 MANL-MEAS SHORTCUT |
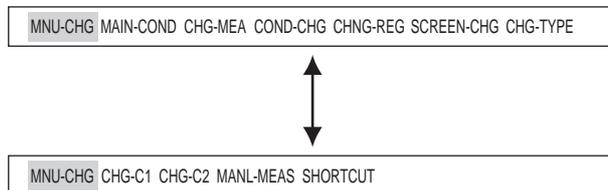
The details of each item on this menu bar are shown on the next page.

1

■ **Details of each item on the menu bar**

Item on the menu bar	Description	Display detail on the screen
MAIN-COND (main conditions)	Displays the MAIN screen.	IVS30J — SYS-CND — OBJECT TYPE COND — SET WIZARD — EDIT MAIN OPS MENU — OPTION
CHG-MEA (Change measurement)	Press the up and down arrow keys to change the display of the evaluation results for each measurement number. (Measurement 0 camera 1 -> measurement 0 camera 2 -> Measurement 1 -> Measurement 2 -> Measurement 3 -> Measurement 4)	MEASURE0 CAM1 NO ↑ This part changes.
COND-CHG (Change the measurement conditions)	Displays the condition change selection list. Change the conditions that get displayed by pressing the up and down arrow keys. For details about the measurement conditions, see pages 8-3 and 8-8 in Introduction and Hardware and Chapter 3 in this manual. For details about the distance and angle conditions, see page 14-2 in this manual. For details about the numeric value calculation conditions, see page 15-7 in this manual.	MEA-CND DST&ANG COND... NUMERIC CALC COND-CHG CHNG-REG
CHNG-REG (change registration)	Change the display of the set of stored details between [A00] - [A07] and [A08] - [A15] using the up and down arrow keys	A0₌ A08₌ to ←→ to A07₂ A07₂
SCREEN-CHG (change screen)	Displays the screen change selection list. Select a screen using the up and down arrow keys. Note: The OPS-MAIN, JDG-COND-CHG,and PC-MNTR do not appear on the popup menu unless "YES" is selected. for each corresponding item on "TYPE RUN COND" menu. Only the currently available screens are listed.	OPS-MAIN PC-MNTR SCREEN-CHG CHG-TYPE
CHG-TYPE (change the object type)	Displays the object type selection list. Select an object type by pressing the up and down keys. This is enabled when Manual Object Type Change is set to "YES."	(TYPE00) ↓ This part changes.
CHG-C1 (change the Camera 1 image position)	Moves the image from Camera 1 up and down the screen using the up and down arrow keys. Note: This is enabled when "CAM1&2" is selected in ①MONITOR OUTPUT on the TYPE RUN COND menu (operating conditions).	
CHG-C2 (change the Camera 2 image position)	Moves the image from Camera 2 up and down the screen using the up and down arrow keys. Note: This is enabled when "CAM1&2" is selected in ①MONITOR OUTPUT on the TYPE RUN COND menu (operation conditions).	
MANL-MEAS (Manual measurement)	Manually move the two crosshair cursors, and measure distance between these two points, as well as coordinate distance on X and Y axes. Note: Unless "MANL-MEAS" is selected on the "⑪EXTENSION FUNC" line in the TYPE RUN COND (operation conditions), this screen cannot be displayed.	MANL-MEAS ①CURSOR1-COORD MOVE(224.208) ②CURSOR2-COORD MOVE(287.271) DIST-BETW-2PT 089.0 DIST-BETW-X 063.0 DIST-BETW-Y 063.0
SHORTCUT	Displays a short cut screen.	【PLACE】 ①SHORTCUT1 NO ②SHORTCUT2 NO ③SHORTCUT3 NO

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 "MEA-CND" line.
- MEASUREMENT 0 only allows you to measure positional deviation.
- For details about the settings for each measurement program, see Chapters 4 to 13.
- 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.

(1) Operation main screen (see page 1-10).

```
(TYPE00)                           F  C1 BRT
                                   V*.**


MEAS   0000ms
MEASURE 0 CAM1  NO












X0~6□□□□□□□□   Y0~7□□□□□□□□   READY█
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHGTYPE
```

Move the cursor to the "MAIN COND" item using the left and right arrow keys and press the SET key.

(2) Select the "OBJECT TYPE COND" using the up and down arrow keys and press the SET key.

```
MAIN MENU                                    F C1 BRT

IVS30J
       ├── SYS-CND
       ├── OBJECT  TYPE  COND
       ├── SET  WIZARD
       ├── EDIT MAIN OPS  MENU
       └── OPTION
```
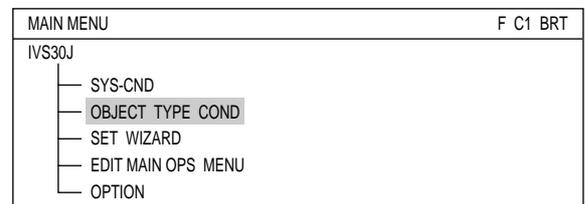
(3) Move the cursor to the "TYPE(NEW)" item on the "OBJECT TYPE COND" line and press the SET key.

```
SELECT OBJECT  TYPE  COND                     F C1 BRT

OBJECT TYPE COND
  ⊞─TYPE00
     └─TYPE(NEW)
```
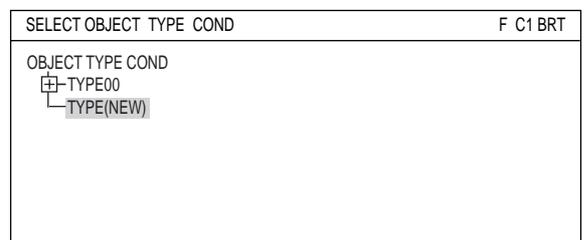
(4) Move the cursor to "TYPE00" on the "SELECT OBJECT TYPE COND" line and press the SET key. To select "TYPE01" and others, move the cursor to "TYPE(NEW)" and press the SET key.

(5) Select "MEAS0 to 4" (MEAS0 is only used for positional deviation measurements) on the "MEAS COND (CAM1)" line and a popup menu will appear. Select any desired measurement program from this popup menu and then press the SET key.

1

1-5 Common operations for each menu

[1] Operations to return to the operation screen

You can return to the operation screen, MAIN MENU, or setting screen from any menu by a single operation.

■ Menu display

[TYPE RUN COND] menu

```
××××   SCREEN  SAVE

        OPS-MENU ◄─── Return to the operation screen
        MAIN     ◄─── Return to the MAIN screen.
        SELECT   ◄─── Return to the currently selected setting screen.
        RETURN   ◄─── Return to the previously selected screen.
```

[2] Saving data

All of the data such as measurement and evaluation conditions entered on the "TYPE RUN COND," "MEA-CND," and "SYSTEM COND" menus, can be saved into the IV-S30J flash memory.

■ Operation procedure

[SYS-CND] menu

```
××××    SCREEN  SAVE



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

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-S30J will start saving the data and the progress will be displayed on the bottom of the screen.

```
                    SAVING
    REFERENCE IMG   ■■
    SYSTEM I/O      ■
    OBJECT TYPE COND ■■■■■■■■■■■□□□□□
```

When the data has been saved in the IV-S30J flash memory, the display will change from "SAVING" to "COMPLETE SAVE."

1-6 Power ON setting menu

[1] Operations menu lock

To prevent accidental changes to conditions you have set, the operation screen can be locked so that the screen cannot be changed to setting screen. 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-S30J), and the [POWER ON SETTING] menu will be displayed on the monitor.

1. Turn ON the power to the IV-S30J 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.

```
[POWER ON SETTING]
① MAIN OPS MENU    UNLOCK   LOCK
② DISPLAY MODE     JAPANESE   ENGLISH
③ OPERATION
```
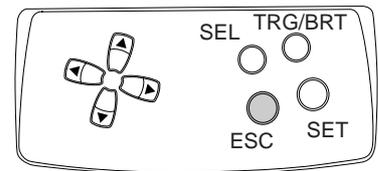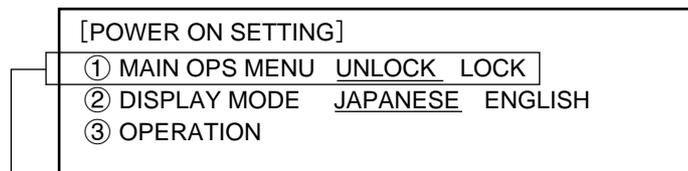
① **MAIN OPS MENU**	Description
UNLOCK	All of the operating conditions for the IV-S30J can be changed.
LOCK	The MAIN OPS MENU is locked and no change can be made.

■ **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-S30J saves the settings in the flash memory and the screen will return to the operation screen.

■ **Display when the operation screen is locked**
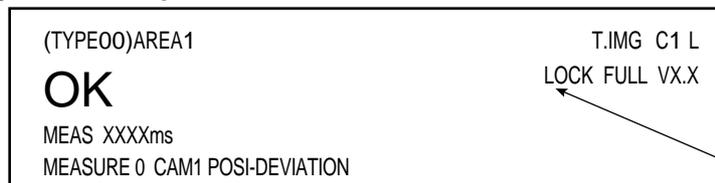
```
(TYPE00)AREA1                          T.IMG  C1 L
                                       LOCK FULL VX.X
OK
MEAS XXXXms
MEASURE 0 CAM1 POSI-DEVIATION
```
"LOCK" will be displayed
on the MAIN OPS MENU

[2] Change the Japanese or English display mode

Change display 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-S30J), 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.

```
[POWER ON SETTING]
①MAIN OPS MENU      UNLOCK  LOCK
②DISPLAY MODE       JAPANESE   ENGLISH      4
③OPERATION
```
3
5
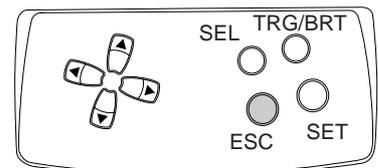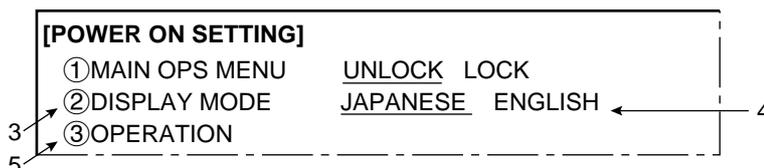
■ **Operating procedure**

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 operation screen.

1

1-7 Remote keypad (IV-S30RK1)

① Direction keys
(up, down, left and right)

④ SEL key

⑤ TRG/BRT key

② SET key

③ ESC key
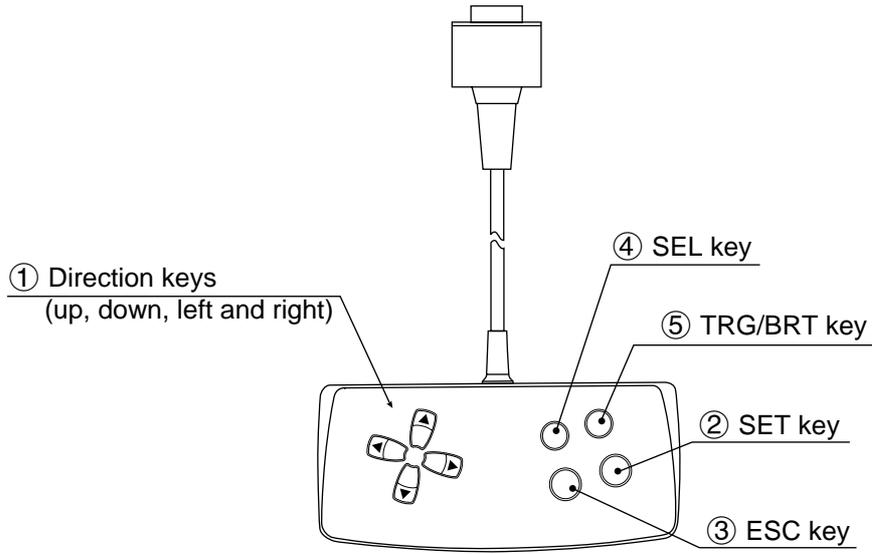
	Key name	Function	Description
①	Direction keys* (up, down, left and right)	Selecting an item on a menu screen	Select an item with the up, down, left and right keys.
		Setting a window	Set each coordinate.
		Setting a value	- Select a digit or an item with the left and right keys, and then specify a value with the up and down keys. - Specify a value with the up, down, right and left keys.
		To enter nested menus	——————
②	SET key	Determine a highlighted item	——————
		Determine the setting value	
③	ESC key	Returning a setting to its original state before being changed	On the REG-COND screen, - Press the left arrow key + ESC key to change between a display of all items and just one item at a time.
		Returning to the previous menu	
④	SEL key	Use to select the display of object images: choose between "F" (Freeze) and "T" (Through) and between "BRT" (bright) and "DRK" (dark).	- When the screen is changed from "Through" to "Freeze," the IV-S30 will capture an image. - Change the brightness of the image displayed on the screen. On the setting screen, - Press the left arrow key and the SEL key to change between Through and Freeze. - Press the right arrow key and the SEL key to change between Bright and Dark.
⑤	TRG/BRT key	Start measurement input	Press this key on the run screen, and a new measurement is triggered.
		Move the cursor to the function menu at the upper area.	——————
		Displays popup menu.	

* The direction keys have an auto-repeat function.

1-8 Operation flow
[1] Power ON and main loop processing

```
                        (Power ON)
                            │
                            ▼
        ┌──────────────────────────────────────┐
        │ Wait to complete the power ON process │
        └──────────────────────────────────────┘
                            │
                            ▼
        ┌──────────────────────────────────────┐
        │     Initializing (CPU, gate array)    │
        └──────────────────────────────────────┘
                            │
                            ▼
        ┌──────────────────────────────────────┐
        │              Memory check             │
        └──────────────────────────────────────┘
                            │
                            ▼
        ┌──────────────────────────────────────┐        ┌─ - System program
        │ Transmitting from flash memory to RAM │────────┤  - Conditions other than
        └──────────────────────────────────────┘        │    the conditions specified
                            │                            └─   for each object type
                            ▼
        ┌──────────────────────────────────────┐
        │             Data setting             │
        │          ( - CPU, variables )        │
        │          (   - Gate array   )        │
        └──────────────────────────────────────┘
                            │
                            ▼
                                         NG
              ◇ Checksum checking ◇──────────────────┐
                            │ OK                      │
                            ▼                         ▼
                                         ┌──────────────────────────┐
                                         │ Display check sum results │
                                         └──────────────────────────┘
      No                                                              Processing after the
    ◇ Settings for all types completed ◇                             power is turned ON
                            │ Yes
                            ▼
        ┌──────────────────────────────────────┐
        │ Transmitting from flash memory to RAM │──── Measurement conditions for
        └──────────────────────────────────────┘     each object type
                            │
                            ▼
        ┌──────────────────────────────────────┐
        │    Obtaining images, capturing        │
        │     specific lines of an image        │
        └──────────────────────────────────────┘
                            │
                            ▼
                                        ON
              ◇     ESC key     ◇──────────────────┐
                            │ OFF                   ▼
                                         ┌──────────────────────────┐
                                         │ Place the operation screen │
                                         │   in the locked state      │
                                         └──────────────────────────┘
                            ▼
                      To the next page
```

1

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```
┌──────────────────────────┐
│ Message display          │──────── Display results.
│ Pattern display          │──────── When the option has been set to "YES"
│ Crosshair cursor display │──────── (System) Display "YES"
└──────────────────────────┘
            │
            ▼
    ◇ (Communication processing)      No
      Data received          ────────┐
            │ Yes                     │
            ▼                         │
┌──────────────────────────┐         │
│ Communication processing │         │
└──────────────────────────┘         │
            │◄────────────────────────┘
            ▼
┌──────────────────────────┐
│ Receive a measurement    │──────── Parallel/general-purpose serial/CCD
│ start input signal       │         trigger
└──────────────────────────┘
            │
            ▼
    ◇ Measurement start ──────── OFF
            │ ON                   │
  ┌─ ─ ─ ─ ─│─ ─ ─ ─┐             ▼
  │ ┌──────────────┐ │    ┌──────────────┐
  │ │PC calculation│ │    │PC calculation│
  │ └──────────────┘ │    └──────────────┘
  │        │         │             │
  │ ┌──────────────┐ │             │
  │ │Executing     │ │             │
  │ │measurements  │ │             │
  │ └──────────────┘ │             │
  └─ ─ ─ ─ ─│─ ─ ─ ─┘             │
            │◄────────────────────┘
            ▼
┌─────────────────────────────────┐
│ Measurement result output       │──── Parallel/general-purpose serial
│ processing                      │
└─────────────────────────────────┘
            │
            ▼
    ◇ Key input ──────── No
            │ Yes         │
            ▼             │
┌──────────────────────────┐      │
│ Process key strokes      │      │
│ Processing on sub-menu   │      │
│  (Menu configuration ⇨ See page │
│ 1-4.)                    │      │
└──────────────────────────┘      │
            │◄─────────────────────┘
```

Main loop
processing

1

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

```
        ┌──────────────────────────────────────────┐
        │     Start (measurement start input ON)    │
        └──────────────────────────────────────────┘
                          │
        ┌──────────────────────────────────────────┐
        │              PC calculation               │
        │ Parallel output (Y0 to Y15), "READY" OFF  │
        └──────────────────────────────────────────┘
                          │
        ┌──────────────────────────────────────────┐
        │        External interface inhibit         │
        │    (keys, communications, parallel)       │
        └──────────────────────────────────────────┘
                          │
        ┌──────────────────────────────────────────┐
        │          Measurement timer start          │        Capture the scan line range that was
        │        Reading the object type No.        │  ←──   specified when setting the
        │       Image capturing (camera 1/2)        │        measurement conditions.
        └──────────────────────────────────────────┘
                          │
      No      ◇───────────────────────────◇
     ┌────────        *1                            *1 The measurement start input is
     │        ◇───────────────────────────◇           set to "PARALLEL" and the
     │                  │ Yes                          'READY' ON signal to "end of
     │        ┌──────────────────┐                     image capture."
     │        │     READY ON      │
     │        └──────────────────┘
     │                  │
     │                  │
      No     ◇───────────────────────────◇
     ┌────────    Is the light level
     │            monitor selected?
     │        ◇───────────────────────────◇
     │                  │ Yes
     │        ┌──────────────────┐
     │        │ Execute the light level │
     │        │   monitor function      │
     │        └──────────────────┘
     │                  │
        ┌──────────────────────────────────────────┐
        │      Executing measurement 0 using        │ ←───┐
        │               camera 1                    │     │
        └──────────────────────────────────────────┘     │
                          │                               │
    Yes   ◇───────────────────────────◇         ┌──────────────────────────────┐
   ┌───────    Was an error detected?            │ [Measurement program that is  │
   │      ◇───────────────────────────◇          │  selected]                    │
   │              │ No                            │ - Positional deviation        │
   │        ┌──────────────────────────────┐     │   measurement                 │
   │        │  Executing measurement 0 using │ ←──└──────────────────────────────┘
   │        │           camera 2             │
   │        └──────────────────────────────┘
   │              │
   │   Yes ◇───────────────────────────◇
   │ ┌──────   Was an error detected?
   │ │     ◇───────────────────────────◇
   │ │            │ No
   ② (To the next page)   ① (To the next page)
```

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
- 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

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↓

Determining the measuring time (timer stop)

↓

Parallel output (Y0 to Y15) OFF

↓

External interface enabled (communications)

↓

No ◇ Serial output ◇ Computer link

General purpose

General purpose serial output | Computer link output

↓

External interface enabled (key, parallel)

↓

*3 Set the measurement start input to any choice other than "parallel" or set the 'READY' ON signal to "end measurement."

No ◇ *3 ◇

Yes

READY ON

↓

Waiting for a measurement start input signal or a key input

- When the halt NG measurement option is set to "YES" (page 3-38), the controller stops measuring when an error occurs.

1

1-9 Table of controller functions

Shown below are the functions for the controller (IV-S30J).

- For details about the controller hardware (cameras, peripheral devices), see the "IV-S30J User's Manual, Instruction and Hardware."

Item		Specifications
		IV-S30J
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
Maximum number of reference images stored / number of whole screens stored		200 / 2 screens
Image scan time		33.3 ms
Gray search time *		15 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	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]
	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, density (1-point search) [Maximum 4 windows]

* 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.

Item		Specifications
		IV-S30J
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.
Window shape		Rectangle, circle, oval (when using area measurement by binary conversion, object counting by binary conversion, object identification by binary measurement), polygon window (maximum 32 sided polygons: When binary area measurement, counting after binary conversion, or object identification (labeling) after binary conversion is selected.)
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.
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: 7 points (X0 to X6)
	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: 001 to 999 (counts down)
External interface	Parallel interface	Input: 7 points, 12/24 VDC Output: 9 points, 12/24 VDC
	General-purpose serial interface	RS232C/RS422 (2.4 to 115.2 kbps)
	Computer link	Built-in compatibility with certain SHARP, OMRON, and Mitsubishi models
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
Measu-rement 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	4 points: Object type change (X1 to X4) 2 points: External input (X5, X6)
	Common for input	1 point: + common
	Output	9 points: 1 READY , 8 user settable logical outputs (Y0 to Y7)
	Common for output	1 point: + common
	Power supply	2 points: +24 VDC, 0 V
Power voltage/consumption		24 VDC (±10 %) 7 W

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.

Item to set	Reference page
Monitor output	2-2
Image capture	2-4
Message display	2-5
Pattern display	2-6
Binary image display	2-7
θ angle correction image display	2-8
Operation main display	2-9
Evaluation change display	2-10
PC monitor screen	2-11
Through display	2-11
Extension function	2-12

■ How to display the TYPE RUN COND screen

On the "MAIN MENU," select "OBJECT TYPE COND", "TYPE 00", and "TYPE RUN COND" in this order.

```
SELECT OBJECT TYPE COND                          F C1 BRT

OBJECT TYPE COND
  ┌─TYPE00                         ①MONITOR OUTPUT
  │  ├─TYPE RUN COND               ②CAPTURE IMG
  │  ├─IMAGE-ADJ                   ③MESSAGE DISPLAY
  │  ├─MEA-CND(CAMERA1)            ④PATTERN DISPLAY
  │  ├─MEA-CND(CAMERA2)            ⑤SHOW BINARY IMG
  │  ├─FINAL NUM.CALC              ⑥SHOW θ FIX IMG
  │  ├─FINAL OUTPUT COND           ⑦OPS MAIN DESP
  │  ├─OBJ-TYPE I/O                ⑧DESP CHG-EVAL
  │  └─OBJ-TYPE SYS.               ⑨PC-MNTR
  └─ TYPE(NEW)                     ⑩THROUGH DISPLAY
                                   ⑪EXTENSION FUNC.
                                   ⑫DISPLAY+CURSOR 1
                                   ⑬CLOSS CURSOR COORD
                                   ⑭DISPLAY+CURSOR 2
                                   ⑮CLOSS CURSOR COORD




SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

The "TYPE RUN COND" screen will appear.

```
TYPE RUN COND SCREEN SAVE                         F C1 BRT

①MONITOR OUTPUT       CAM1
②CAPTURE IMG          PARTIAL-IMG
③MESSAGE DISPLAY      YES(NUMERIC)
④PATTERN DISPLAY      YES
⑤SHOW BINARY IMG      YES
⑥SHOW θ FIX IMG       YES
⑦OPS MAIN DISP        YES
⑧DISP CHG-EVAL        NO
⑨PC-MNTR              NO
⑩THROUGH DISPLAY      NO
⑪EXTENSION FUNC.      NO








SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```
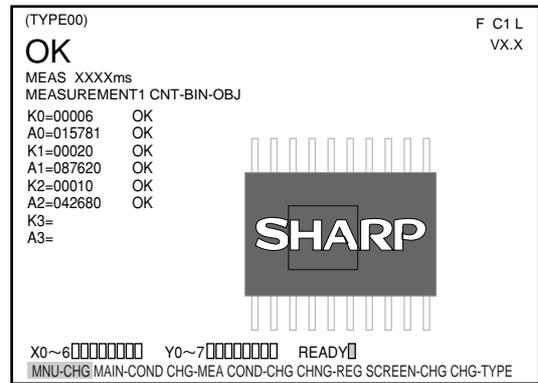
2

[1] Monitor output

When two cameras have been connected to IV-S30J, 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 operation screen.

- Output monitor switching

There are two methods for changing the monitor output: change the TYPE RUN COND settings, use external input signals through the parallel port to make changes from outside.

```
TYPE RUN COND SCREEN SAVE                    F  C1  BRT

①MONITOR OUTPUT      CAM1 ─────►  CAM1
②CAPTURE IMG         PARTIAL-IMG    CAM2
③MESSAGE DISPLAY     YES(NUMERIC)   CAM1&2
④PATTERN DISPLAY     YES
⑤SHOW BINARY IMG     YES
⑥SHOW θ FIX IMG      YES
⑦OPS MAIN DISP       YES
⑧DISP CHG-EVAL       NO
⑨PC-MNTR             NO
⑩THROUGH DISPLAY     NO
⑪EXTENSION FUNC.     NO




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```
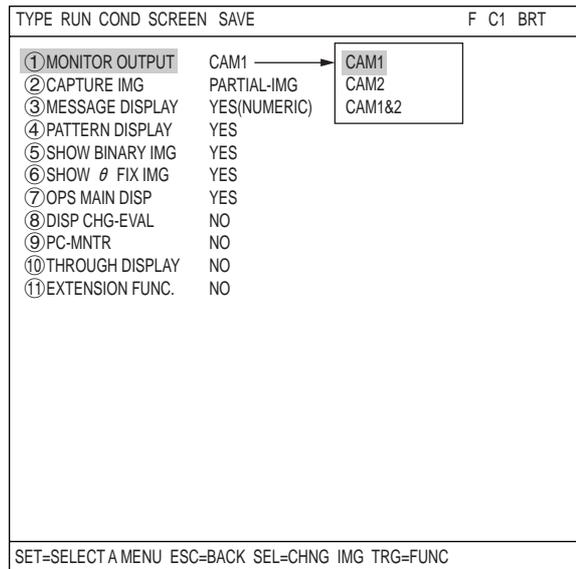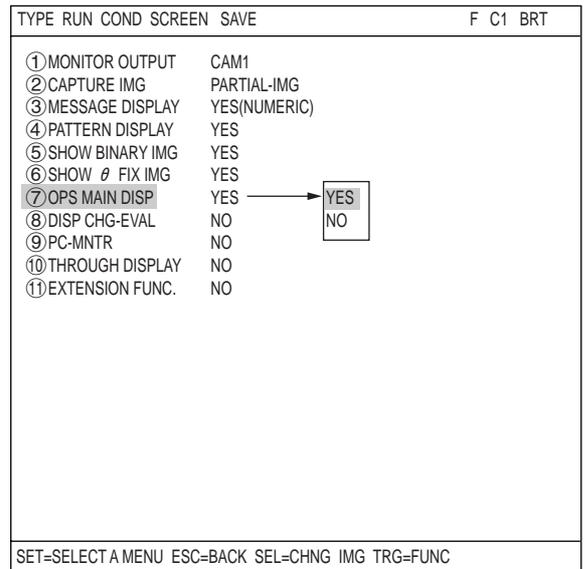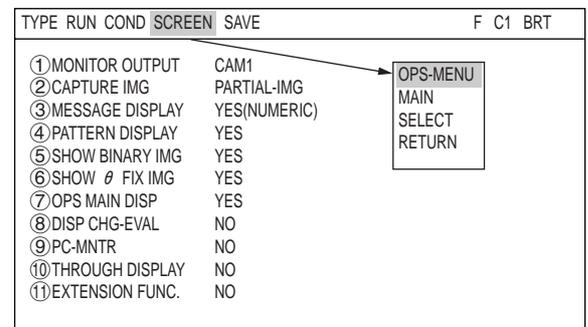
(1) Change the monitor output by changing the TYPE RUN COND settings

Select the "①MONITOR OUTPUT" item on the "TYPE RUN COND" screen and then select an item from the popup menu.

①**MONITOR OUTPUT**	**Description**
CAM1	Display the camera 1 image on the whole screen.
CAM2	Display the camera 2 image on the whole screen.
CAM1&2	Display the camera 1 image on upper half, and the camera 2 image on lower half.

■ **Display examples on the operation screen**

- Camera 1 on the whole screen

(When "CAM1" has been specified in item ①MONITOR OUTPUT.)

F C1 H

SHARP
SERIAL NO.
8F053G26
MODEL
IV–S33MX
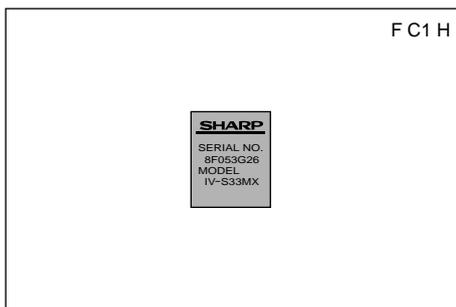
- Camera 2 on the whole screen.

(When "CAM2" has been specified in item ①MONITOR OUTPUT.)

F C2 H

★
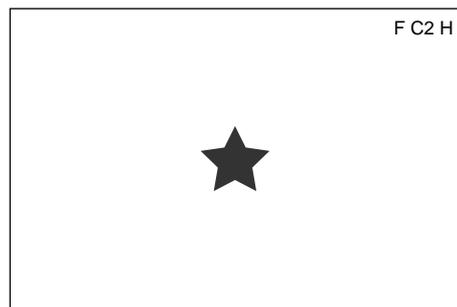
- Simultaneous display on a divided screen

(When "CAM1&2" has been specified in item "①MONITOR OUTPUT.")

F C1/C2 H

SHARP
SERIAL NO.
8F053G26
MODEL
IV–S30J

Camera 2 image

★

Camera 1 image
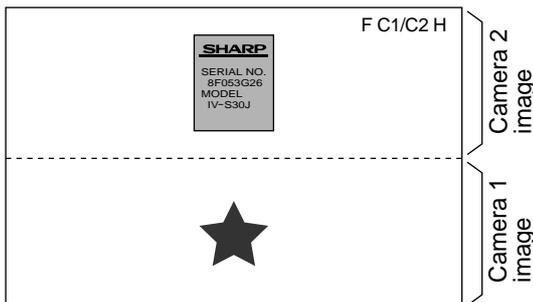
(2) Output monitor switching by parallel input
On the operation screen, select "MAIN-COND" ->
"SYS-CND" -> "I/O CONDITIONS" in that order.
Move the cursor to the "⑤PARALLEL INP X6" line
using up/down arrow keys and press the SET key.
Select "CHNG-IMG-OUT-CAM" on the popup
menu that is displayed and then press the SET key.

Every time the X6 signal is turned from OFF to
ON, the selected camera display will be changed.

```
        CAM1          CAM2        CAM1&2(HORIZ)
   ┌─► whole screen ─► whole screen ─► divided screen ─┐
   └──────────────────────────────────────────────────┘
```
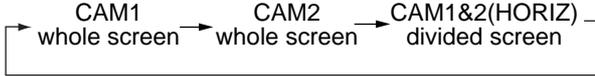
The display example of the operation screen is
the same as in section (1).

```
┌────────────────────────────────────────────────────────┐
│ I/O CONDITION  SCREEN  COND  SAVE            F  C1  BRT  │
│                                                         │
│ ①MEAS INP I/F      PARALLEL+SERIAL                      │
│                                                         │
│ ②OUT I/F(PARAL.)   NO                                   │
│ ③MANL TYPE CHNG    NO                         ┌───────────────────┐
│ ④PARALLEL INP X5   EXT-INP                    │ EXT-INP           │
│                                               │ CHNG-IMG-OUT-CAM  │
│ ⑤PARALLEL INP X6   CHNG-IMG-OUT-CAM ─────────►│ CAM-MEAS          │
│ ⑥STROBE OUT        NO                         │ 2 IMAGES          │
│ ⑦'READY'ON         CAPTURE COMPLETE           └───────────────────┘
│                                                         │
│                                                         │
│                                                         │
│                                                         │
│                                                         │
│ SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC        │
└────────────────────────────────────────────────────────┘
```

2

2

[2] Image capture

In item "②CAPTURE IMG" on the "TYPE RUN COND" screen, specify the range which will be captured during operation.

```
TYPE RUN COND SCREEN SAVE                    F  C1  BRT

①MONITOR OUTPUT      CAM1
②CAPTURE IMG         PARTIAL-IMG  ─────▶  PARTIAL-IMG
③MESSAGE DISPLAY     YES(NUMERIC)          WHOLE-IMG
④PATTERN DISPLAY     YES                   NO
⑤SHOW BINARY IMG     YES
⑥SHOW θ FIX IMG      YES
⑦OPS MAIN DISP       YES
⑧DISP CHG-EVAL       NO
⑨PC-MNTR             NO
⑩THROUGH DISPLAY     NO
⑪EXTENSION FUNC.     NO
```

CAPTURE 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.
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
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-S30J.

■ **Example of a comparison of the capture times**

- When "WHOLE-IMG" is selected: 33.3 ms

Capture whole image

480 lines
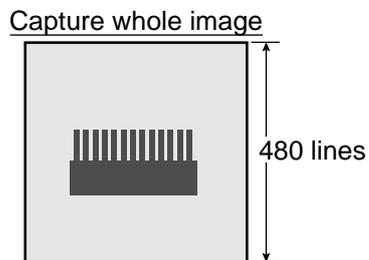
- When the "PARTIAL-IMG" is selected (when there are 240 scan lines): 16.6 ms

Capture partial image

240 lines

2-4
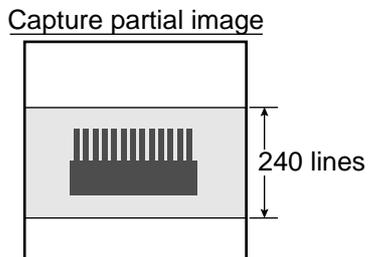
[3] Message display

Select "YES" or "NO" to display messages on the operation screen.

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

Setting to "NO" reduces the processing time.
Processing time:
YES(NUMERIC) > YES(NO NUMERIC) > NO

```
TYPE RUN COND SCREEN SAVE                    F  C1  BRT

 ①MONITOR OUTPUT      CAM1
 ②CAPTURE IMG         PARTIAL-IMG
 ③MESSAGE DISPLAY     YES(NUMERIC) ───→   YES(NUMERIC)
 ④PATTERN DISPLAY     YES                 YES(NO NUMERIC)
 ⑤SHOW BINARY IMG     YES                 NO
 ⑥SHOW θ FIX IMG      YES
 ⑦OPS MAIN DISP       YES
 ⑧DISP CHG-EVAL       NO
 ⑨PC-MNTR             NO
 ⑩THROUGH DISPLAY     NO
 ⑪EXTENSION FUNC.     NO




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

2

■ Display examples

- When "YES(NUMERIC)" is selected

```
(TYPE00)AREA1                           F C1 L
OK                                      V*.**
MEAS XXXXms
MEASURE 0  CAM1 POSI-DEVIATION

REGST.NO 0(0~7)
X0=176.0      OK
Y0=322.0      OK
x0=+000.0     OK
y0=+000.0     OK
M0=+10000     OK
B0=+001.7     OK
X1=534.0      OK
Y1=480.0      OK
x1=+001.0     OK
y1=+001.0     OK
M1=+09999     OK

X0~6 □□□□□□□  Y0~7 □□□□□□□   READY□
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

Can be deleted by pressing the SET key.

- When "NO" is selected

- When "YES(NO NUMERIC)" is selected

```
(TYPE00)AREA1                           F C1 L
OK                                      V*.**
MEAS XXXXms
MEASURE 0  CAM1 POSI-DEVIATION






X0~6 □□□□□□□  Y0~7 □□□□□□□   READY□
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

Press the SET key

Press the ESC key

```
X0~6 □□□□□□□  Y0~7 □□□□□□□   READY□
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

The menu bar will disappear.

The menu bar will be displayed.

[4] Pattern display

Select "YES" or "NO" to determine whether to show the pattern display (solid lines and dashed lines of the rectangles in the window) over an image displayed on the operation screen.

Note: When the "CAM1&2" is selected on the "①MONITOR OUTPUT" (page 2-2), pattern display cannot be selected.

PATTERN DISPLAY	Description
YES	Displays patterns in the window, such as the rectangles defined for the inspection area and the search area.
NO	Patterns will not be displayed on the operation screen.

```
TYPE  RUN  COND  SCREEN  SAVE                    F  C1  BRT

①MONITOR OUTPUT      CAM1
②CAPTURE IMG         PARTIAL-IMG
③MESSAGE DISPLAY     YES(NUMERIC)
④PATTERN DISPLAY     YES  ──────▶  YES
⑤SHOW BINARY IMG     YES             NO
⑥SHOW θ FIX IMG      YES
⑦OPS MAIN DISP       YES
⑧DISP CHG-EVAL       NO
⑨PC-MNTR             NO
⑩THROUGH DISPLAY     NO
⑪EXTENSION FUNC.     NO




SET=SELECT A MENU  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

■ Display examples

- When "YES" is selected for PATTERN DISPLAY.

```
(TYPE00)                                    F  C1 L
OK                                          VX.X
MEAS  XXXXms
MEASURE 0 CAM1 POSI-DEVIATION

REGST. NO. 0(0~7)
X0=176.0      OK
Y0=322.0      OK
x0=+000.0     OK
y0=+000.0     OK
M0=+10000     OK
B0=+001.7     OK
X1=534.0      OK
Y1=480.0      OK
x1=+001.0     OK
y1=+001.0     OK
M1=+09999     OK

X0~6 □□□□□□□□ Y0~7 □□□□□□□□  READY □
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

- When "NO" is selected for PATTERN DISPLAY

```
(TYPE00)                                    F  C1 L
OK                                          VX.X
MEAS  XXXXms
MEASURE 0 CAM1 POSI-DEVIATION

REGST. NO. 0(0~7)
X0=176.0      OK
Y0=322.0      OK
x0=+000.0     OK
y0=+000.0     OK
M0=+10000     OK
B0=+001.7     OK
X1=534.0      OK
Y1=480.0      OK
x1=+001.0     OK
y1=+001.0     OK
M1=+09999     OK

X0~6 □□□□□□□□ Y0~7 □□□□□□□□  READY □
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

[5] Binary image display

Select "YES" or "NO" to display a binary image on the operation screen.

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

- When "NO" is selected on the "④PATTERN DISPLAY," the "⑤SHOW BINARY IMG" item will not appear.

SHOW BINARY IMG	Description
YES	A binary image will be displayed on the operation screen.
NO	A binary image will not be displayed on the operation screen.

```
TYPE RUN COND SCREEN SAVE                    F C1 BRT
┌──────────────────────────────────────────────────┐
│ ①MONITOR OUTPUT      CAM1                         │
│ ②CAPTURE IMG         PARTIAL-IMG                  │
│ ③MESSAGE DISPLAY     YES(NUMERIC)                 │
│ ④PATTERN DISPLAY     YES                          │
│ ⑤SHOW BINARY IMG     YES  ──→  ┌──────┐           │
│ ⑥SHOW θ FIX IMG      YES       │ YES  │           │
│ ⑦OPS MAIN DISP       YES       │ NO   │           │
│ ⑧DISP CHG-EVAL       NO        └──────┘           │
│ ⑨PC-MNTR             NO                           │
│ ⑩THROUGH DISPLAY     NO                           │
│ ⑪EXTENSION FUNC.     NO                           │
│                                                    │
└──────────────────────────────────────────────────┘
SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

2

■ Display examples

- When "YES" is selected for the "⑤SHOW BINARY IMG"

```
(TYPE00)                              F C1 L
OK                                    VX.X
MEAS XXXXms
MEASUREMENT1 CNT-BIN-OBJ
K0=00006      OK
A0=015781     OK
K1=00020      OK
A1=087620     OK
K2=00010      OK
A2=042680     OK
K3=
A3=                    SHARP

X0~6□□□□□□□  Y0~7□□□□□□□  READY□
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

- When "NO" is selected for the "⑤SHOW BINARY IMG"

```
(TYPE00)                              F C1 L
OK                                    VX.X
MEAS XXXXms
MEASUREMENT1 CNT-BIN-OBJ
K0=00006      OK
A0=015781     OK
K1=00020      OK
A1=087620     OK
K2=00010      OK
A2=042680     OK
K3=
A3=                    SHARP

X0~6□□□□□□□  Y0~7□□□□□□□  READY□
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

[6] θ angle correction image display

Select "YES" or "NO" to display a θ angle corrected image on the operation screen.

SHOW FIX θ IMG	Description
YES	A θ angle corrected image will be displayed on the operation screen.
NO	A θ angle corrected image will not be displayed on the operation screen.

```
TYPE RUN COND SCREEN SAVE                    F  C1  BRT

①MONITOR OUTPUT      CAM1
②CAPTURE IMG         PARTIAL-IMG
③MESSAGE DISPLAY     YES(NUMERIC)
④PATTERN DISPLAY     YES
⑤SHOW BINARY IMG     YES
⑥SHOW θ FIX IMG      YES  ──────▶  YES
⑦OPS MAIN DISP       YES            NO
⑧DISP CHG-EVAL       NO
⑨PC-MNTR             NO
⑩THROUGH DISPLAY     NO
⑪EXTENSION FUNC.     NO




SET=SELECT A MENU  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

■ **Display examples**

(Reference image)　　(Measured image)

Position of reference image

- When the θ angle correction image display mode has been set to YES.

- When the θ angle correction image display mode has been set to NO.

[7] Operation main display

When the operation screen was set to display other screens (such as the "DISP CHG-EVAL" and "PC-MNTR" screens), this item should be selected to return to the main display from other screens. On the "TYPE RUN COND" screen, select "⑦OPS MAIN DISP" and then "YES" on the popup menu. That will return you to the main operation screen.

Note: When other screens are set to "YES" (such as the "⑧DISP CHG-EVAL" and "⑨PC-MNTR" screens), make sure to select "YES" from the ⑦OPS MAIN DISP.

```
TYPE RUN COND SCREEN SAVE                    F  C1  BRT

①MONITOR OUTPUT      CAM1
②CAPTURE IMG         PARTIAL-IMG
③MESSAGE DISPLAY     YES(NUMERIC)
④PATTERN DISPLAY     YES
⑤SHOW BINARY IMG     YES
⑥SHOW θ FIX IMG      YES
⑦OPS MAIN DISP       YES  ──────▶  YES
⑧DISP CHG-EVAL       NO             NO
⑨PC-MNTR             NO
⑩THROUGH DISPLAY     NO
⑪EXTENSION FUNC.     NO




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Press the TRG/BRT key to move the cursor to the upper function menu. Select "SCREEN" and press the SET key. Then select "OPS-MENU."

```
TYPE RUN COND SCREEN SAVE                    F  C1  BRT

①MONITOR OUTPUT      CAM1
②CAPTURE IMG         PARTIAL-IMG              OPS-MENU
③MESSAGE DISPLAY     YES(NUMERIC)             MAIN
④PATTERN DISPLAY     YES                      SELECT
⑤SHOW BINARY IMG     YES                      RETURN
⑥SHOW θ FIX IMG      YES
⑦OPS MAIN DISP       YES
⑧DISP CHG-EVAL       NO
⑨PC-MNTR             NO
⑩THROUGH DISPLAY     NO
⑪EXTENSION FUNC.     NO
```

Select "SCREEN-CHG" on the lower menu on the operation screen and press the SET key. "OPS-MAIN" will be displayed in the lower right corner of the screen. While the "OPS-MAIN" line is highlighted, press the SET key. The main display will then change back to the operation screen from the other screens (e.g. the JDG-COND-CHG and PC-MNTR screens).

```
(TYPE00) AREA1                              F  C1  DRK○
                                                     V*.**
                                            C1=002.2 OK
 OK                                         C2=100.0 OK
MEAS XXXXms
MEASURE 0 CAM1  POSI-DEVIATION
┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│                                       │
│                                       │
│                                       │
│                                       │
│                                       │
│                                       │
│                                       │
│                                       │
│                             OPS-MAIN  │
│                             PC-MNTR   │
└ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘

X0~6 □□□□□□□   Y0~7 □□□□□□□□   READY ▌
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

2
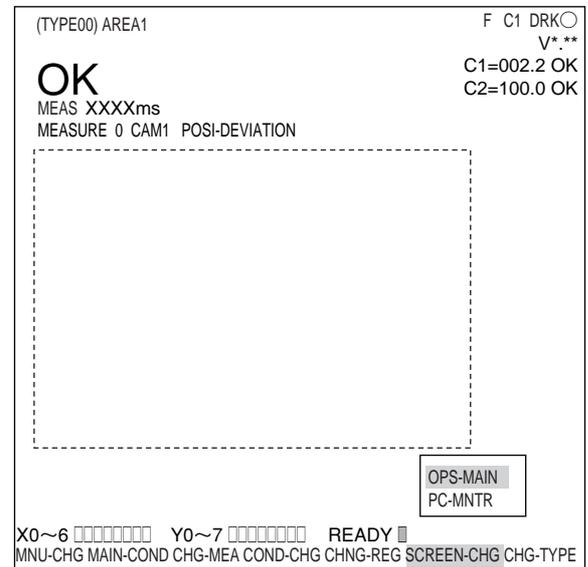
[8] Evaluation change display

Specify whether the evaluation condition change menu can be displayed on the operation screen or not.

Select the "⑧DISP CHG-EVAL" line on the "TYPE RUN COND" screen and select "YES" on the popup menu.

```
TYPE RUN COND SCREEN  SAVE                    F  C1  BRT

①MONITOR OUTPUT     CAM1
②CAPTURE IMG        PARTIAL-IMG
③MESSAGE DISPLAY    YES(NUMERIC)
④PATTERN DISPLAY    YES
⑤SHOW BINARY IMG    YES
⑥SHOW θ FIX IMG     YES
⑦OPS MAIN DISP      YES
⑧DISP CHG-EVAL      YES ──────▶  YES
⑨PC-MNTR            NO             NO
⑩THROUGH DISPLAY    NO
⑪EXTENSION FUNC.    NO

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Press the TRG/BRT key to move the cursor to the upper function menu. Select "SCREEN" and press the SET key. Then select "OPS-MENU."

```
TYPE RUN COND SCREEN SAVE                     F  C1  BRT

①MONITOR OUTPUT     CAM1
②CAPTURE IMG        PARTIAL-IMG          OPS-MENU
③MESSAGE DISPLAY    YES(NUMERIC)         MAIN
④PATTERN DISPLAY    YES                  SELECT
⑤SHOW BINARY IMG    YES                  RETURN
⑥SHOW θ FIX IMG     YES
⑦OPS MAIN DISP      YES
⑧DISP CHG-EVAL      NO
⑨PC-MNTR            NO
⑩THROUGH DISPLAY    NO
⑪EXTENSION FUNC.    NO
```

Select "SCREEN-CHG" on the lower menu on the operation screen, and press the SET key. "JDG-COND CHG" will be displayed in the lower right corner of the screen. You can display the evaluation condition change menu by pressing the up and down keys.
- 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 operation main screen, except for the area marked "evaluation condition change menu shown during operation."

```
(TYPE00)                                      F  C1  BRT

MEAS 0000ms
MEASURE  0  CAM1  NO





                                          JDG-COND-CHG
                                          PC-MNTR
Display evaluation condition
change menu while in operation
X0~6 □□□□□□□   Y0~7 □□□□□□□□    READY ▉

MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

2

[9] PC monitor screen

Specify whether to display the PC monitor on the operation screen.

Select the "⑨PC-MNTR" line on the "TYPE RUN COND" screen and select "YES" on the popup menu. Now the PC monitor screen can be displayed.

Select "SCREEN-CHG" on the lower menu bar of the operation screen and then select "PC-MNTR" on the popup menu. The PC monitor will be displayed.

```
(TYPE00)AREA1                              T  C1 DRK○
                                         LOCK FULL  V*.**
OK                                       C1=002.2 OK
MEAS XXXXms                               C2=100.0 OK

①  ────→  _ X00_~ _06_ □□□□□□□
②  ────→  Y000~007 □□□□□□□ READY □
③  ────→  C000~007 □□□□□□□

④  ────→  [NUMERIC CALC]      [TMR]         [CNTR]
           AN00= +00000250.0 OK   TM0:200      CN0:100
           AN01= -00000300.0 OK   TM1:300      CN1:150
⑤          AN02=NOT SET          TM2:NOT SET  CN2:NOT SET
           AN03=NOT SET          TM3:NOT SET  CN3:NOT SET
           AN04=NOT SET          TM4:NOT SET  CN4:NOT SET
⑥          AN05=NOT SET          TM5:NOT SET  CN5:NOT SET
           AN06=NOT SET          TM6:NOTSET   CN6:NOT SET
           AN07=NOT SET          TM7:NOT SET  CN7:NOT SET


⑦  ────  MMU-CHG MAIN-COND SEL-OUT SEL-AUX SEL-NUM SCREEN-CHG CHG-TYPE
```

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
SEL-OUT	Change the output relay address (Y00 to Y15) using the up and down keys (in units of 8 points).
SEL-AUX	Change the auxiliary relay address (C000 to C127) using the up and down keys (in units of 8 points).
SEL-NUM	Change the final numerical calculation address (AN00 to AN15) using the up and down keys (in units of 8 points).

The other data displayed is the same as on the operation screen. ⇨See page 1-10.

[10] Through display

Select the desired measurement image status (FREEZE or THROUGH) by choosing either "YES" or "NO" on the operation screen.

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

```
TYPE RUN COND SCREEN SAVE                       F  C1 BRT

①MONITOR OUTPUT      CAM1
②CAPTURE IMG         PARTIAL-IMG
③MESSAGE DISPLAY     YES(NUMERIC)
④PATTERN DISPLAY     YES
⑤SHOW BINARY IMG     YES
⑥SHOW θ FIX IMG      YES
⑦OPS MAIN DISP       YES
⑧DISP CHG-EVAL       NO
⑨PC-MNTR             NO
⑩THROUGH DISPLAY     NO  ───→  YES
⑪EXTENSION FUNC.     NO         NO






SET=SELECT A MENU  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```
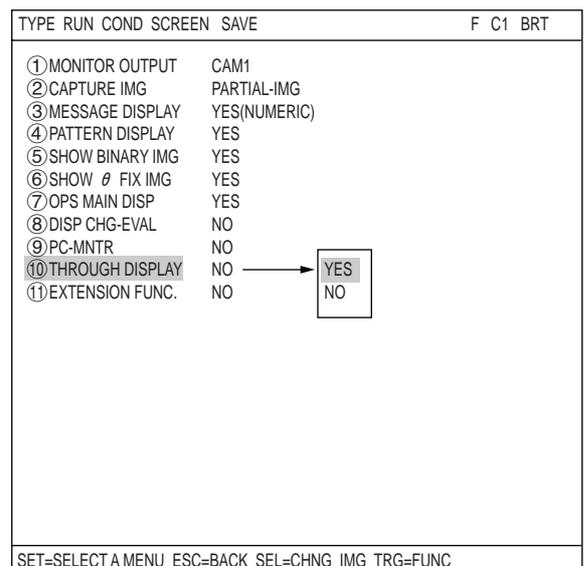
[11] Extension functions

The extension function has crosshair cursor display and manual display functions.

2

(1) Crosshair cursor display

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 (256,240)

■ **Operation procedure**

1. On the "TYPE RUN COND" screen, move the cursor to item "⑪EXTENSION FUNC." using the up and down keys, and press the SET key.
2. Select "DISPLAY+CURSOR" on the popup menu and press the SET key.
3. Press the SET key on the "⑫DISPLAY+CURSOR 1" line and select "1" or "2" on the popup menu. Then press the SET key.
4. Select "⑬CROSS CURSOR COORD" and press the SET key. Now, the crosshair appear on the screen. Move the crosshair cursor using the up/down/left/right arrow keys. (It moves one pixel at a time)
5. When the cursor is positioned where you want it, press the SET key to confirm the position.

[Display example]

Measurement image of camera 1.

(TYPE00)AREA1

OK

MEAS XXXXms
MEASURE 0 CAM1 POSI DEVIATION

Measurement image of camera 2.

X0〜6 □□□□□□□ Y0〜7 □□□□□□□ READY □

MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE

Displays two crosshair cursors.
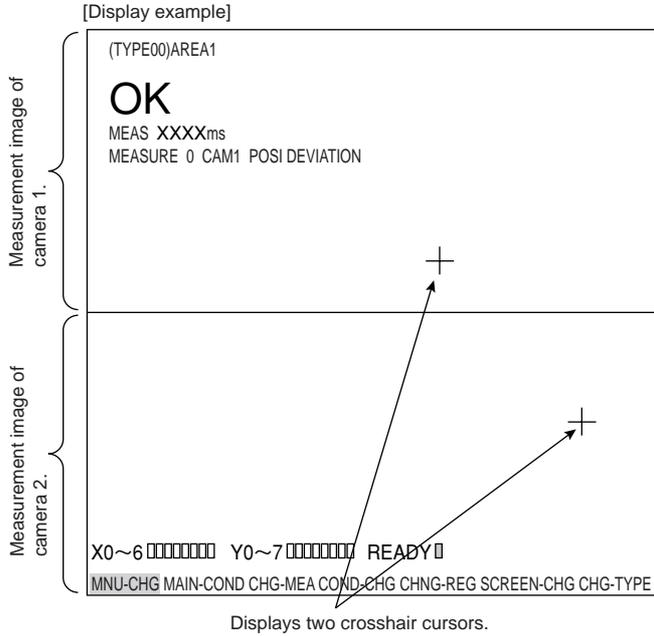
If you select "⑭DISPLAY+CURSOR 2," you can display two cursors when you output monitor images from Cameras 1 and 2.

TYPE RUN COND SCREEN SAVE   F C1 BRT

①MONITOR OUTPUT   CAM1
②CAPTURE IMG   PARTIAL-IMG
③MESSAGE DISPLAY   YES(NUMERIC)
④PATTERN DISPLAY   YES
⑤SHOW BINARY IMG   YES
⑥SHOW θ FIX IMG   YES
⑦OPS MAIN DISP   YES
⑧DISP CHG-EVAL   NO
⑨PC-MNTR   NO
⑩THROUGH DISPLAY   NO
⑪EXTENSION FUNC.   DISPLAY+CURSOR ──── NO
⑫DISPLAY+CURSOR 1   1 ──────────┐   DISPLAY+CURSOR
⑬CLOSS CURSOR COORD SET (256,240)│ 1   MANL-MEAS
⑭DISPLAY+CURSOR 2   NO   2

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC

(2) Manual measurement

With this function, you can measure distance between two points, the distance between X coordinates, or the distance between Y coordinates that were selected manually on the operation main screen.

■ **Operation procedure**

1. Select "⑪EXTENSION FUNC." on the "TYPE RUN COND" menu using the up and down arrow keys. Then press the SET key.
2. Select "MANL-MEAS" on the popup menu and press the SET key.

```
TYPE RUN COND SCREEN SAVE                    F  C1  BRT

①MONITOR OUTPUT      CAM1
②CAPTURE IMG         PARTIAL-IMG
③MESSAGE DISPLAY     YES(NUMERIC)
④PATTERN DISPLAY     YES
⑤SHOW BINARY IMG     YES
⑥SHOW θ FIX IMG      YES
⑦OPS MAIN DISP       YES
⑧DISP CHG-EVAL       NO
⑨PC-MNTR             NO              NO
⑩THROUGH DISPLAY     NO              DISPLAY+CURSOR
⑪EXTENSION FUNC.     MANL-MEAS  ──→  MANL-MEAS
```
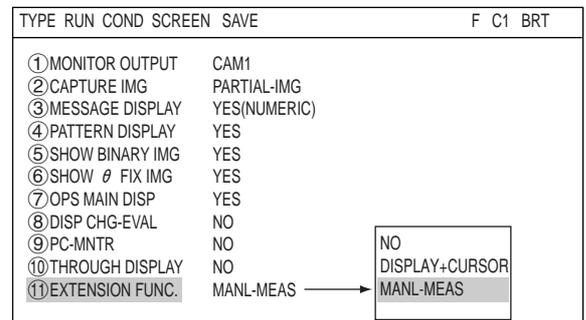
3. Move the cursor to the upper function menu by pressing the TRG/BRT key and select "SCREEN." Then press the SET key. Select "OPS-MENU" on the popup menu and return to the operation screen.

```
TYPE RUN COND SCREEN SAVE                    F  C1  BRT

①MONITOR OUTPUT      CAM1                    OPS-MENU
②CAPTURE IMG         PARTIAL-IMG             MAIN
③MESSAGE DISPLAY     YES(NUMERIC)            SELECT
④PATTERN DISPLAY     YES                     RETURN
⑤SHOW BINARY IMG     YES
⑥SHOW θ FIX IMG      YES
⑦OPS MAIN DISP       YES
⑧DISP CHG-EVAL       NO
⑨PC-MNTR             NO
⑩THROUGH DISPLAY     NO
⑪EXTENSION FUNC.     NO
```
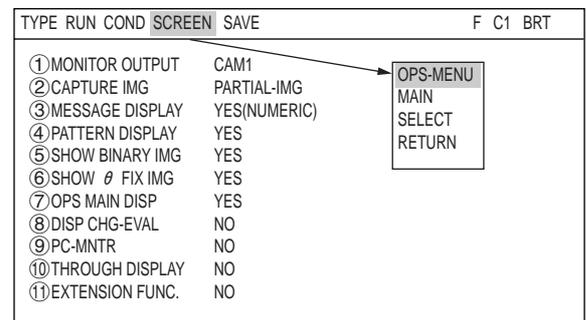
4. Move the cursor to the "MNU-CHG" (menu change) item on the bottom of the operation screen and press the SET key to change the bottom menu display. Move the cursor to "MANL-MEAS" (manual measurement) and press the SET key.
5. The menu items for manual measurements will appear on the screen.
6. Select "①CURSOR1-COORD" or "②CURSOR2-COORD" and press the SET key.
7. Move cursor 1 or cursor 2 using the up/down/left/right keys. (They move one pixel at a time.)
   ⇨ The distance between the two points, and between the X coordinates and Y coordinates for the two points, will change on real time basis.
8. After the positions of the points are determined, press the SET key.
9. When the operation is complete, press the ESC key.
   ⇨ The manual measurement menu items will disappear.

```
(TYPE00)AREA1

OK
MEAS XXXXms
MEASURE 0 CAM1 POSI DEVIATION

MANL-MEAS
①CURSOR1-COORD MOVE(224,208)
②CURSOR2-COORD MOVE(287,271)
  DIST-BETW-2PT    089.0
  DIST-BETW-X      063.0
  DEST-BETW-Y      063.0




X0～6 □□□□□□□  Y0～7 □□□□□□□  READY□
MNU-CHG NEXT-NG CHG-C1 CHG-C2 MANL-MEAS SHORTCUT
```

Manual measurement menu

Cross hair cursor 1   Cross hair cursor 2

2
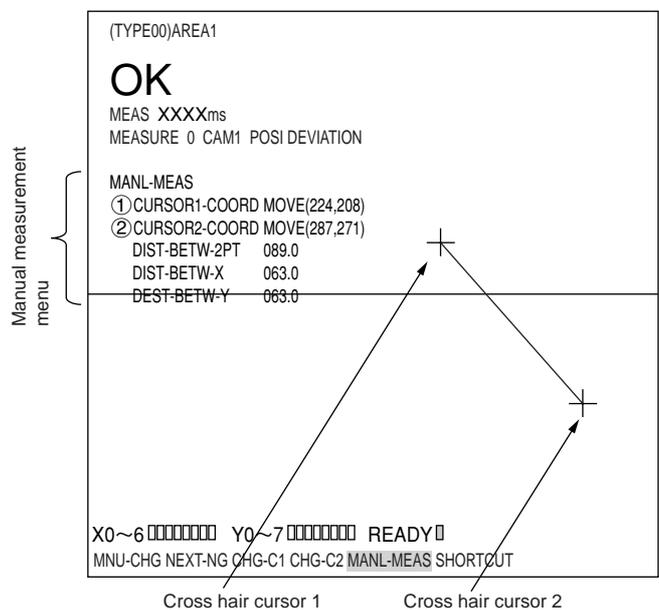
2-2 Setting the system conditions

Set the following items on the "SYS-CND" menu to set the system conditions for the controller.

■ **Setting item**
- Input/output conditions
- Communication setting
- Computer link
- Gain/offset

■ **For the following items, see the pages listed below.**
- Input/output conditions ⇨ Chapter 16
- Communication setting ⇨ Chapter 17
- Computer link ⇨ Chapter 18

```
MAIN MENU                                    F  C1  BRT

IVS30J
       ┌ SYS-CND
       ├ OBJECT TYPE COND
       ├ SET WIZARD
       ├ EDIT MAIN OPS MENU
       └ OPTION




SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```
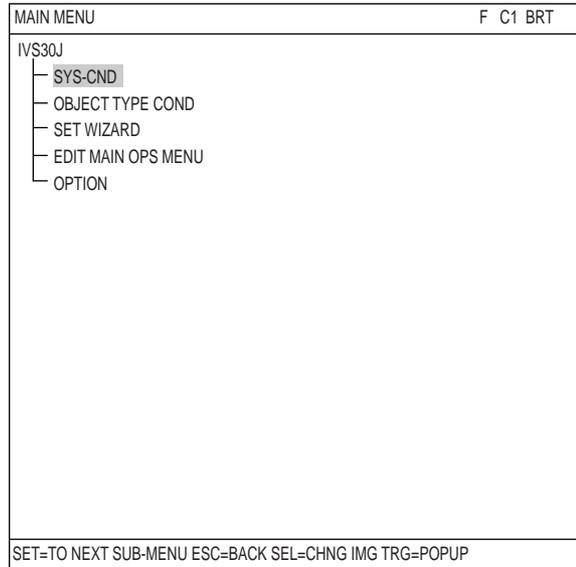
[1] Manually setting the object type

On the operation screen, the object type (00 to 15) can be changed manually (using the remote keypad).

```
SYSTEM COND SET                              F  C1  BRT

SYS-COND
       ┌ I/O CONDITIONS        ①MEAS INP I/F
       ├ COMM-SET              ②OUT I/F(PARAL.)
       ├ COMPUTER LINK         ③MANL TYPE CHNG
       └ GAIN-OFFSET           ④PARALLEL INP X5
                               ⑤PARALLEL INP X6
                               ⑥STROBE OUT
                               ⑦'READY'ON




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```
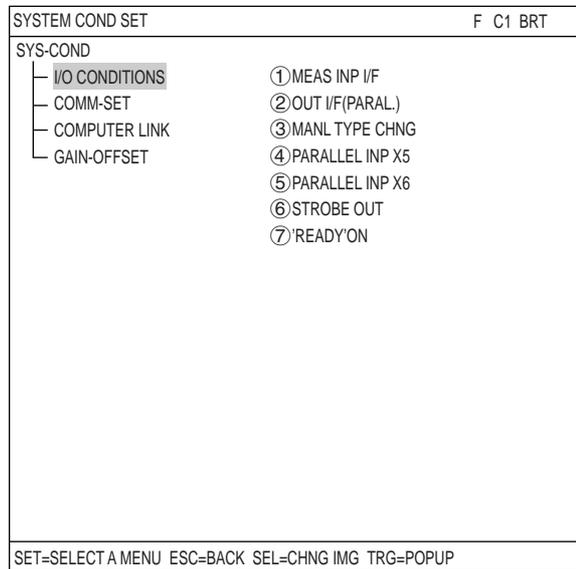
On the MAIN MENU, select "SYS-CND" -> "I/O CONDITIONS" -> "③MANL TYPE CHNG" in that order and then select "YES" or "NO" on the popup menu.

MANL TYPE CHNG	Description
YES	The type can be manually changed on the operation screen. Note: If the "③MANL 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 operation screen.

```
I/O CONDITION SCREEN COND SAVE               F  C1  BRT

①MEAS INP I/F       PARALLEL+SERIAL

②OUT I/F(PARAL.)    NO
③MANL TYPE CHNG  NO ──────▶ ┌────┐
④PARALLEL INP X5    EXT-INP │ NO │
                            │ YES│
                            └────┘
⑤PARALLEL INP X6    EXT-INP
⑥STROBE OUT         NO
⑦'READY'ON          CAPTURE COMPLETE




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```
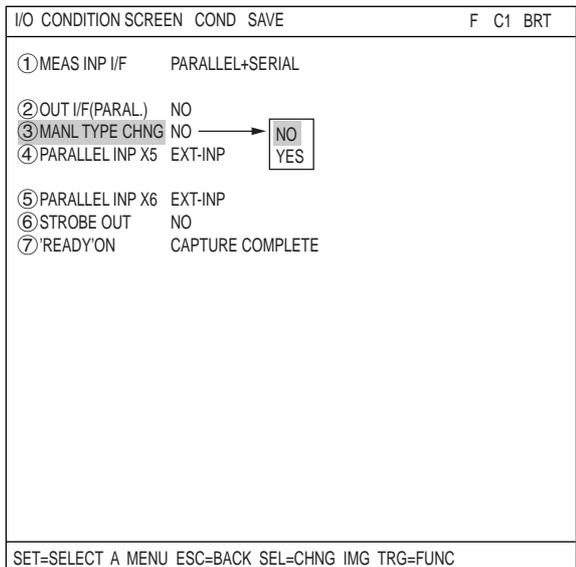
[2] Gain/offset adjustment

The gain and offset of the IV-S30J can only be adjusted by our service engineers. Users must not try to change them.
The data which can be adjusted is shown below for reference purpose only.
Generally, an image from the CCD camera can be optimized by adjusting the optical system, such as the lens iris. To make fine adjustments, the IV-S30J 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.

2

● **Setting method**
   On the MAIN MENU, select "SYS-CND" -> "GAIN OFFSET" and the following message will appear on the screen.

CHANGING A SETUP MAY LEAD TO A MACHINE FAILURE. DO YOU CHANGE IT?

(YES=SET, NO=ESC)

```
GAIN-OFFSET  SCREEN  COND  SAVE                    F  C1  BRT

①OFFSET    (CAM1)   ＋(↑) －(↓)  (026)
②GAIN      (CAM1)   ＋(↑) －(↓)  (245)
③OFFSET    (CAM2)   ＋(↑) －(↓)  (026)
④GAIN      (CAM2)   ＋(↑) －(↓)  (245)
⑤CONTRAST (MNTR)    ＋(↑) －(↓)  (055)


SET=VALUE INPUT  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

Press the SET key the "GAIN OFFSET" screen at the right appears.

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 Editing Operation screen

In this controller, the operation screen display can be changed. You can move, enlarge, reduce, or hide any block of text.

2

(1) Move the cursor to "MAIN-MENU" on the operation screen and press the SET key.

(2) Move the cursor to "EDIT MAIN OPS MENU" and press the SET key.

```
MAIN MENU                                         F  C1 BRT

IVS30J
         ─── SYS-CND
         ─── OBJECT  TYPE  COND
         ─── SET  WIZARD
         ─── EDIT MAIN OPS  MENU
         ─── OPTION




SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```
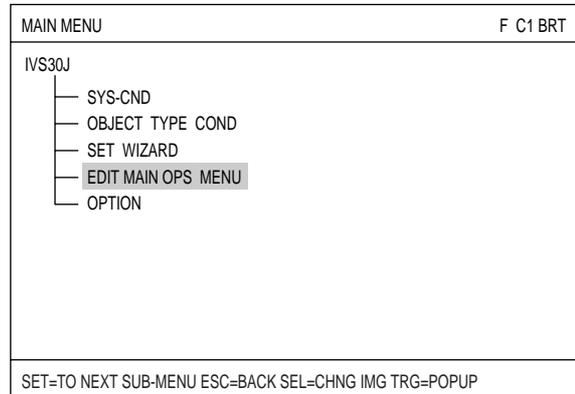
(3) Now the operation screen will appear. Select a block of text you want to edit using the up, down, left, and right arrow keys, and press the SET key. A pop up menu will appear and you can select from move, enlarge, reduce, and hide. (In this example, the block of text "OK" is selected.)

- **MOVE**
  Select "MOVE" using the SET key. Now the highlighted block of text can be moved using the up, down, left, and right arrow keys. When the text is in the desired new position, press the SET key again.

- **MAGNIFICATION/REDUCTION**
  Move the cursor to the "MAGNIFCATION" or "REDUCTION" line and press the SET key. The highlighted block of text can be enlarged or reduced.

```
OPS-MAIN            SCREEN OBJECT SAVE RESET      F  C1 BRT

(TYPE00) SAMPLE00                            F  C1 DRK  ○
                                             LOCK FULL V*.* ■
OK                                           C1=002.2 OK

MEAS   XXXXms                                C2=100.0 OK
MEAS1    MEAS-BIN-AREA  ┌─────────────┐      NG-IMG 00(00)
                        │ MOVE        │
                        │ MAGNIFCATION│
                        │ REDUCTION   │
MEAS PROGRAM            │ NON-DISP    │
MEAS RESULT            └─────────────┘




X0∼6  Y0∼7  READY
```

- **NON-DISP**
  Move the cursor to the "NON-DISP" line and press the SET key. The highlighted block of text will be deleted.
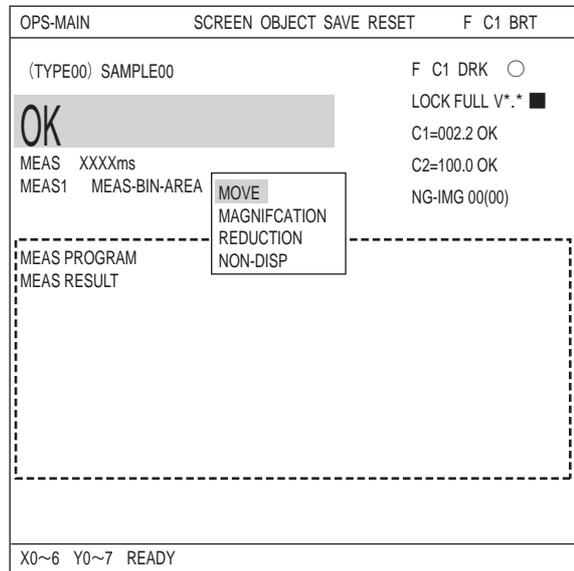
2-4 Option

With the IV-S30J, you can initialize the measurement settings, and run a self-diagnosis from the option menu.

Setting method

1) Display the "OPTION" from the "MAIN MENU."

```
MAIN MENU                                    F  C1  BRT

IVS30J
        ── SYS-CND
        ── OBJECT  TYPE  COND
        ── SET  WIZARD
        ── EDIT MAIN OPS  MENU
        ── OPTION
```

2) Select the operation you want, such as "①INITIALIZATION" or "②SELF DIAGNOSIS."

```
OPTION        SCREEN  SAVE                    F  C1  BRT

①INITIALIZATION     ALL-INIT       INIT-RAM
②SELF DIAGNOSIS     EXEC
```

① INITIALIZATION

Select any of the "ALL-INT" (initialize both FROM and RAM), or "INT-RAM" and the following message will appear.

①MEM INIT?(YES=[SET], NO=[ESC])

Press the SET key to start the initialization. The bar shown below will appear and display the progress of the initialization.

INITIALIZATION

REFERENCE IMG   ■■
SYSTEM I/O   ■
OBJECT TYPE COND   ■■■■■■■□□□

After the initialization is complete, the word "INITIALIZING" will change to "COMPLETE INIT." Press the ESC key to return to main screen.

② SELF DIAGNOSIS

Select "②SELF DIAGNOSIS" and press the SET key twice. The controller will execute a self-diagnosis and display the results of the diagnosis, as shown right. If the diagnosis results are normal, "OK" will be displayed. If the results are abnormal, "NO" will be displayed.

When the diagnosis is complete, the "DIAGNOSING" display will change to "COMPLETE DIAGNOSIS ."

```
OPTION        SCREEN  SAVE                    F  C1  BRT

①INITIALIZATION     ALL-INIT       INIT-RAM
②SELF DIAGNOSIS     EXEC


                          When the diagnosis is complete, the
                          "DIAGNOSING" display will change to
                          "COMPLETE DIAGNOSIS ."


                          DIAGNOSING
VRAM                 OK
SDRAM                OK

TYPE COND            OK
REFFERENCE IMG       OK
BOOT-PROG            OK
SYSTEM-PROG          OK


SET=EXEC ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Chapter 3 : Setting Measurement Conditions

3-1 Outline

The measuring conditions for each object type are set on the "OBJECT TYPE COND" (conditions for object type) menu. A maximum of 16 object type numbers can be registered.

```
SELECT OBJECT TYPE COND

OBJECT TYPE COND
  ┌─TYPE00
  ├─TYPE01
  ├─TYPE02
  ├─TYPE03
  ├─TYPE04
  ├─TYPE05
  └─TYPE(NEW)
```
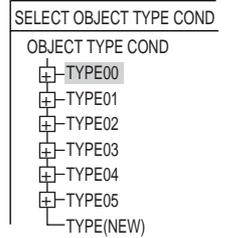
■ **How to enter the setting screen**

On the MAIN MENU, move the cursor to "OBJECT TYPE COND" and press the SET key. The "SELECT OBJECT TYPE COND" screen will appear. Select "TYPE00," "MEA-CND(CAMERA1)," and "MEAS0" or "MEAS(NEW)."
Note: "MEAS0" is only used for measuring positional deviation.

```
SELECT OBJECT TYPE COND

OBJECT TYPE COND
  ┌─TYPE00
  │   ├─ TYPE RUN COND
  │   ├─ IMAGE-ADJ
  │   ├─ MEA-CND(CAMERA1)
  │   │    ├─ MEAS0
  │   │    ├─ POSI-CORRECT
  │   │    └─ MEAS (NEW)
  │   ├─ MEA-CND(CAMERA2)
  │   ├─ FINAL NUM.CALC
  │   ├─ FINAL OUTPUT COND
  │   ├─ OBJ-TYPE I/O
  │   └─ OBJ-TYPE SYS.
  └─ TYPE(NEW)
```
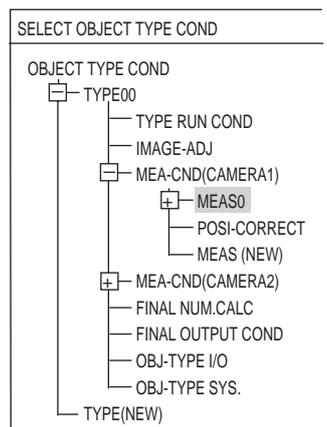
Choose a measurement program from the popup menu at "①MEAS SELECTION" to bring up the "MEAS CND" screen.
⇨ For details, see Chapter 8: "Setting Example Using the Menu Tree" in the Instruction and Hardware.

Note: New measurement programs are allocated to "MEAS01" through "MEAS04." The smallest measurement number available (from 1 to 4) will be assigned. "MEAS0" is dedicated to positional deviation measurements.

```
MEASUREMENT 1   SCREEN  COND  SAVE

①MEAS SELECTION         POSI-DEVIATION
                              ↓
                     ┌─────────────────┐
                     │ NO              │
                     │ POSI-DEVIATION  │
                     │ CHK-DEG-MATCH   │
                     │ INSPECT-LEAD    │
                     │ MEAS-BIN-OBJ    │
                     │ LABEL-BIN-OBJ   │
                     │ POINT-MEAS      │
                     │ MULTI-POSI      │
                     │ MULTI MATCHES   │
                     └─────────────────┘
```

3
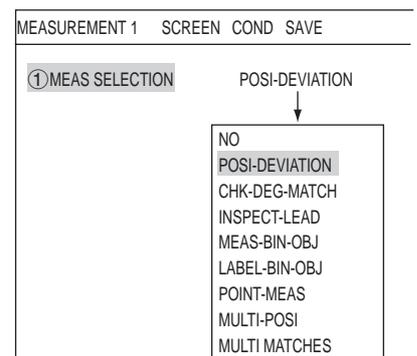
■ **Setting procedure**

A general outline of the setting procedures is shown below. For details, see each chapter.

Setting the measurement program conditions	----	MEASURE 0

MEASURE 0
MEASURE 1
MEASURE 2   Jump to the next page
MEASURE 3
MEASURE 4

Select the image pre-processing method	----	Image pre-processing ⇨ See page 3-19
Set final numerical calculation	----	"FINAL NUM.CALC" ⇨ See Chapter 14
Set final output condition	----	"FINAL OUTPUT COND" ⇨ See Chapter 15
Setting the input/output conditions	----	"OBJ-TYPE I/O" ⇨ See Chapter 16
Setting the system conditions	----	"OBJ-TYPE SYS"
Save the settings in the flash memory	----	"SAVE" ⇨ See page 1-14
Return to the MAIN OPS MENU	----	"OPS-MENU"

■ **Outline of setting the measurement program**

The measurement program can be specified from "MEAS0" through "MEAS4." (Camera1/camera 2)

```
SELECT OBJECT TYPE COND                                   F  C1  BRT

 OBJECT TYPE COND
   ⊟─TYPE00
       ─── TYPE RUN COND
       ─── IMAGE-ADJ
       ⊟─ MEA-CND(CAMERA1)
           ⊞── MEAS0(POSI-DEVIATION) ──┐
           ── POSI-CORRECT              │
           ⊞── MEAS01(CHK-DEG-MATCH) ───┤
           ⊞── MEAS02(INSPECT-LEAD) ────┼← Measurement program
           ⊞── MEAS03(MEAS-BIN-AREA) ───┤
           ⊞── MEAS04(CNT-BIN-OBJ) ─────┘
       ⊞─ MEA-CND(CAMERA2)
       ─── FINAL NUM.CALC
       ─── FINAL OUTPUT COND
       ─── OBJ-TYPE I/O
       ─── OBJ-TYPE SYS.
   ⊞─TYPE01
   ⊞─TYPE02
   ⊞─TYPE03
   ⊞─TYPE04

SET=TO NEXT SUB-MENU  ESC=BACK  SEL=CHNG IMG  TRG=POPUP
```

When you want to specify the measurement conditions using "POSI-DEVIATION."

```
MEAS CND   SCREEN  COND  SAVE                             F  C1  BRT


  ① DTECT PRECISION  STANDARD
  ② REGISTER NO       0(0~7)
  ③ MODE              1P-SCH


  REGISTER NO.     00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
  ⑤ MDL 0        S  ×  ×  ×  ×  ×  ×  ×
  ⑥ MDL 1        E  S  ×  ×  ×  ×  ×  ×

                              ┌──────────────────┐
                              │ NO               │
                              │ 1P-SCH           │
                              │ 2P-SCH           │
                              │ 1P-EDGE          │
                              │ 2P-EDGE          │
                              │ 1P-SCH+1P-EDGE   │
                              └──────────────────┘




SET=SELECT A MENU  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

┌─────────────────┐   ┌─────────────────┐   ┌─────────────────┐
│ Set the specific │ → │ Set the evaluation│ → │ Set the method for│
│ conditions for each│   │ conditions (testing)│   │ numeric calculation│
│ measurement program│   │   │   │ (testing)   │
└─────────────────┘   └─────────────────┘   └─────────────────┘

┌─────────────────────────┐
│ Set the output conditions (see│ → Select "SCREEN" and then "OPS-MENU" to the
│ Chapter 16: Setting the │   operation screen.
│ Input/Output Conditions)│
└─────────────────────────┘

3-2 Shared settings

[1] Window shape selection and settings

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

EX: Register conditions of "Positional deviation measurement."

```
REG COND  SCREEN  COND  SAVE  DETAIL                F  C1  BRT

①REGISTER NO        0(0~7)
②MEAS SHAPE  (MDL0)  RECTANGLE
③REFIMG ARE  (MDL0)  SET      (224,208)~(287,271)
④SEARCH ARE  (MDL0)  SET      (216,200)~(295,279)

                                            RECTANGLE
                                            X-LINE
                                            Y-LINE

                        +
```
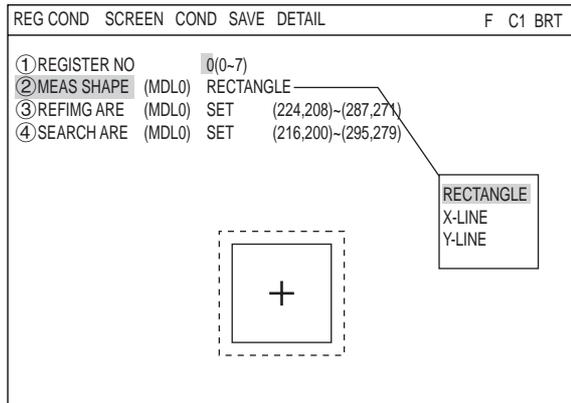
(1) Rectangular window

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 measurement (edge detection).
	Binary image window mask	Area measurement by binary conversion, object counting by binary conversion, object identification by binary conversion.

■ **How to set a rectangular window**

1. Moving the mask
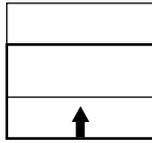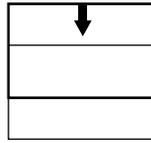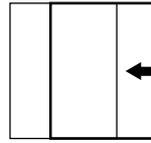
- Up key   - Down key   - Left key   - Right key
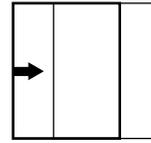
2. Specifying the upper left corner
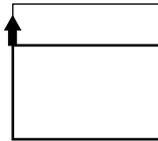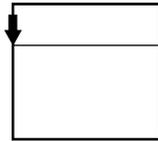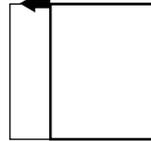
- Up key   - Down key   - Left key   - Right key
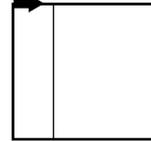
3. Specifying the lower right corner
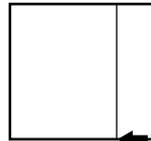
- Up key   - Down key   - Left key   - Right key
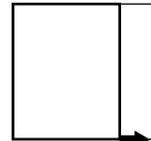
■ **To register reference images**
To register reference images, the system should be in the "Freeze" mode.
⇨ See page 1-10

■ **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   **3. Specifying the ending point**

- Left key   - Right key   - Left key   - Right key

(The up and down keys function the same as in the move item)   (The up and down keys function the same as in the move item)
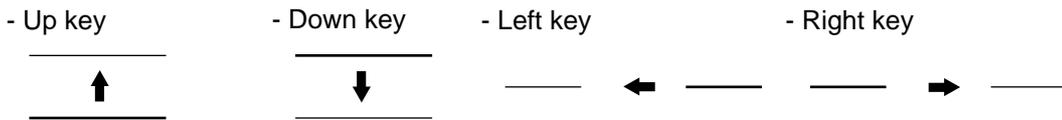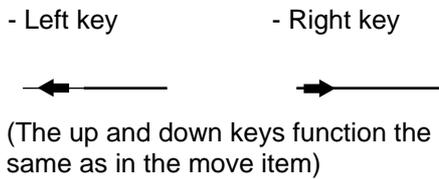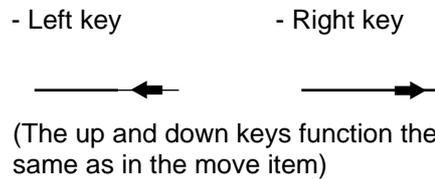
■ **How to set vertical lines**

1. Move

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

2. Specifying the starting point   **3. Specifying the ending point**

- Up key   - Down key   - Up key   - Down key

(The left and right keys function the same as in the move item)   (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	In units of pixels	8 pixels	512 pixels
Search area	Dotted line	Vertical direction: One pixel at a time			

- Vertical lines

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

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
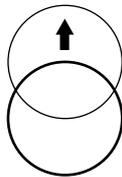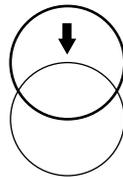
- Up key   - Down key   - Left key   - Right key
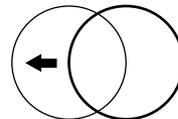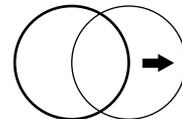
2. Specifying the radius
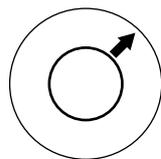
- Up/right key   - Down/left key
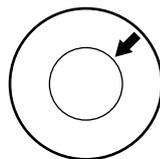
(4) Elliptical window

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
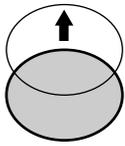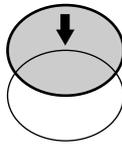
- Up key	- Down key	- Left key	- Right key
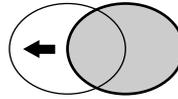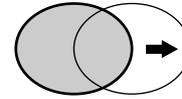
2. Specifying the radius
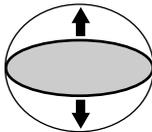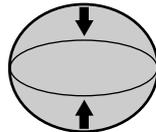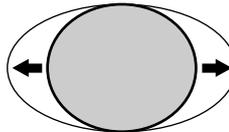
- Up key	- Down key	- Left key	- Right key
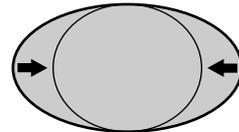
(5) Polygonal window
With the binary area measurement function, object counting after binary conversion function, object identification after binary conversion function, or point measurement after binary conversion function, you can create any shape of polygonal window with up to 32 sides, in addition to the rectangles, circles, and ovals that were available in previous versions.
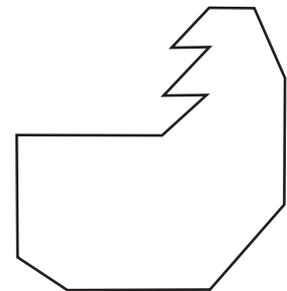
Any polygonal window
(up to 32 sides)

■ **How to create a window**
On the "POLYGON" setting screen, specify a coordinate using the up, down, left, and right arrow keys, and then press the SET key. Thereafter, specify points 02, 03 and so on, in numerical order. After specifying the last coordinate, press the SET key again to confirm the polygonal shape you have drawn.
To edit the polygonal shape, select a point to modify using the up and down arrow keys, and press the SET key. A popup menu will appear. Select CHANGE, INSERT or DELETE.

① 6P (305,153)
② 7P (305,186)
③ 8P (272,186)
④ 9P (272,211)
⑤ 10P (243,211)
⑥ 11P (243,236)
⑦ 12P (217,239)
⑧ 13P (217,239)
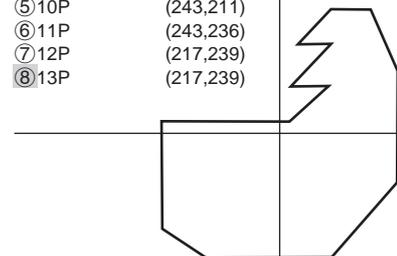
[2] Image settings

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

(1) Pixel contraction and detection precision (gray scale processing)

■ **Measurement condition setting screen**

The display will change from 1 to 2 to 3 using the up and down arrow keys.

```
MEAS CND
──────────────────────────────────
①DTECT PRECISION  STANDARD ──→ STANDARD
                               HIGH PRECISION
```

```
REG COND
──────────────────────────────────
⑤CONTR. PIXL(MDL0)   1
```
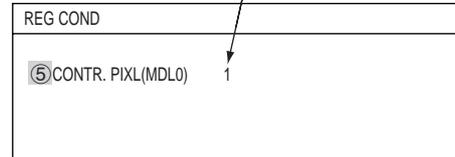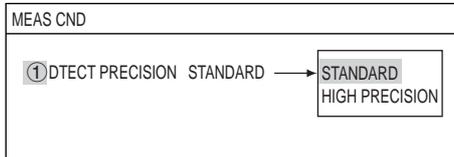
Note: At the "DETAIL" item in the upper function menu, select "CONTR.PIXEL." Then, "⑤ or ⑨CONTR.PIXL" will appear on the screen.

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 Reference image (Standard) Search coordinates use a 1 pixel level of precision (High precision) Search coordinates use a sub-pixel level of precision (1/10) Degree of match High precision pixel detection / Camera image / Standard pixel detection Point of detection / Pixel / Point of detection
⑤⑨CONTR. PIXL (Grey search 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.

3

(2) Threshold value setting

The IV-S30J 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.

Threshold valve B

Threshold valve A

(Captured image)

Binary conversion
(upper limit 255, lower limit A)

Binary conversion
(upper limit 255, lower limit B)

(Threshold value)
255
Lower limit A — White
B — Black
0

Binary conversion
(upper limit A, lower limit B)

(Threshold value)
255
Upper limit A — Black
— White
Lower limit B — Black
0

(Threshold value)
255
A — White
Lower limit B — Black
0
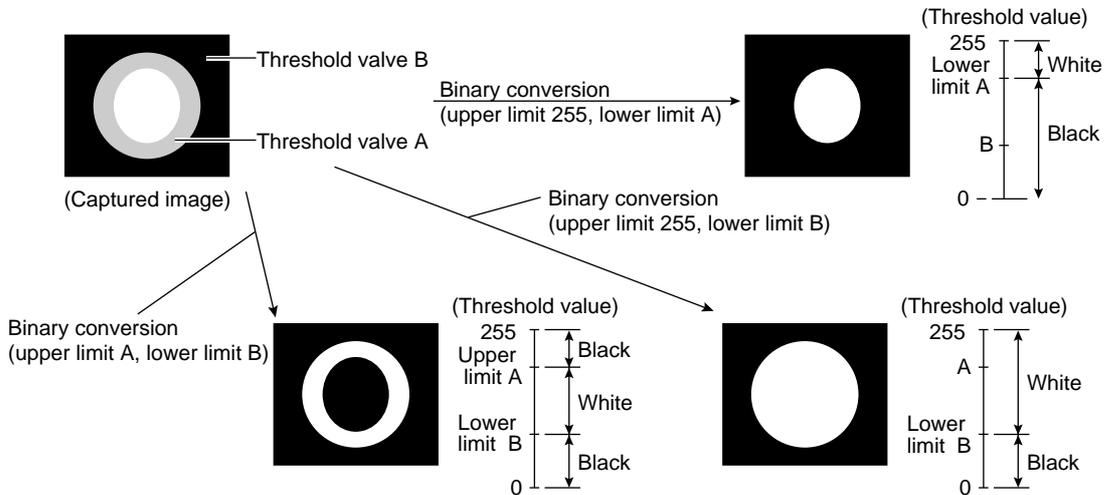
■ **Setting the threshold value automatically**

The binary threshold value can be set automatically.

In the binary area condition of each measurement program, execute the "AUTO REG" 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**

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

- Binary area condition (binary image mask) menu of the binary area measurement

THRESHOLD VAL AUTO-REG RESET   F C1 DRK

①U.LM   255(0~255)
②L.LM   100(0~255)   L LIMIT ONLY
                                   U&L LIMITS

+

SET=CHNG ESC=BACK SEL=CHNG IMG TRG=FUNC

3-10
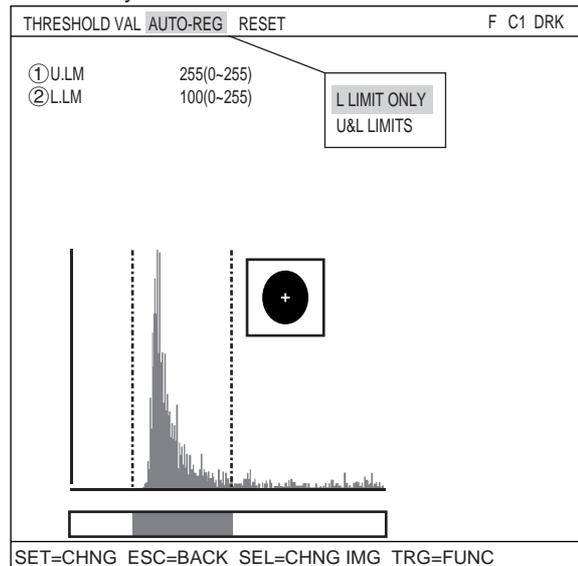
(3) Setting window boundaries (enable/disable)
This function enables and disables the labeling (object identification) of binary images located that cross over the window frame boundary.
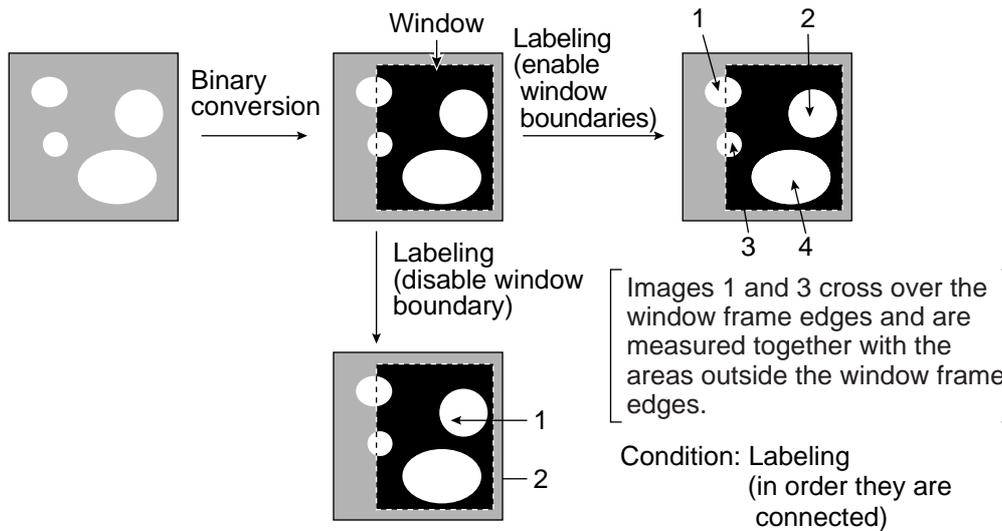
Images 1 and 3 cross over the window frame edges and are measured together with the areas outside the window frame edges.

Condition: Labeling
(in order they are
connected)

■ **Measurement programs which are affected by these settings**
Object counting by binary conversion, object identification by binary conversion

■ **Setting method**
Select "DETAIL" in the upper function menu on the REG COND screen. Select
"BOUNDARY PROCESS" from the popup menu and then press the SET key.
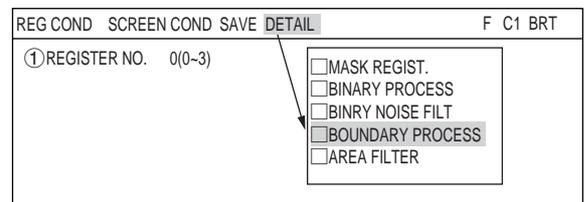
(4) Object identification and numbering function (labeling)
Object identification and numbering (labeling) is a process for locating separate object and assigning serial numbers (labels) one at a time in a binary image. By this process, multiple objects in the same binary image can be handled separately or as a group.

■ **Measurement programs which are affected by these settings**
Object counting by binary conversion, object identification by binary conversion

3-11

3

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

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

Threshold correction value

Variation in lighting

Fixed

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.

Fails to convert the image due to a variation in lighting

Threshold correction using either VAR-DIFF (enter variations in lighting as value) and VAR-RATE (enter variations in lighting as a rate) can be selected the 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)

■ **Setting method**

Select "③THRESHOLD" on the "REG COND" screen and then change the upper and lower limit values using the up, down, left, and right arrow keys.

```
REG COND  SCREEN COND SAVE  DETAIL              F  C1  BRT

①MEAS SHAPE    RECTANGLE
②MEAS AREA     SET  (224,208)~(287,271)
③THRESHOLD     SET  [U.LM255 L.LM100(0~255)]
④INVERT B/W    NO          ↑          ↑

                  Change using the up and
                  down arrow keys.
```

(6) 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.
The IV-S30J has both "contraction → expansion" and "expansion → contraction" functions for eliminating binary noise.

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.
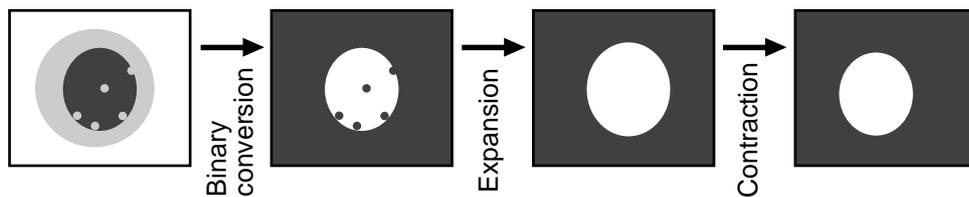
2 Contraction → expansion
When isolated white noise is eliminated by contraction, the areas shrunk by contraction are returned to their original size by expanding them again.
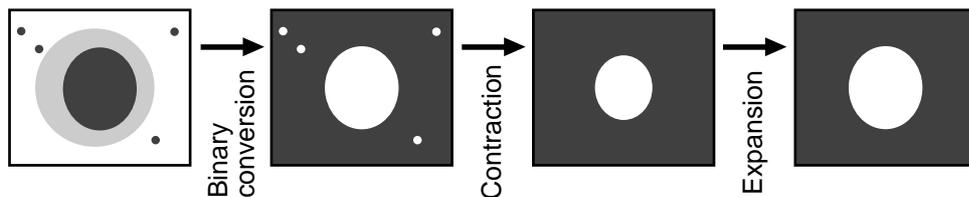
- Number of times of expansion and number of times of contraction can be set independently. When the number of contraction cycles is set to 0, and the number of expansion cycles is one or greater, then only the expansion function will be used.
On the other hand, if the number of expansion cycles is set 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

■ **Setting method**
Select "DETAIL" in the upper function menu on the REG COND screen, and choose "BINRY NOISE FILT" to change the blank box to a filled box. Then, "⑤BINRY NOISE FILT" will appear on the REG COND screen. Press the SET key on this line and select "EXPD. -> CONTR." or "CONTR -> EXPD." from the popup menu.

3
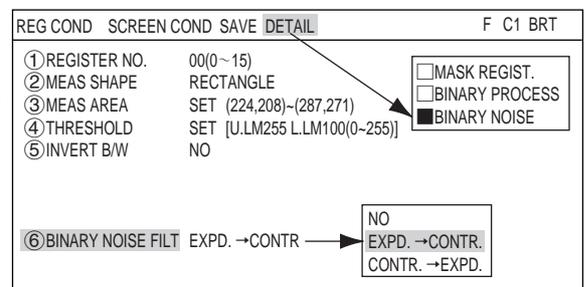
(7) Edge detection

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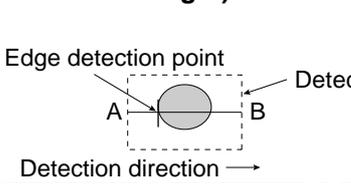
• **Vertical transition point from light to dark (moving from top to bottom)**

Edge detection point

A ◯ B

Detection area

Detection direction →

Edge detection point

A

B

Detection direction

Light

Brightness level

Dark

Edge width   Flat width

A   Direction   B

Difference in level
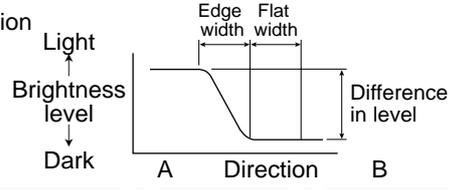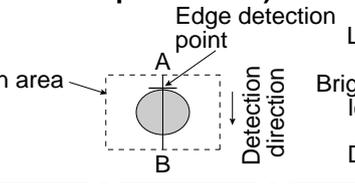
• **Horizontal transition point from light to dark (moving from right to left)**
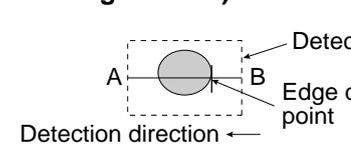
• **Vertical transition point from light to dark (moving from bottom to top)**

Detection area

A ◯ B

Edge detection point

Detection direction ←

A

B

Detection direction

Light

Brightness level

Dark

Edge width   Flat width

A   Direction   B

Difference in level
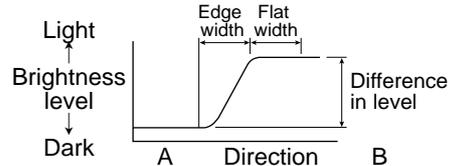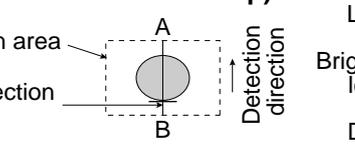
• **Center (dark), horizontal (left and right)**

Edge detection point
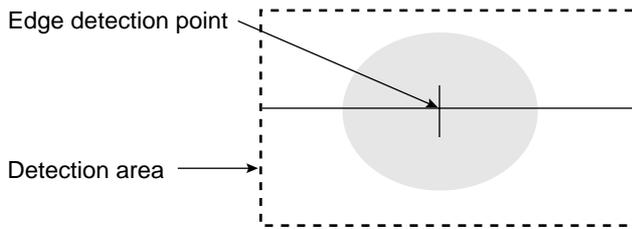
Detection area

• **Edge detection of the inside and outside edges of a two circles**

A: Moving right horizontally from light to dark

B: Moving right horizontally from dark to light

C: Moving left horizontally from dark to light

D: Moving left horizontally from light to dark

Internal diameter (between B and C)
External diameter (between A and D)
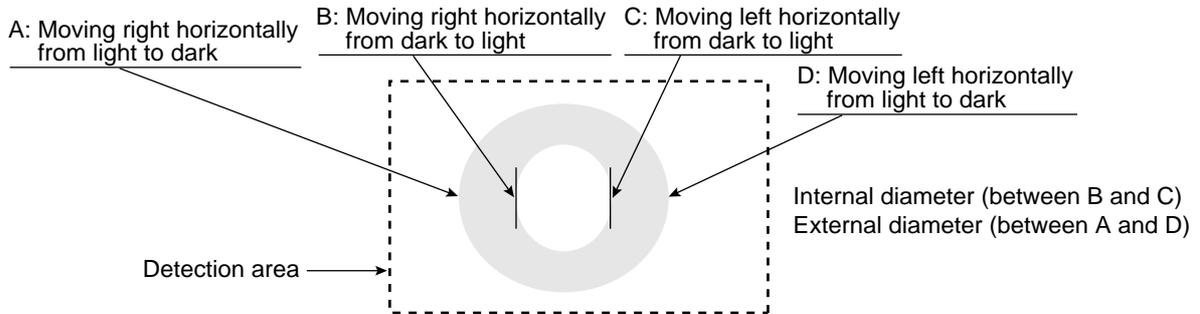
Detection area

- 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.REG" (automatic setting) for the edge detection condition in each measurement program, the IV-S30J can automatically detect edges in the measurement areas, and set the optimum threshold values automatically (density difference and edge width).

■ **Measurement programs which are affected by these settings**
Positional deviation measurement (edge detection), lead inspection, multiple position measurement (edge detection).

- Edge detection menu of the lead inspection

```
THRESHOLD VAL  AUTO-REG  RESET                    F  C1  BRT

①GRYS      050(0~255)
②EDGE.W    2(1~8)
③FLAT.W    04(1~16)




SET=CHNG  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```
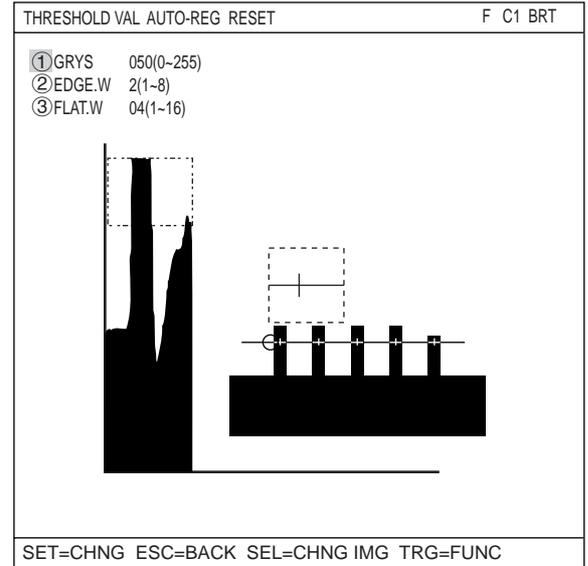
(8) Artifact processing
Artifact processing is a method of processing that eliminates the false detection of the edge of the target object when an artifact is in the line being scanned. This process can be used during edge detection. The real edge of the target object is detected by computing the average 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).
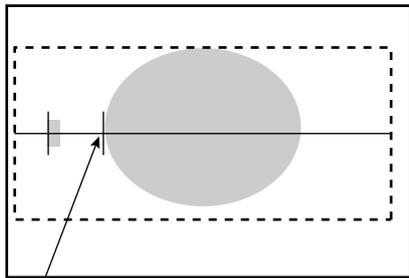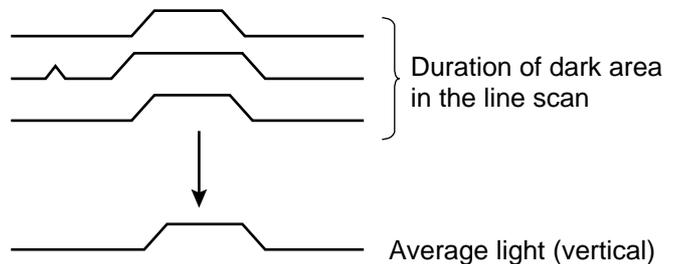
Duration of dark area in the line scan

Average light (vertical)

Edge detection point
(with artifact processing: enabled)

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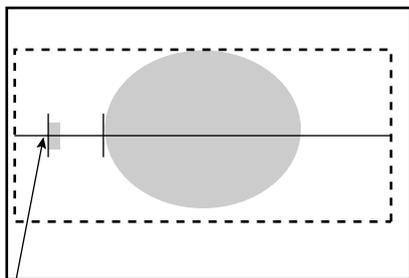
Edge detection point (with artifact processing off)

■ **Measurement programs which are affected by these settings**
Positional deviation measurement (edge detection), lead inspection, and multiple position measurement (edge detection).

3-15

(9) 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-S30J 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.
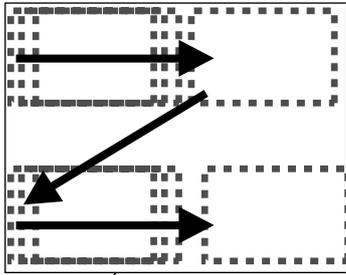
Search in the specified search area on the captured image
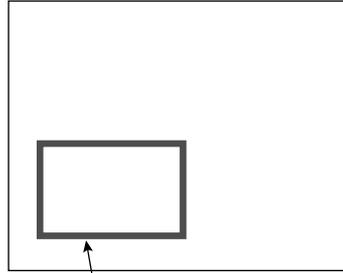
Find the area having the maximum features in the reference image area.

■ **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.

■ **Setting method**
Move the cursor to the "④REFERENCE IMG" with up and down arrow keys on the reference image area setting screen. Next, select "CONTRAST SRCH." Finally, press the SET key.

```
RECTANGLE   RESET   RETURN                          F  C1  BRT

MDL 0
①UP.L              (224,208)
②LO.R              (287,271)
③MOVE
④REFERENCE IMG  ──────────▶  CONTRAST SRCH
                             REG
                             DISP

                    ┌ ─ ─ ─ ─ ─ ┐
                    │           │
                    │     +     │
                    │           │
                    └ ─ ─ ─ ─ ─ ┘

                                          X:224  Y:208
SET=DECISION ESC=BACK SEL=CHNG IMG TRG=FUNC
```
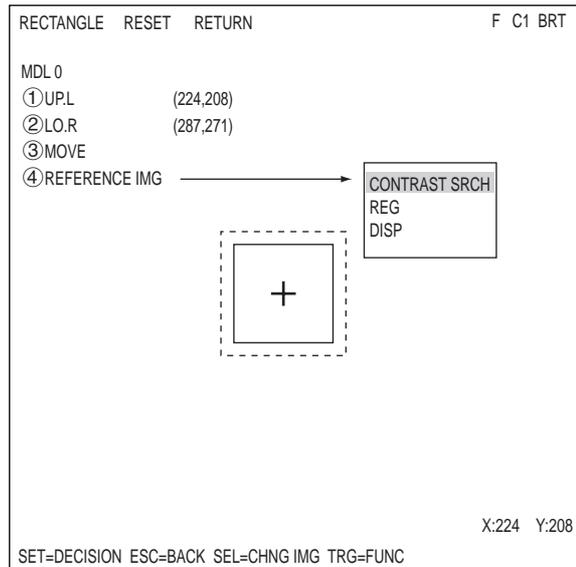
[3] Evaluation conditions

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

```
EVALUAT COND  SCREEN  COND  SAVE

 ①REGISTER        00(0~15)           [TEST RESULT]        [OUTPUT]
 ②CONDITION SET RESET  AUTO(±10%)
 ③MATCH LVL (MDL0) -10000~+10000   M0=+09000     OK    NO
 ④X COORD. (MDL0)  000.0~511.0      X0= 000.0     OK    NO
 ⑤Y COORD. (MDL0) 000.0~479.0       Y0= 000.0     OK    NO
 ⑥GLAY LVL (MDL0) 000.0~255.0       G0= 116.0     OK    NO
 ⑦MATCH LVL (MDL1) -10000~+10000   M1=+09000     OK    NO
 ⑧X COORD. (MDL1)  000.0~511.0      X1= 000.0     OK    NO
 ⑨Y COORD. (MDL1) 000.0~479.0       Y1= 000.0     OK    NO
 ⑩GLAY LVL (MDL1) 000.0~255.0       G1= 116.0     OK    NO
 ⑪TEST            EXEC(WITH-POSI. ADJ WITHOUT-POSI.ADJ)


SEL=VALUE INPUT  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

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 3-30 to 3-32.

● Condition setting
  Upper and lower limit values of the all evaluation condition items can be set automatically with the following processes.
  After testing more than one good workpieces, the IV-S30J automatically set the limits based on the test results.

Condition settings	Details
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 cursor to the "AUTO" position and press the up and down keys to change the value. After determining the value, press the SET key, upper and lower limits of each item will be automatically set with tis %.be the upper and lower limit without any condition.

■ **Setting method**

There are two ways to get to the evaluation condition setting screen.

1) Select "CND" in the upper function menu on the MEAS CND (or REG COND) screen and press the SET key. Select "EVALUATION" on the pop up menu to go to the "EVALUAT COND" screen.

```
MEAS CND    SCREEN   COND   SAVE                    F  C1  BRT

①DTECT PRECISION  STANDARD          IMG PRE-PROC
②REGISTER NO.     0(0~7)            REG-COND(S)
③MODE            1P-SCH             REG-COND(E)
④DTECT ANGL       −15¡              POSITION CORRECTION
⑤ANGLE UNIT       10                EVALUATION
                                    DST&ANGL
REGISTER NO.                        NUM-CALC
⑥MDL 0         00 01 02 03 04 05 06 07  OUT
⑦MDL 1         S
               ×

SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

2) Move the cursor to the "EVALUATION COND" item on the Menu tree screen and press the SET key.

```
SELECT OBJECT TYPE COND                             F  C1  BRT

OBJECT TYPE COND                    ①REGISTER NO.
⊟ TYPE00                            ②CONDITION SET
   ├ TYPE RUN COND                  ③X COORD.   (BDL0)
   ├ IMAGE-ADJ                      ④Y COORD.   (MDL0)
   ⊟ MEA-CND(CAMERA1)               ⑤x DEVIATE  (MDL0)
      ⊟ MEAS0(POSI-DEVIATION)       ⑥y DEVIATE  (MDL0)
         ├ IMG PRE-PROC             ⑦MATCH LVL  (MDL0)
         ⊟ MEAS CND                 ⑧ANGULAR DEVIATE
            ├ REG-COND(S)           ⑨X COORD.   (MDL1)
            └ REG-COND(E)           ⑩Y COORD.   (MDL1)
         ├ EVALUATION COND          ⑪x DEVIATE  (MDL1)
         ⊞ DISTANCE&ANGLE COND      ⑫y DEVIATE  (MDL1)
         ├ NUM-CALC                 ⑬MATCH LVL  (MDL1)
         └ OUT-COND                 ⑭TEST
      ├ POSI-CORRECT
      └ MEAS(NEW)
   ⊞ MEA-CND(CAMERA2)
   ├ FINAL NUM.CALC
   ├ FINAL OUTPUT COND
   └ OBJ-TYPE I/O

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

[4] Image pre-processing

A comparative calculation between images, gray level changes, and space filter are available for image pre-processing.

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, midrange emphasis
Space filter	Smoothing (center/average),edge emphasis,edge extraction, horizontal edge,vertical edge

3

■ How to get to the "IMG PRE-PROC" screen

Select "OBJECT TYPE COND" and then "TYPE00" or "TYPE(NEW)" on the "MAIN COND" screen. Then select "MEA-CND(CAMERA1)" and "MEAS" to open a measurement screen. At the "①MEAS SELECTION" item, press the SET key and choose a measurement program from the popup menu.
Note: If the "①MEAS SELECTION" is set to "NO," the image pre-processing cannot be specified.

```
MEASUREMENT 1  SCREEN  COND  SAVE

①MEAS SELECTION     POSI-DEVIATION        NO
                                          POSI-DEVIATION
                                          CHK-DEG-MATCH
                                          INSPECT-LEAD
                                          MEAS-BIN-OBJ
                                          CNT-BIN-OBJ
                                          LABEL-BIN-OBJ
                                          POINT-MEAS
                                          MALTI-POSI
                                          MULTI MATCHES
```
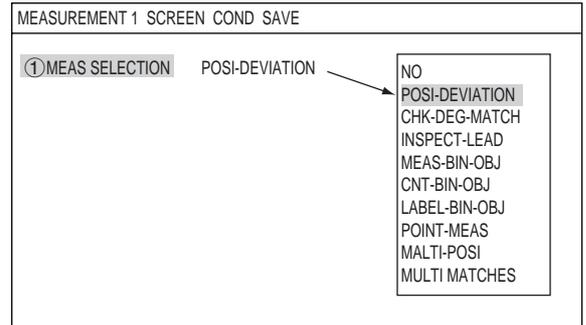
Press the ESC key to return to the OBJECT TYPE COND screen. Then select "IMG PRE-PROC."

```
SELECT OBJECT TYPE COND                           F  C1  BRT

OBJECT TYPE COND
 ├─ TYPE00                              ①COMPARE IMGS
 │    ├─ TYPE RUN COND                  ②COMP IMGS COND
 │    ├─ IMAGE-ADJ                      ③CHNG GRAY LEVEL
 │    ├─ MEA-CND(CAMERA1)               ④CONTRAST MAGNI
 │    │   ├─ MEAS0(POSI-DEVIATION)      ⑤SPACE FILTER
 │    │   │   ├─ IMG PRE-PROC           ⑥NUM.OF FILTER
 │    │   │   ├─ MEAS CND
 │    │   │   ├─ EVALUATION COND
 │    │   │   ├─ DISTANCE&ANGLE COND
 │    │   │   ├─ NUM-CALC
 │    │   │   └─ OUT-COND
 │    │   ├─ POSI-CORRECT
 │    │   └─ MEAS(NEW)
 │    ├─ MEA-CND(CAMERA2)
 │    ├─ FINAL NUM.CALC
 │    ├─ FINAL OUTPUT COND
 │    ├─ OBJ-TYPE I/O
 │    └─ OBJ-TYPE SYS.
 └─ TYPE(NEW)

SET=TO NEXT SUB-MENU  ESC=BACK  SEL=CHNG IMG  TRG=POPUP
```

The "IMG PRE-PROC" screen will appear.

⇨ For details about "COMPARE IMGS" (compare images), see page 3-20.
⇨ For details about "CHNG GRAY LEVEL" (change gray level), see page 3-22.
⇨ For details about "SPACE FILTER," see page 3-23.

```
IMG PRE-PROC  SCREEN  COND  SAVE                  F  C1  BRT

①COMPARE IMGS       NO

②CHNG GRAY LEVEL    NO

③SPACE FILTER       NO
```

3
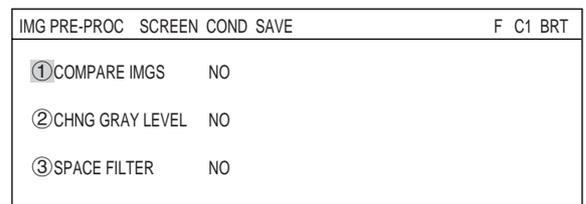
(1) Comparative calculations between images

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.

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.	COMPARE IMGS SCREEN SAVE F C1 BRT	
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)	①CALC.TYPE NO ⟶ NO ②CALC.AREA SET (232,216)-(279,263) SUBI1-T1 DIFF.ABS | I1-T1 |	
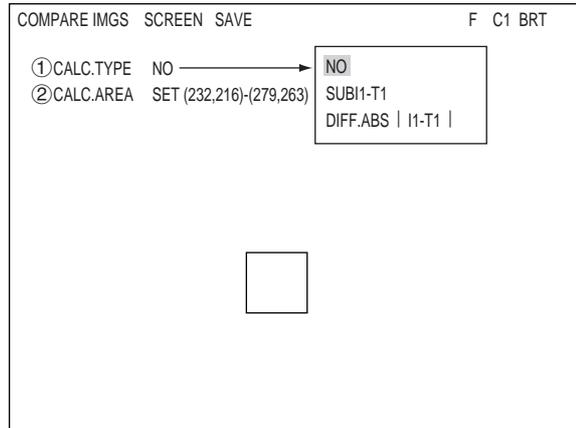
■ **Example of comparative calculations between images**

Image A   Light level 0   Image B

Light level 180

- Subtraction
  (Image A - Image B)

- Subtraction
  (Image B - Image A)

- The absolute value
  of the differences
  (| Image A - Image B |)
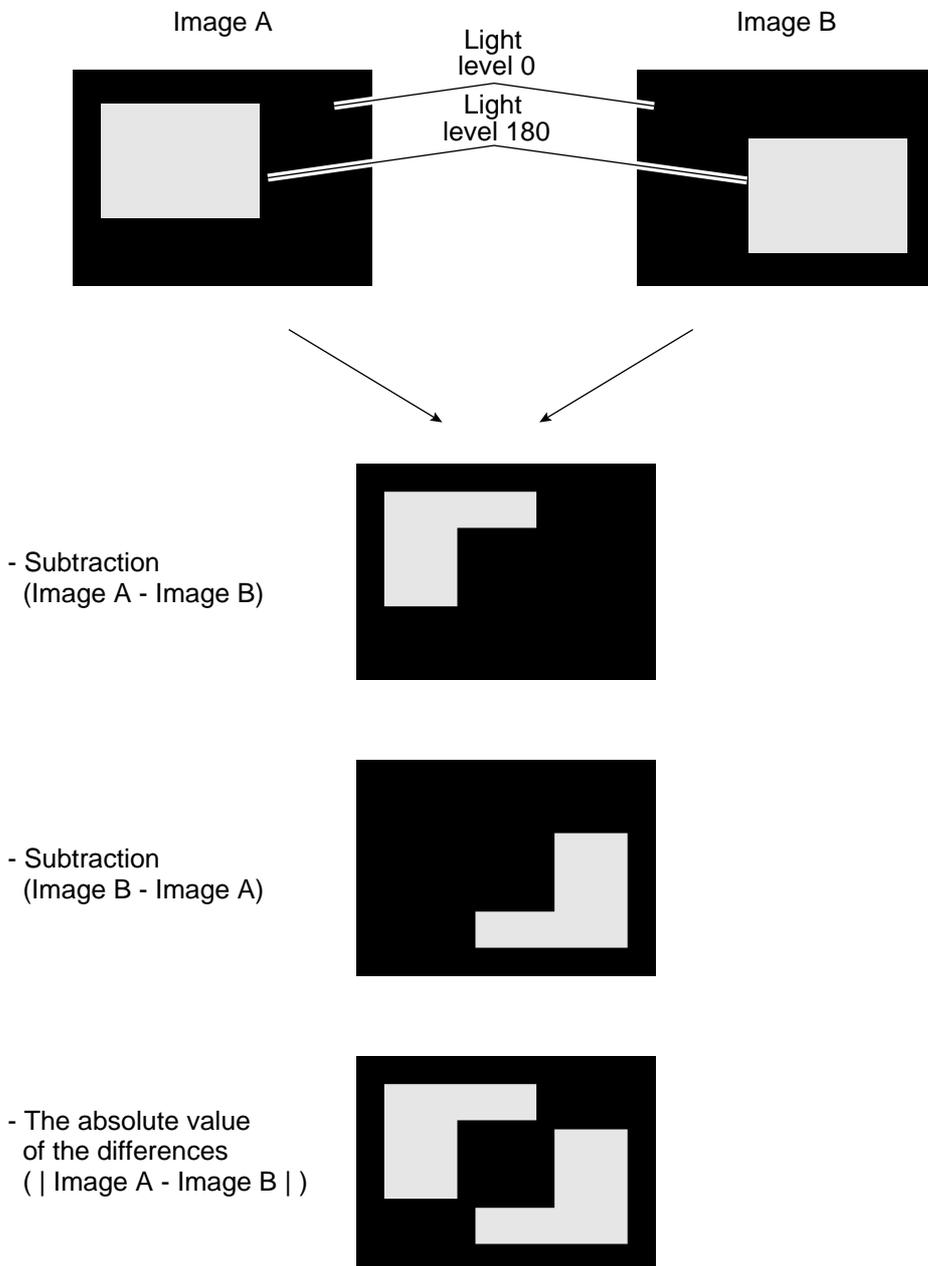
■ **Setting details**

1. Select the camera to be used for "①COMPARE IMGS" from the popup menu. Then select the "②COMP IMGS COND" item to get to the setting screen.

```
IMG PRE-PROC  SCREEN COND SAVE              F  C1  BRT

①COMPARE IMGS     CAM1 ──────────→    NO
②COMP IMGS COND   (TO NEXT SUB-MENU)      CAM1
③CHNG GRAY LEVEL  CONTRAST MAGNI          CAM1&2
④CONTRAST MAGNI   00.0TIMES
⑤SPACE FILTER     SMOOTH(AVE)
⑥NUM.OF FILTER    1(0~5)


















SET=SELECT A MENU  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

3
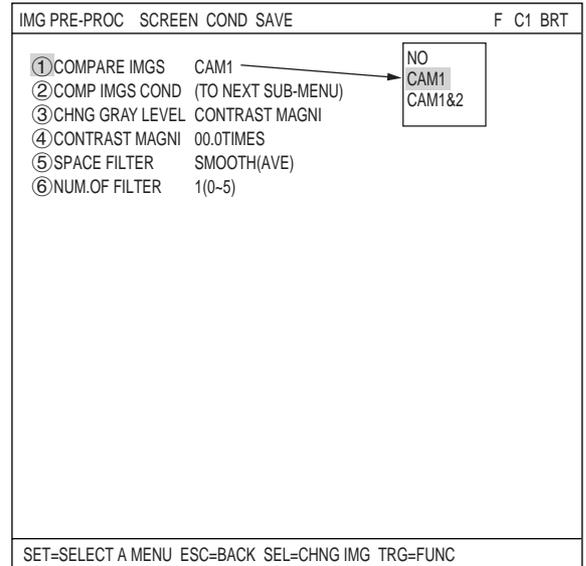
2. Select "①CALC.TYPE" and then set "②CALC.AREA."

```
COMPARE IMGS  SCREEN  SAVE                 F  C1  BRT

  ①CALC.TYPE      NO
  ②CALC.AREA      SET   (232,216)-(279,263)





              ┌───┐
              │   │
              └───┘






SET=SELECT A MENU  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```
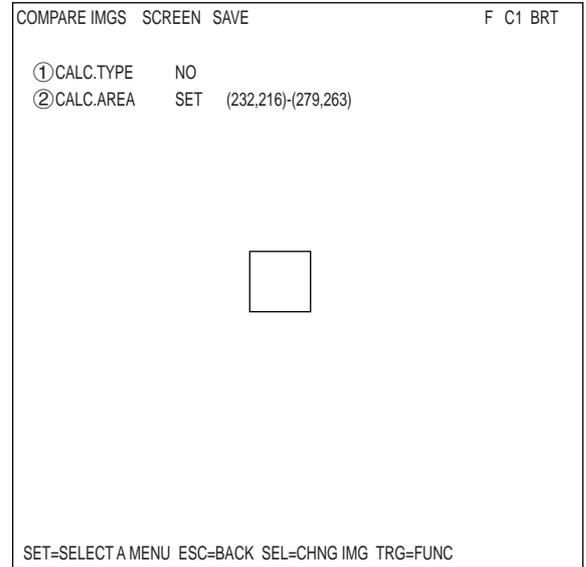
The list of settings which may be selected at item "①COMPARE IMGS" is as follows.

SELECT CAMERA	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."

3

(2) Gray level change

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

```
IMG PRE-PROC  SCREEN  COND  SAVE                    F  C1  BRT

① COMPARE IMGS        NO

② CHNG GRAY LEVEL ──→ ┌─────────────┐
                      │ NO          │
③ SPACE FILTER        │ CONTRAST MAGNI
                      │ γ +         │
                      │ γ -         │
                      │ CHNG-L      │
                      │ INCRS-M     │
                      └─────────────┘
```
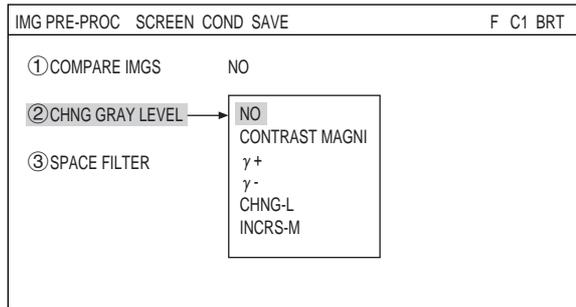
Gray level change	Details
Magnification by N processing (**.* TIMES)	To improve the contrast (the ratio of high value gray levels to low value gray levels), specify a magnification rate (00.0 to 99.9) for multiplying the image data. - If the magnified gray level exceeds 255, the system will correct the 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:
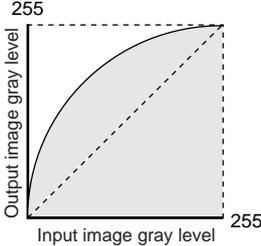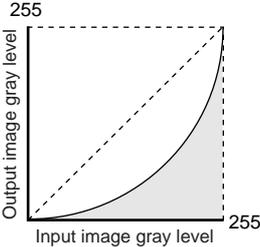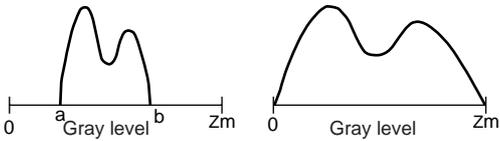
Input image gray level(G)	Output image gray level
0 to 127	$(G \div 127)^2 \times 127$
128 to 255	$(\sqrt{(G-128) \div 127 \times 127}) + 127$

(3) 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-S30J, you can select from "smoothing (average, center)," "edge emphasis," "edge extraction," "horizontal edge," and "vertical edge."

```
IMG PRE-PROC  SCREEN COND SAVE              F  C1  BRT

①COMPARE IMGS      NO

②CHNG GRAY LEVEL   NO
                                         ┌──────────────┐
③SPACE FILTER      SMOOTH(AVE)  ───────► │NO            │
④NUM.OF FILTER     7(0~5)                │SMOOTH(AVE)   │
                                         │SMOOTH(CENT)  │
                                         │EMPHAS EDGE   │
                                         │EXTRACT EDGE  │
                                         │HORIZ-EDGE    │
                                         │VERT-EDGE     │
                                         └──────────────┘
```

3

Item	Contents	
Smoothing (center)	- 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.	- 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.
Smoothing (average)	- 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.	
Edge emphasis	- Display images with sharp boundaries between brighter and darker areas. - Used to stabilize and create a binary outline around unclear objects.	
Edge extraction	- Display images after extracting and clarifying the boundaries between the brighter and darker areas.	- Used to measure objects with low contrast.
Horizontal edge	- Horizontal edge extraction: Display only the horizontal boundaries of an object.	
Vertical edge	- Vertical edge extraction: Display only the vertical boundaries of an object.	

■ **Example of an image**

- No
- Smoothing

- Edge emphasis
- Edge extraction (All)

- Edge extraction (horizontal)
- Edge extraction (vertical)

3

[5] Image adjustment
■ How to set the image adjustment function
Select "IMAGE-ADJ" on the "SELECT OBJECT TYPE COND" screen and press the SET key.

```
SELECT OBJECT TYPE COND                          F  C1 BRT

OBJECT TYPE COND
 ┌─TYPE00                              ①ADJ.IMG GRAY(CAM1)
 │        ── TYPE RUN COND             ②ADJ.COND(CAM1)
 │        ── IMAGE-ADJ                 ③ADJ.IMG GRAY(CAM2)
 │       ┌┼─ MEA-CND(CAMERA1)          ④ADJ.COND(CAM2)
 │       ┌┼─ MEA-CND(CAMERA2)
 │        ── FINAL NUM.CALC
 │        ── FINAL OUTPUT COND
 │        ── OBJ-TYPE I/O
 │        ── OBJ-TYPE SYS.
 └─TYPE(NEW)
```
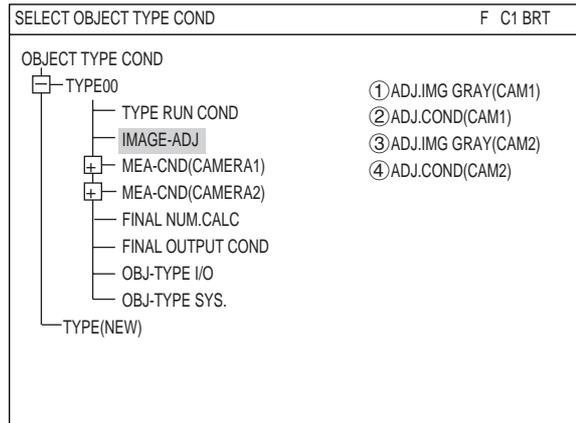
● Shading correction
This process removes unevenness from images that have gray level unevenness caused by an illumination.

```
IMAGE-ADJ   SCREEN  SAVE                          F  C1 BRT

                                        ┌────┐
                                        │ NO │
①ADJ.IMG GRAY(CAM1)   YES ─────────────▶│ YES│
②ADJ-COND(CAM1)       (TO NEXT SUB-MENU)└────┘
③ADJ.IMG GRAY(CAM2)   NO
```
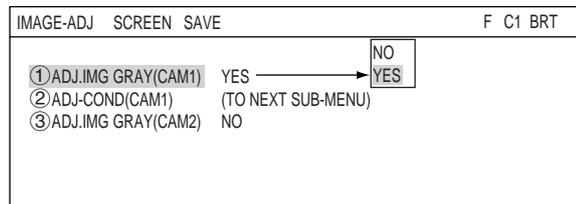
● Adjustment condition
To set the adjustment conditions for gray level corrections, select "②ADJ-COND" and then press the SET key to show the sub menu.

```
ADJ.IMG GRAY  SCREEN  SAVE                        F  C1 BRT

①ADJ.MODE        SUBTRACTING
②ADJ.AREA        SET  (224,208)-(287,271)
③SET STD.GRAY LV SET  (224,208)-(287,271)  GRAY(000)

                                      ┌─────────────┐
                                      │ SUBTRACTING │
                                      │ DECREASING  │
                                      │ FILTERING   │
                                      └─────────────┘
```

Correction mode	Details
SUBTRACTING	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.
DECREASING	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.

[6] Binary image mask

Use the binary image mask when an object to measure by binary conversion cannot be measured using rectangle, circle, or ellipse window.
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 (black fixed)

3

■ Measurement programs which are affected by this setting

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

■ Setting method

1. On the SELECT OBJECT TYPE COND screen, select "MEAS CND" (measurement conditions) and press the SET key. The MEA-CND screen will appear. Select "①WINDOW" and press the SET key. Select "BINARY-IMG-MASK" from the popup menu.

```
MEA-CND   SCREEN  COND  SAVE          *              F  C1  BRT
                                   NUM-OF-MASK 1
①WINDOW          BINARY-IMG-MASK   NUM-OF-MASK 2
②REGISTER NO.    0                 NUM-OF-MASK 4
③REGISTER EXIST  NO                BINARY-IMG-MASK
④MASK BINARY IMG NO                POLYGON


   REGISTER NO.   00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑤BINARY AREA      ✕
```
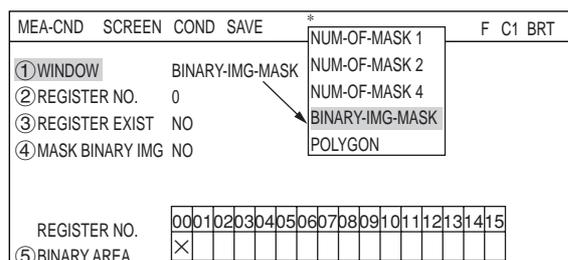
2. Highlight the "④MASK BINARY IMG" item and press the SET key. A popup menu will appear. Select "REF-IMG" or "MANUAL" and the "⑤BIN IMG MASK" line will appear.
   Selecting "REF-IMG" ➪ See page 3-26 to 27.
   Selecting "MANUAL" ➪ See page 3-28 to 29.

```
MEA-CND   SCREEN  COND  SAVE                         F  C1  BRT

①WINDOW          BINARY-IMG-MASK
②REGISTER NO.    0
③REGISTER EXIST  NO                         NO
④MASK BINARY IMG REF-IMG  ────────────────▶ REF-IMG
⑤BIN IMG MASK    (TO NEXT SUB-MENU)         MANUAL
   REGISTER NO.   00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑥BINARY AREA      ✕
```
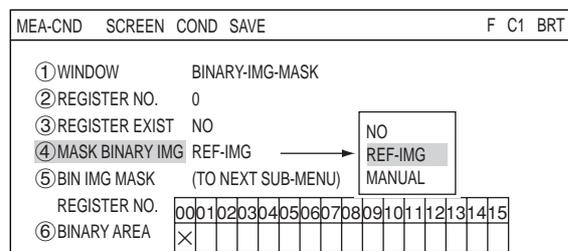
3. Select "⑤BIN IMG MASK" (binary image masking condition) and press the SET key. The, MASK BINARY IMG screen will appear.

```
MEA-CND   SCREEN  COND  SAVE                         F  C1  BRT

①WINDOW          BINARY-IMG-MASK
②REGISTER NO.    0
③REGISTER EXIST  NO
④MASK BINARY IMG REF-IMG
⑤BIN IMG MASK    (TO NEXT SUB-MENU)

REGISTR NO.      00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑥BIN AREA COND    ✕
```
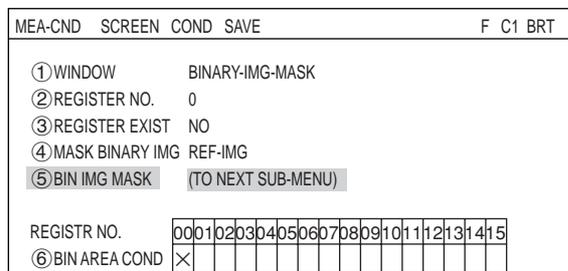
4. Here you can set the masking conditions. First move the cursor to "①MASK AREA" and press the SET key. Specify and confirm the position and size of a masking area. On the "②THRESHOLD" line, adjust the threshold value between 0 and 255. At "③MASK INVERT B/W," select whether or not to invert the masking area. When a mask noise removing method is specified in "④MASK NOISE FILTR ," the "⑤NUM.OF MASK FILT" (number of times to filter) line will appear. Set the number of times from 0 to 5.

```
MASK BINARY IMGCREEN  SAVE                           F  C1  BRT

①MASK AREA       SET  (232,216) ~ (279,263)
②THRESHOLD       SET  [U.LM255 L.LM100 (0~255) ]
③MASK INVERT B/W NO
④MASK NOISE FILTR EXPD. → CONTR. ──────▶  NO
⑤NUM.OF MASK FILT EXPD.0  CONTR.0 (0~5)   EXPD. → CONTR.
                                          CONTR. → EXPD


                        ┌───┐
                        │   │ ◀──── MASK AREA
                        └───┘
```
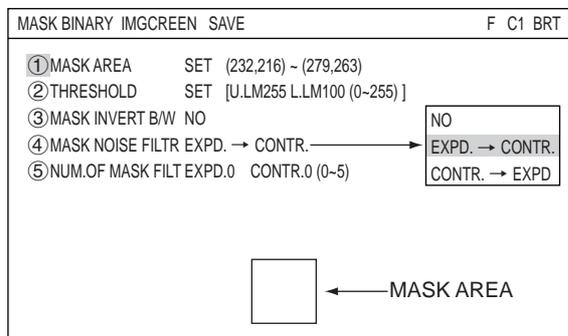
■ **Setting example**

● **When "④MASK BINARY IMG" is set to "REF-IMG."**
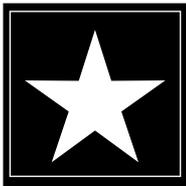Shown below is an example of how to specify a binary image mask for a star shape.
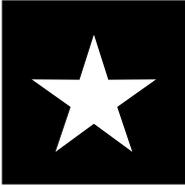
1) Store a binary image mask on the "BINARY IMG MASK" menu (mask setting = standard) shown above.

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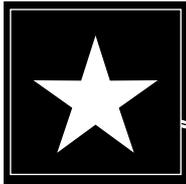
Mask outline

  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.

Binary image mask

Star-shaped binary image mask (outside boundary)

Star-shaped object to be measured (inside boundary)
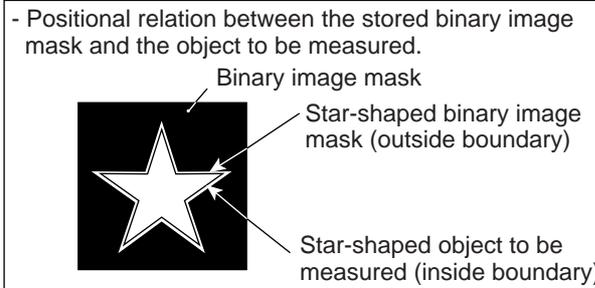
  3. Return to the "TYPE MEAS COND" menu. Select "MEAS-COND" in the "⑤MEAS-BIN-AREA" item

2) Settings on the "TYPE MEAS COND" menu

  1. Select "YES" from the popup menu at "③ REGISTER EXIST."
  2. Select "◯" (00) at the "⑥BINARY AREA" item and press the SET key to bring up the "REG COND" menu.

```
REGIST COND   SCREEN  COND  SAVE              F  C1  BRT

  ①WINDOW          BINARY-IMG-MASK
  ②REGISTER NO.    0
  ③REGISTER EXIST  YES ──────────────→  ┌─────┐
  ④MASK BINARY IMG REF-IMG              │ YES │
  ⑤BIN IMG MASK    (TO NEXT SUB-MENU)   │ NO  │
                                        └─────┘
  REGISTR NO.   00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
  ⑥BINARY AREA  ◯

SET=SELECT(YES/NO) ESC=BACK SEL=CHNG IMG TRG=FUNC
```

3) Setting the binary area conditions

| MASK REGIST. |
| BINARY PROCESS |
| BINRY NOISE FILT |

3

REG COND SCREEN COND SAVE （ DETAIL ）   F C1 BRT

① MEAS SHAPE   RECTANGLE | RECTANGLE |
② MEAS AREA   SET (224,208)~(287,271) | CIRCLE |
③ THRESHOLD   SET [U.LM255 L.LM100(0~255)] | ELLIPSE |
④ INVERT B/W   NO
⑤ MASK SHAPE | NO |
⑥ MASK AREA   (224,208)~(287,271) | YES |
⑦ BINARY PROCESS   FIXED
⑧ BINARY NOISE FILT   NO

| FIXED |
| THRES-ADJ(VAR-DEFF) |
| THRES-ADJ(VAR-RATE) |

| NO |
| EXPD.→CONTR. |
| CONTR.→EXPD |

SET=SELECT A MENU ESC=BACK SEL=CHNG IMGTRG=FUNC

THRESHOLD VAL AUTO-REG   RESET   F C1 BRT

① U.LM   255(0~255)
② L.LM   100(0~255)

SET=CHNG ESC=BACK SEL=CHNG IMG TRG=FUNC

RECTANGLE RESET   RETURN   F C1 BRT

① UP.L   (224,208)
② LO.R   (287,271)
③ MOVE

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

Measuring area
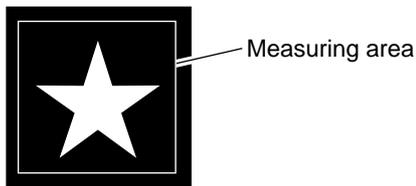
2. Return to the MAIN OPS MENU.

4) Measure the binary area

Captured image   Binary mask image (registered in step ①-2)

Image after executing
a measurement

White dots (six)

- The white dots will be converted to
  black dots by applying the binary
  image mask.

3-27
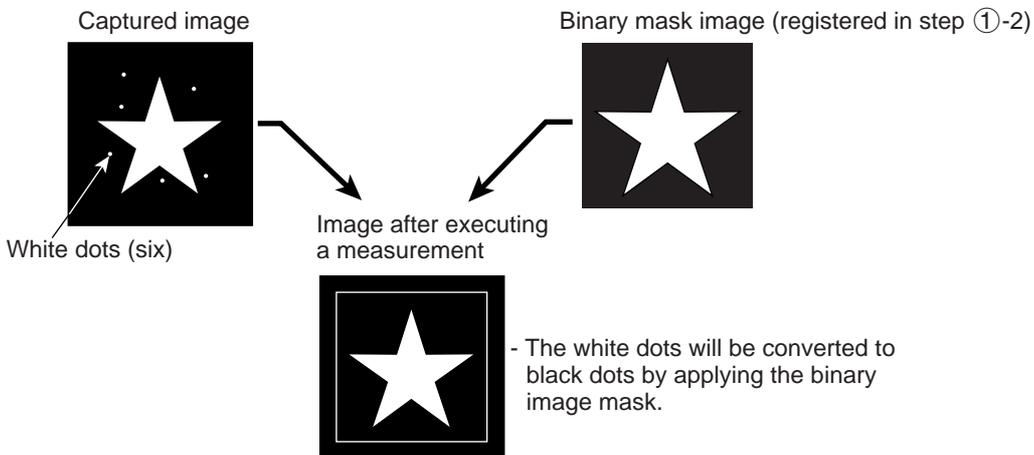
● **When "④MASK BINARY IMG" is set to "MANUAL."**

Shown below is an example of a binary image mask that matches the following shape (an 8 pointed star).
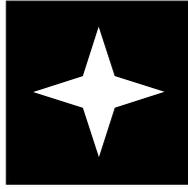
```
MEA-CND   SCREEN  COND  SAVE                    F  C1  BRT

①WINDOW          BINARY-IMG-MASK
②REGISTER NO.    0                    NO
③REGISTER EXIST  NO                   REF-IMG
④MASK BINARY IMG MANUAL──▶  MANUAL


  REGISTER NO.   00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑤BIN AREA COND   ✕
```

1. Select "④MASK BINARY IMG" and press the SET key. Select "MANUAL" from the popup menu.

2. Select "⑤BIN IMG MASK" (binary mask conditions) and press the SET key twice.

```
MEA-CND   SCREEN  COND  SAVE                    F  C1  BRT

①WINDOW          BINARY-IMG-MASK
②REGISTER NO.    0
③REGISTER EXIST  NO
④MASK BINARY IMG REF-IMG
⑤BIN IMG MASK    (TO NEXT SUB-MENU)

REGISTR NO.     00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑥BIN AREA COND  ✕
```

3. The "MASK BINARY IMG" screen will appear. Select "①MASK AREA" and press the SET key twice.

```
MASK BINARY IMG  SCREEN  SAVE                   F  C1  BRT

①MASK AREA       SET
②MASK IMVERT B/W NO
③MASK REGIST.    REG  DISP
```

4. The "POLYGON" setting screen will appear.

```
POLYGON    RESET  MOVE  RETURN                  F  C1  BRT

①POINT01        (255,255)







                                           X:224  Y:208
```

5. Select "0" using the up and down keys and then select "MOVE" using the left and right keys. Finally, press the SET key.

```
MASK BINARY IMGCREEN SAVE                        F  C1  BRT

①PO01T01              (255,255)
②PO02T01              (254,226)
③PO03T01              (221,226)
④PO04T01              (221,251)
⑤PO05T01              (274,276)
⑥PO06T01              (274,247)
⑦PO07T01              (257,247)
⑧PO08T01              ()



                                                 X:256  Y:240
```

6. Move vertex 02 to 08 a little outside of the first point on the star using the up, down, left, and right keys, and then press the SET key.
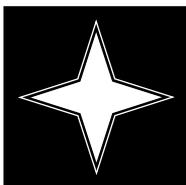
```
MASK BINARY IMGCREEN SAVE                        F  C1  BRT

①PO01T01              (255,255)
②PO02T01              (254,226)
③PO03T01              (221,226)
④PO04T01              (221,251)
⑤PO05T01              (274,276)
⑥PO06T01              (274,247)
⑦PO07T01              (257,247)
⑧PO08T01              ()



                                                 X:124  Y:276
```

7. After creating a mask area, press the ESC key to return to the "MASK BINARY IMG" screen. Select "③MASK REGIST" and press the SET key. The cursor will move to the "REG" position. Press the SET key to register the mask.
   - 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 "②MASK INVERT B/W" line.

```
MASK BINARY IMG SCREEN SAVE                      F  C1  BRT

①MASK AREA            SET
②MASK IMVERT B/W  NO
③MASK REGIST.        REG   DISP
```

[7] 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 q 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 q 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]

Scanned image

Image after correction

An image with a jagged edge will be created.

An image with smooth edges will be created.

Scanned image   (Standard) (High precision)

q image after angular correction

3-30
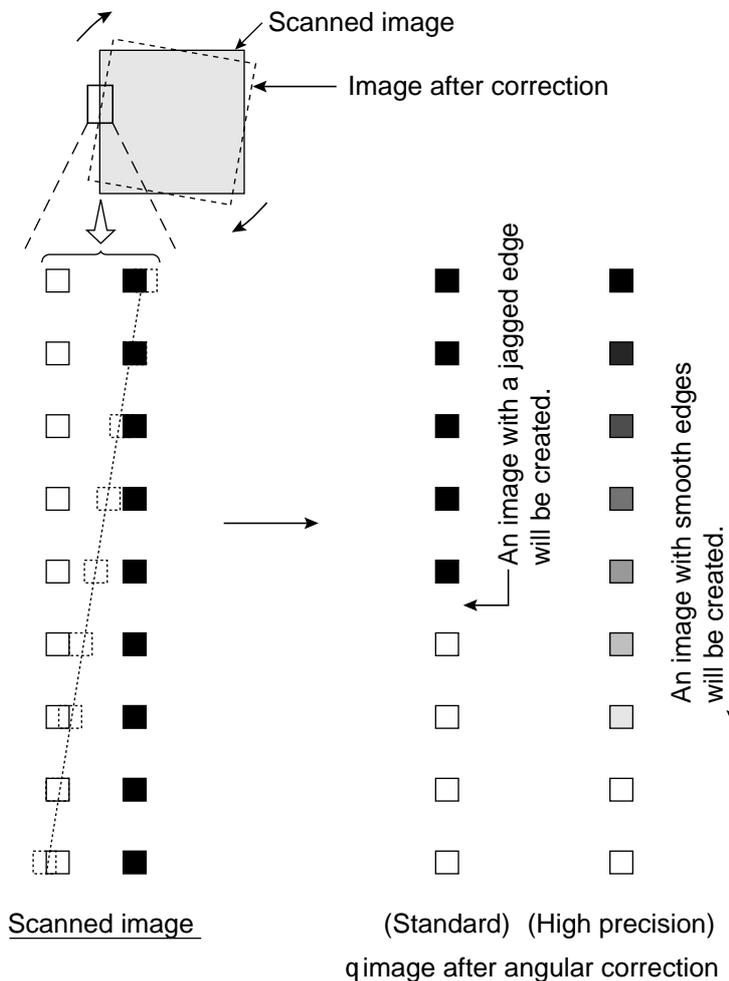
(2) Operation setting details
Select the "POSI-CORRECT" condition item on the "SELECT OBJECT TYPE COND" screen and press the SET key to enter the correction.

```
POSI-CORRECT  SCREEN  COND  SAVE                    F  C1  BRT

① CORRECTION REG.      2ND STAGE CORRECTION
② MODE(1ST)            ANGLE-ADJ.(STANDARD)
                                            ┌─────────────────────┐
③ X CORRECT ADJ.(1ST)  YES                  │ NO                   │
④ X CORRECTION         REG0(0~7) MDL0       │ 1ST STAGE CORRECTION │
⑤ Y CORRECT ADJ.(1ST)  YES                  │ 2ND STAGE CORRECTION │
⑥ Y CORRECTION         REG0(0~7) MDL0       └─────────────────────┘
⑦ ADJUST ANGL.(1ST)    YES                  ┌─────────────────────┐
⑧ ADJUST ANGL          REG0(0~7) MDL0       │ NO                   │
                                            │ XY-ADJ.              │
⑨ MODE(2ND)            XY-ADJ.              │ ANGLE-ADJ.(STANDARD) │
⑩ X CORRECT ADJ.(2ND)  YES                  │ ANGLE-ADJ.(HIGH)     │
⑪ X CORRECTION         REG0(0~7) MDL0       └─────────────────────┘
⑫ Y CORRECT ADJ.(2ND)  YES                  ┌─────────────────────┐
⑬ Y CORRECTION         REG0(0~7) MDL0       │ NO                   │
                                            │ XY-ADJ.              │
                                            └─────────────────────┘

SET=SELECT A MENU  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

■ **Setting procedure**

Mode 0 · · · · · ·

| No | XY ADJ.
- X CORRECTION (no/yes)
- Y CORRECTION (no/yes) | ANGLE ADJ. (STANDARD HIGH)
- X CORRECTION (no/yes)
- Y CORRECTION (no/yes)
- ADJUST ANGL (no/yes) |

Mode 1 · · · · · ·

| No | XY ADJ.
- X CORRECTION (no/yes)
- Y CORRECTION (no/yes) | ANGLE ADJ. (STANDARD HIGH)
- X CORRECTION (no/yes)
- Y CORRECTION (no/yes)
- ADJUST ANGL (no/yes) |

(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)

Coordinates (X1, Y1) of object in the reference image (model 0)

Target object coordinates (X2, Y2)

[Measurement results]
- Detected coordinates: (X2, Y2)
- Deviation amount: X2-X1, Y2-Y1

Y2-Y1

Search area

X2-X1
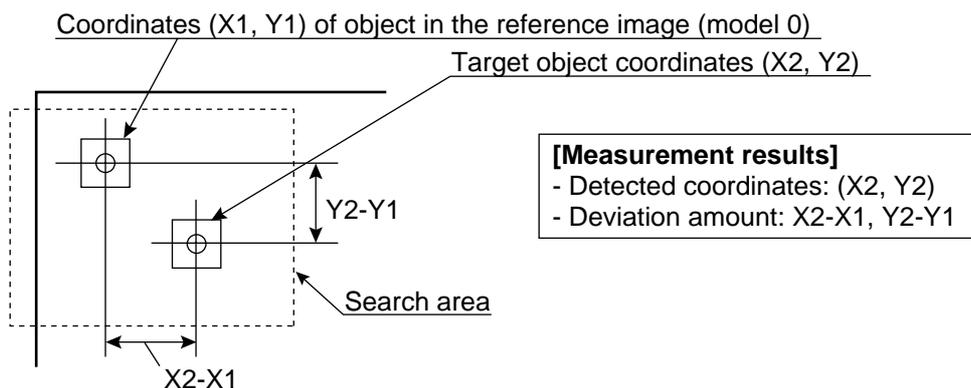
2. Measuring a point using measurement 1

Y2-Y1

Point

X2-X1

3-31

3
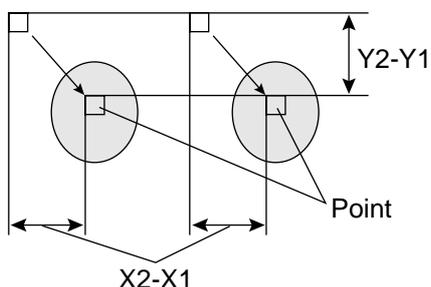
■ **Example of angular correction**

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

- Registration image

Reference image (model 0)

Detected coordinates (model 0)

Search area (model 0)

Reference image (model 1)

Detected coordinates (model 1)

Search area (model 1)
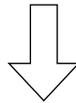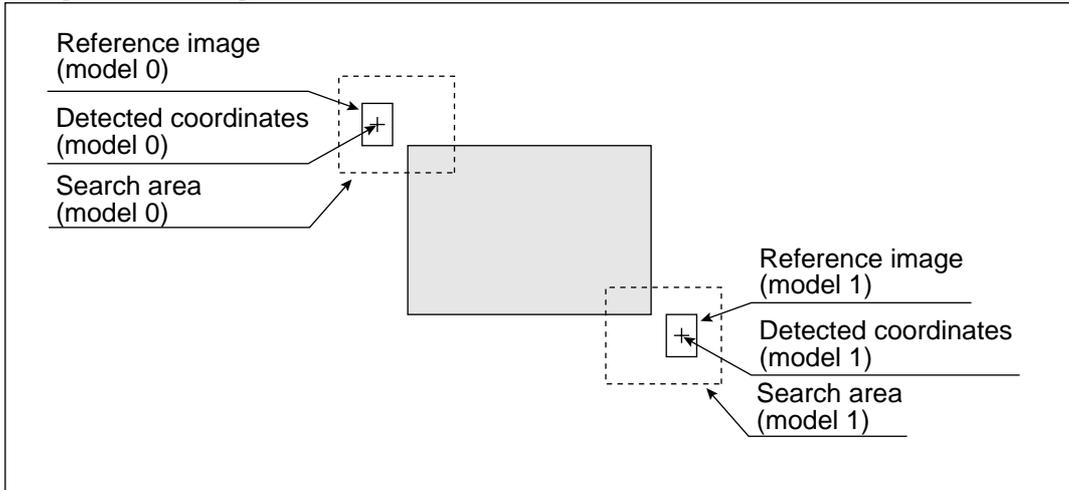
- Measurement image   Detecting the amount of angular deviation

Detected coordinates (model 0)

Position of registration image

θ

Detected coordinates (model 1)
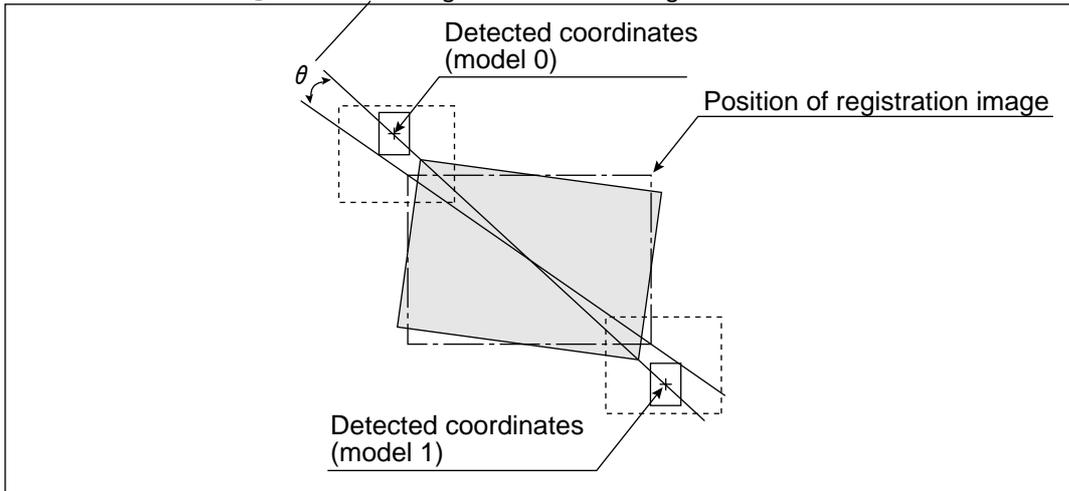
2. Performing measurement 1 to 4 (of distance and angle measurement) on an image that has been rotated around its center by the amount of angular deviation detected in step 1.

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

3
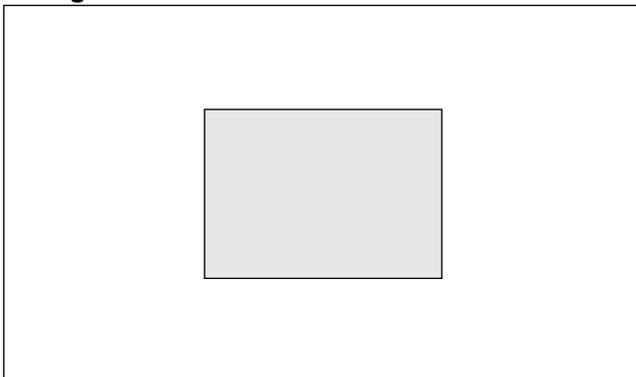
[8] Title registration
A title for a object type number can be entered and saved when the object type number is displayed on the screen.

■ 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
Select "OBJECT TYPE COND" on the "MAIN MENU" screen and then select "TYPE00" (the current type). Then press the "TRG/BRT" key. Select "TITLE" from the popup menu and press the SET key.

```
SELECT OBFECT TYPE COND                          F  C1  DRK
OBJECT TYPE COND
 ⊞  TYPE00

          OPS-MENU
          SAVE
          COPY
          PASTE
          DEL
          SPECIFY NUMBER
          TITLE
```
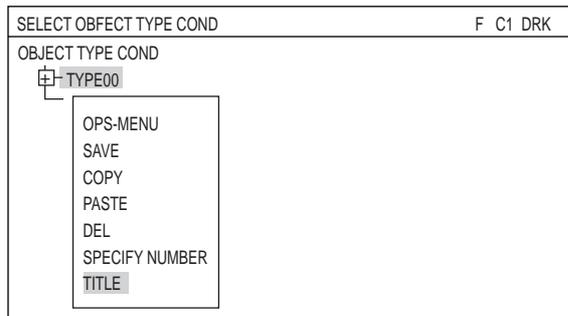
STORE OBJCT TITLE	Setting details
A to Z	These characters and symbols are used to enter the title name.
0 to 9	
= to >	
SP (space bar)	This is used to make spaces.
← →	These are used to move the cursor.
DEL. (delete)	This is used to delete the character to the right of the cursor.
END	Exit the title registration screen.
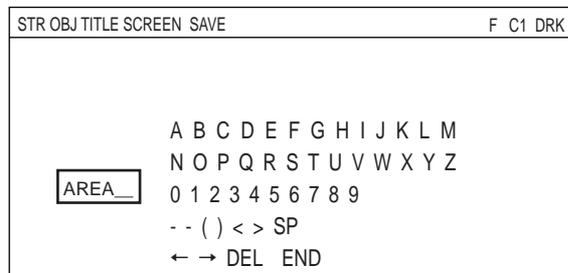
The title that has been entered will be displayed in the top left corner of the operation screen and "SELECT OBJECT TYPE COND" screen.

```
STR OBJ TITLE SCREEN  SAVE                       F  C1  DRK


                          A B C D E F G H I J K L M
                          N O P Q R S T U V W X Y Z
         AREA__           0 1 2 3 4 5 6 7 8 9
                          - - ( ) < > SP
                          ← → DEL  END
```

Operation screen

```
(TYPE00) AREA                                    F  C1  DRK
                                                 V*.**
OK
MEAS  XXXXms
MEASURE 0 CAM1 POSI-DEVIATION
```

SELECT OBJECT TYPE COND screen

```
SELECT OBJECT TYPE COND                          F  C1  BRT

OBJECT TYPE COND
 ⊟  TYPE00(AREA)
      ├─ TYPE RUN COND
      ├─ IMAGE-ADJ
      ⊟─ MEA-CND(CAMERA1)
          ⊟─ MEAS0(POSI-DEVIATION)
              ├─ IMG PRE-PROC
              ⊞─ MEAS CND
              ├─ EVALUATION COND
              ⊞─ DISTANCE&ANGLE COND
```
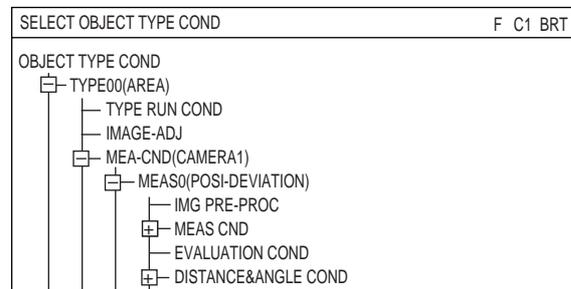
3-3 Input & Output / System settings

[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

Select "OBJECT TYPE COND" → "TYPE00" (current type) and "OBJ-TYPE SYS," in that order, on the "MAIN MENU" screen.

1. Select "②MNTR LIGHT LVL (CAM1)" (monitor light level). Select "YES" from the popup menu. Then, the "③LIGHT LV COND" item will appear on the screen.

```
OBJ-TYPE SYS. SCREEN SAVE                            F  C1  BRT

①HALT ON NG MEAS      YES                   NO
②MNTR LIGHT LVL(CAM1) YES ─────────▶ YES
③LIGHT LV COND         (TO NEXT SUB-BENU)
④MNTR LIGHT LVL(CAM2) YES
⑤LIGHT LV COND         (TO NEXT SUB-MENU)
⑥MOVE ALL WINDOW      (TO NEXT SUB-MENU)
```
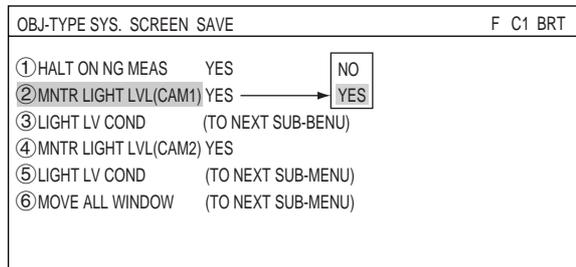
2. Select "③LIGHT LV COND" and press the SET key. The "LIGHT LV COND" screen and monitoring window will appear.
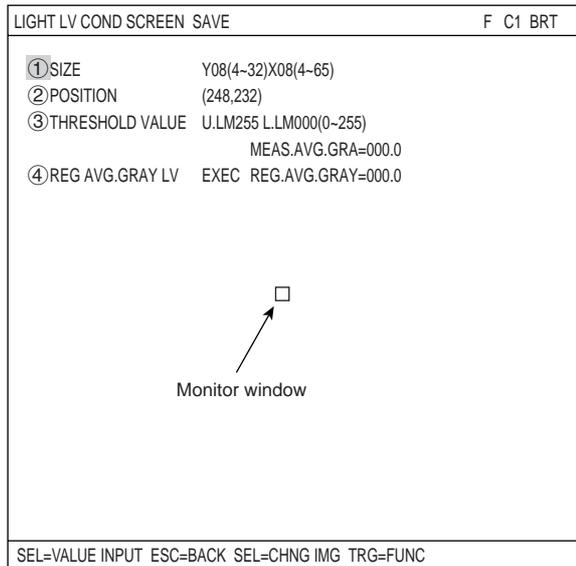
3. Press the SEL key and move the cursor to the upper function menu. Set the image mode to "T" (Through).

```
LIGHT LV COND SCREEN SAVE                            F  C1  BRT

①SIZE            Y08(4~32)X08(4~65)
②POSITION        (248,232)
③THRESHOLD VALUE U.LM255 L.LM000(0~255)
                          MEAS.AVG.GRA=000.0
④REG AVG.GRAY LV  EXEC  REG.AVG.GRAY=000.0




                          □
                          ↑

                    Monitor window




SEL=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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 twice. 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. Move the cursor to the upper function menu by pressing the TRG/BRT key and select the "SAVE" item using the left and right arrow keys. Then press the SET key.
   - A message "SAVE DATA? (YES = [SET], NO = [ESC])" will appear on the screen. Press the SET key to save the data.

   After the measurement monitoring function is turned ON and images have been captured, the lighting monitoring function set above will be active.

3

3

[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-S30J 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)

- When the shutter speed is fast
  (1/1000 of a second)
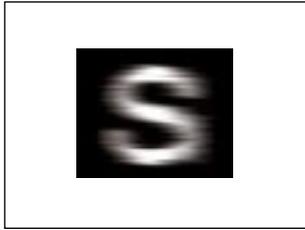
The object is blurred across the screen.
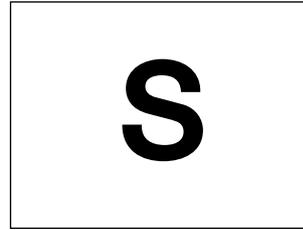
The object is frozen on the screen.

■ Setting procedure

On the MAIN MENU screen, select "OBJECT TYPE COND," "TYPE00" (current type) and "OBJ-TYPE I/O," in that order.

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.

```
OBJ-TYPE I/O  SCREEN SAVE                          F  C1  DRK

  ①TRIG CCD START     BIN
  ②CCD TRIG COND      (TO NEXT SUB MENU)
  ③SHUTTER SPEED      1/00060(1/30~1/10000)
  ④SERIAL OUTPUT      ANY

  ⑤CAMNO              NO 1(1~2)
  ⑥CALIBRATION        NO
```

1/ 00060

This cursor will move to the left and right.

3. Set the value using the up and down keys.
4. Repeat steps 2 and 3 to set each digit.
   After setting all of the digits, press the SET key.
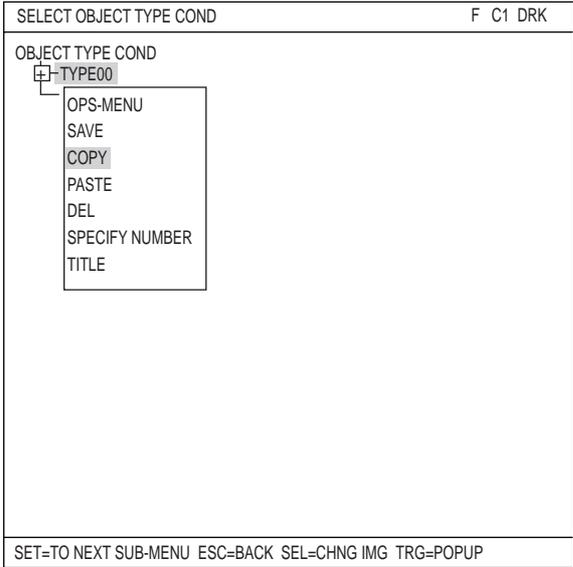
[3] Copying

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) |
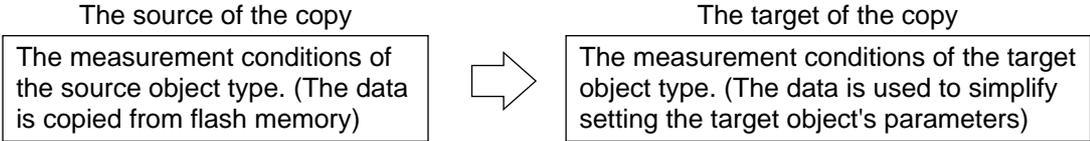
■ **Operation procedure**

On the "MAIN MENU" screen, select "OBJECT TYPE COND" and then "TYPE00" (current type). At this point, press the TRG/BRT key to display the popup menu. Select "COPY" from the popup menu and press the SET key.

```
SELECT OBJECT TYPE COND                         F  C1  DRK

OBJECT TYPE COND
  ┌─ TYPE00
  └─┐
    │ OPS-MENU
    │ SAVE
    │ COPY
    │ PASTE
    │ DEL
    │ SPECIFY NUMBER
    │ TITLE




SET=TO NEXT SUB-MENU  ESC=BACK  SEL=CHNG IMG  TRG=POPUP
```

⬭ **Notes**

- Do not disconnect the power while the IV-S30J 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 search function are not copied with the operation above. Make sure reset them.

[4] Halt on NG measurement

You can stop all measurements when an NG image (according to the final evaluation results) occurs while operating the IV-S30J.

Select "①HALT ON NG MEAS" on the "OBJECT TYPE SYS." menu.

```
OBJ-TYPE SYS.  SCREEN  SAVE                      F  C1  BRT
①HALT ON NG MEAS      YES  ◄──        NO
②MNTR LIGHT LVL(CAM1) YES             YES
③LIGHT LV COND        (TO NEXT SUB-BENU)  NO(NG MEAS DISP)
④MNTR LIGHT LVL(CAM2) YES
⑤LIGHT LV COND        (TO NEXT SUB-MENU)
⑥MOVE ALL WINDOW      (TO NEXT SUB-MENU)
```
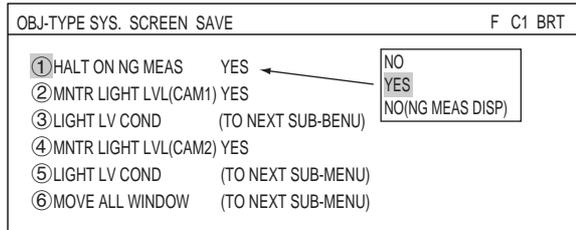
①HALT ON NG MEAS	Description
NO	Even if an NG image (final evaluation result) is detected while operating the IV-S30J, the system will continue making measurements.
YES	When an NG image is detected (according to the final evaluation result) while operating the IV-S30J, the controller will stop making measurements.
NO (NG MEAS DISP)	Even if an NG image (final evaluation result) is detected while operating the IV-S30J, the system will continue making measurements. But, it displays the occurred NG measurements at first.

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

(Setting whether to stop measurements when an NG occurs)
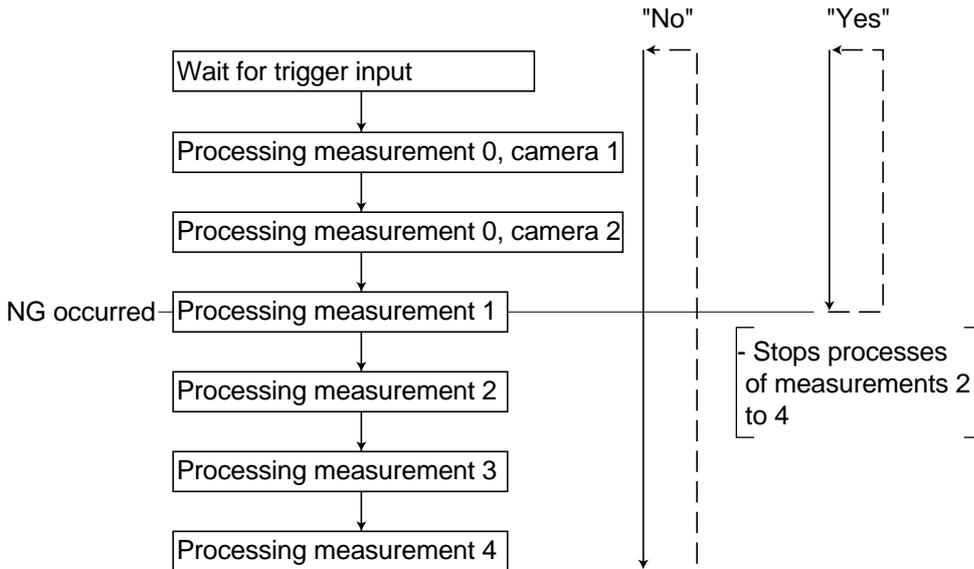
[5] Window group move

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 "⑥MOVE ALL WINDOW" in the" OBJECT TYPE SYS" menu.

```
OBJ-TYPE SYS.  SCREEN  SAVE                    F  C1 BRT

①HALT ON NG MEAS       YES
②MNTR LIGHT LVL(CAM1) YES
③LIGHT LV COND         (TO NEXT SUB-BENU)
④MNTR LIGHT LVL(CAM2) YES
⑤LIGHT LV COND         (TO NEXT SUB-MENU)
⑥MOVE ALL WINDOW      (TO NEXT SUB-MENU)
```

3

1. While "①SELECT CAMERA" is selected, press the up and down arrow keys to select either "CAM1" or "CAM2." Then press the SET key.

```
MOVE ALL WIN  SCREEN  SAVE                    F  C1 BRT

①SELECT CAMERA      CAM1
②STR COORD POSI     MOVE(256,240)  COORDINATES STORED
③MOVE ALL WINDOW   MOVE(256,240) EXEC
```

2. Select "②STR COORD POSI" (store coordinate position) and press the SET key. Then select "MOVE" by using the left and right arrow keys and finally, press the SET key.

3. 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.

4. Select "COORDINATES STORED" 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.

5. Select "③MOVE 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.

6. 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.
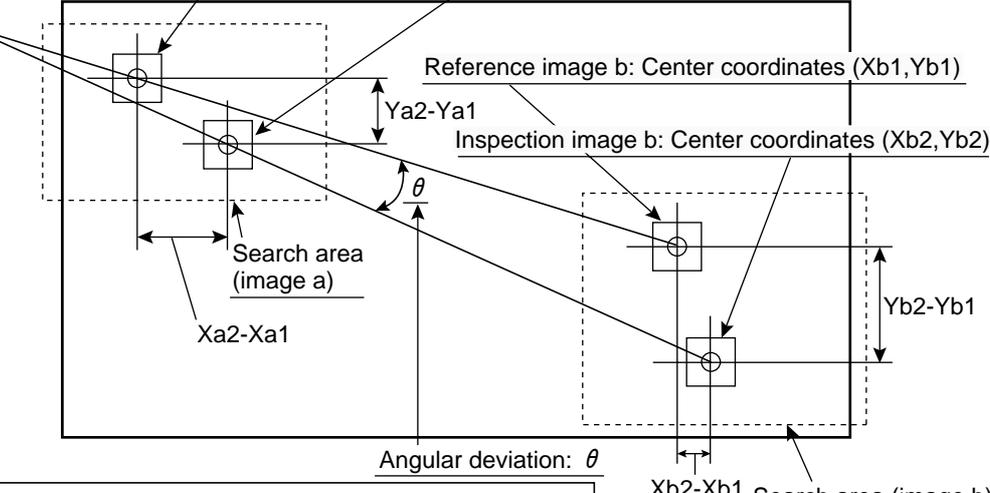

Distance to move A
Coordinates of the new
Coordinates of the original
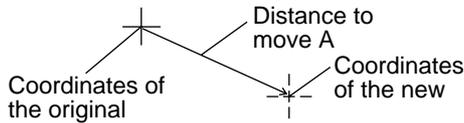
7. Select "EXEC" (execute) using the left and right keys and press the SET key.
   ⇨ All the windows registered to the same object type will be shifted horizontally at the same time by the distance between the original coordinates to the new coordinates. After the move is complete, a "Window group move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

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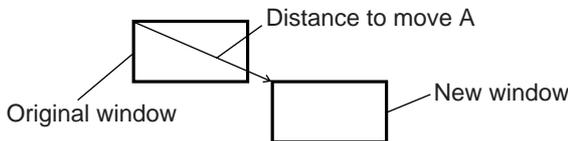
- When some part of the window to be moved will move outside of the image display area, the "Out of range" message will be displayed together with the measurement number and register number. In this case, select "Continue" or "Halt."
  If "Continue" is selected, the window will be shifted to the limit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

Chapter 4: Positional Deviation Measurement

4-1 Outline

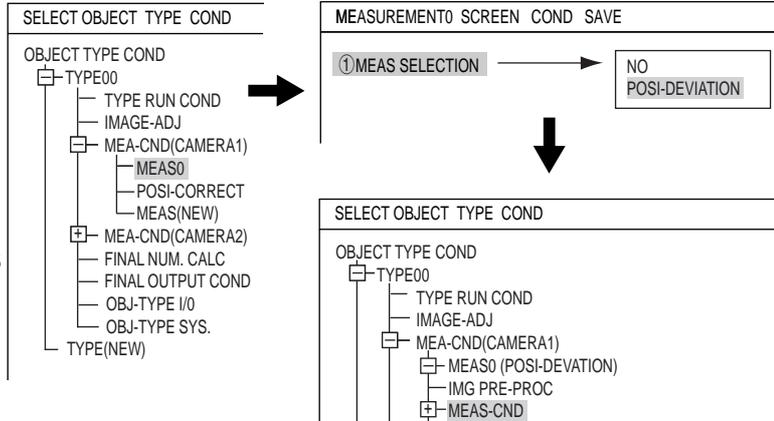|	
Purpose	The gray scale search function and edge detection function* make possible measuring positional deviation as well as the absolute position. - It is also possible to detect the position of sub-pixel units with great accuracy. - A rotation angle of 360° can be detected. (When a one point gray search is selected).
Application	Used to determine the position of machine parts and substrates.

Example	**[Determining the location of the positioning (the fiducial mark) mark that identifies the position of the substrate]**
	(1) 1 point search: Detecting the deviation in position in X and Y directions
	Reference image: Center coordinates (X1,Y1)
	Inspection Image: Center coordinates (X2,Y2)
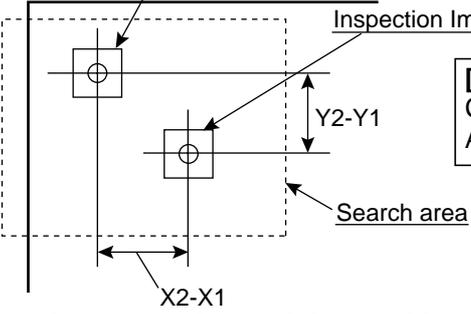	
	[Measured result]
	Center coordinates: (X2,Y2)
	Amount of deviation: X2-X1, Y2-Y1
	Y2-Y1
	Search area
	X2-X1
	
	(2) 2 point search: Determining positional deviation in X and Y directions as well as rotational deviation
	Reference image a: Center coordinates (Xa1,Ya1)
	Inspection image a: Center coordinates (Xa2,Ya2)
	Reference image b: Center coordinates (Xb1,Yb1)
	Ya2-Ya1
	Inspection image b: Center coordinates (Xb2,Yb2)
	θ
	Search area (image a)
	Xa2-Xa1
	Yb2-Yb1
	Angular deviation: θ
	Xb2-Xb1 Search area (image b)
	
	[Measured results]
	- Center coordinates of image a: (Xa2,Ya2)
	- Amount of deviation of image a: Xa2-Xa1, Ya2-Ya1
	- Center coordinates of image b: (Xb2,Yb2)
	- Amount of deviation of image b: Xb2-Xb1, Yb2-Yb1
	- Deviation angle: θ
	
	* Gray scale search / edge detection function
	  Gray scale search: Compares a workpiece image with the 256-level gray-scale reference image to find an area that matches the reference image.
	    ⇨ See page G-6 of the User's Manual (Instruction & Hardware).
	  Edge detection: Finds the boundary between light and dark areas in an image.
	    ⇨ See page G-3 of the User's Manual (Instruction & Hardware).
	  - The deviation angle θ, determined in the 2-point search, is used to readjust the rotation of the image for measurements 1 to 4.

4

4-2 Setting operation

■ Setting the measurement conditions

Select "MAIN COND" -> "OBJECT TYPE COND" -> "TYPE00" ->"MEA CND (CAMERA1) " -> "MEAS0," in that order.
On the "①MEAS SELECTION" line, select "POSI-DEVIATION" from the popup menu. Press the ESC key to return to the OBJECT TYPE COND (menu tree) screen, and select the "MEAS CND" item to enter the MEAS CND screen.
⇨ For details, see "Chapter 8: Setting examples using the menu tree" in Introduction and Hardware.

```
SELECT OBJECT TYPE COND

OBJECT TYPE COND
└─ TYPE00
    ├─ TYPE RUN COND
    ├─ IMAGE-ADJ
    ├─ MEA-CND(CAMERA1)
    │   ├─ MEAS0
    │   ├─ POSI-CORRECT
    │   └─ MEAS(NEW)
    ├─ MEA-CND(CAMERA2)
    ├─ FINAL NUM. CALC
    ├─ FINAL OUTPUT COND
    ├─ OBJ-TYPE I/0
    └─ OBJ-TYPE SYS.
    └─ TYPE(NEW)
```

```
MEASUREMENT0  SCREEN  COND  SAVE

①MEAS SELECTION  ⟶   NO
                      POSI-DEVIATION
```

```
SELECT OBJECT TYPE COND

OBJECT TYPE COND
└─ TYPE00
    ├─ TYPE RUN COND
    ├─ IMAGE-ADJ
    └─ MEA-CND(CAMERA1)
        ├─ MEAS0 (POSI-DEVATION)
        ├─ IMG PRE-PROC
        └─ MEAS-CND
```

Note: "POSI-DEVIATION" (positional deviation) measurement can be specified in the "MEAS0" (measurement 0) and "MEAS1" (measurement 1) to "MEAS4" (measurement 4) functions. If you choose "MEAS(NEW)," the smallest available measurement number will be chosen automatically ("MEAS1" to "MEAS4").

① **DTECT PRECISON**
Select detection precision. You can select one of two levels (standard/high), according to your conditions, the desired precision level for detection results, and the detection speed.
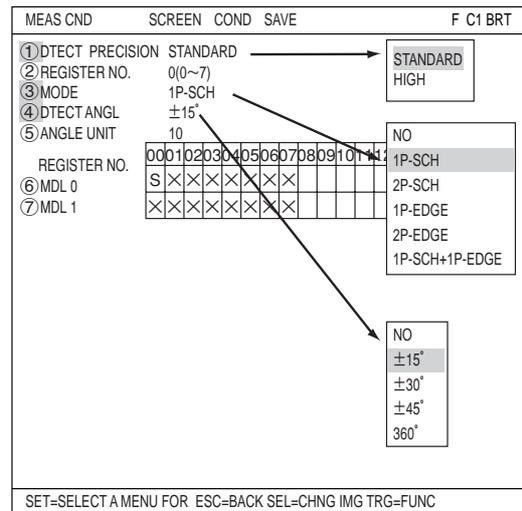⇨ For details, see page 3-9.

② **REGISTER NO.**
Enter a register number. When making positional deviation measurements, you can select any register from 0 to 7 (a total of 8 registers).

③ **MODE**
Select a mode for detection.
The details of each mode are as follows.

```
MEAS CND      SCREEN  COND  SAVE          F C1 BRT

①DTECT PRECISION  STANDARD              STANDARD
②REGISTER NO.     0(0~7)                HIGH
③MODE            1P-SCH
④DTECT ANGL      ±15°
⑤ANGLE UNIT      10                     NO
                                        1P-SCH
  REGISTER NO.   00 01 02 03 04 05 06 07 08 09 10 11  2P-SCH
⑥MDL 0          S  ×  ×  ×  ×  ×  ×  ×         1P-EDGE
⑦MDL 1          ×  ×  ×  ×  ×  ×  ×  ×         2P-EDGE
                                        1P-SCH+1P-EDGE

                                        NO
                                        ±15°
                                        ±30°
                                        ±45°
                                        360°

SET=SELECT A MENU FOR  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

Detection Mode	Details	Usable models
NO (None)	Does not detect.	
1P-SCH (1-point search)	Detect the positional deviation of one point in the scanned image compared to a single reference image, after performing a gray search.	Model 0 only
2P-SCH (2-point search)	Detect the positional deviation of two points in the scanned image compared to two reference images, after performing a gray search.	Model 0 and 1
1P-EDGE (1-point edge)	Detect the positional deviation of one point in the scanned image compared to a single reference image, after performing edge detection.	Model 0 only
2P-EDGE (2-point edge)	Detect the positional deviation of two points in the scanned image compared to two reference images, after performing edge detection.	Model 0 and 1
1P-SCH + 1P-EDGE (1-point search and 1-point edge)	Detect the positional deviation of two points, one point after performing a gray search and one point after performing edge detection.	Model 0 and 1

Gray search ⇨ See page 3-9.

Edge detection ⇨ See page 3-14.

④ **DTECT ANGL and** ⑤ **ANGLE UNIT**
When the "1P-SCH" or "1P-SCH + 1P-EDGE" is selected in "③MODE," you can specify angle detection.
⇨ For details about angle detection, see page 4-12.
Select a detection range on the "④DTECT ANGL" line and select the units at "⑤ANGLE UNIT."

REGISTER NO. (⑥**MDL 0,** ⑦**MDL 1)**
The specified modes are displayed for each register number on these lines. When a 1-point search or 1-point edge is specified, only "⑥MDL 0" will be available. When a 2-point search, 2-point edge, or 1-point search and 1-point edge is specified, "⑦MDL 1" is also available.
The "S" in the table indicates a gray search, and the "E" indicates edge detection. "X" means not used.

4

 • **An example of mode settings**

REGISTER NO.	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
⑥MDL0	S	S	S	E	E	✕	✕	✕								
⑦MDL1	S	✕	E	E	✕	✕	✕	✕								

S ：Gray search
E ：Edge detection
✕ ：No setting

REGISTER0 : 2P-SCH
REGISTER1 : 1P-SCH
REGISTER2 : 1P-SCH + 1P-EDGE
REGISTER3 : 2P-EDGE
REGISTER4 : 1P-EDGE

■ How to set the register conditions

● **How to enter the REG-COND setting screen**
There are three methods for getting to the REG-COND setting screen.

1) On the MEAS CND setting screen, move the cursor to "⑥MDL 0" or "⑦MDL 1" and press the SET key. The cursor will move into the table. Move the cursor to the "S" or "E" column and press the SET key.
Note: If you press the SET key in the "X" column, the setting will be invalid.

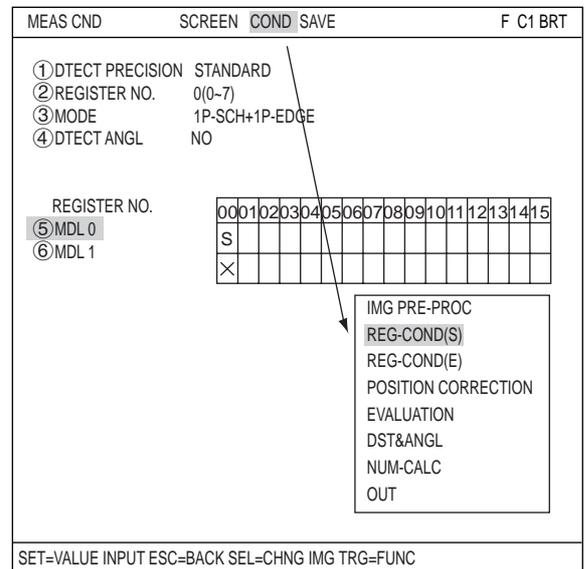About "S" ⇨ See pages 4-4 to 6.
About "E" ⇨ See pages 4-7 to 8.

2) On the MEAS CND setting screen, press the TRG/BRT key to move the cursor to the upper function menu. Select the "COND" item and then select the "REG-COND(S)" or "REG-COND(E)" item and press the SET key.
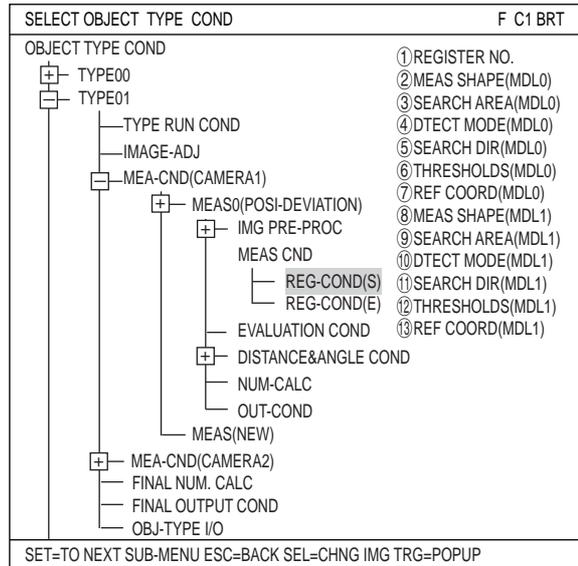
About "REG-COND(S)"
⇨ See pages 4-4 to 6.
About "REG-COND(E) "
⇨ See pages 4-7 to 8.

```
MEAS CND        SCREEN COND SAVE              F  C1 BRT

①DTECT PRECISION   STANDARD
②REGISTER NO.      0(0~7)
③MODE             1P-SCH+1P-EDGE
④DTECT ANGL        NO

  REGISTER NO.      00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑤MDL 0              S
⑥MDL 1              ✕

                                 IMG PRE-PROC
                                 REG-COND(S)
                                 REG-COND(E)
                                 POSITION CORRECTION
                                 EVALUATION
                                 DST&ANGL
                                 NUM-CALC
                                 OUT

SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

3) On the menu tree, move the cursor to the "MEAS CND" item, and press the right arrow key. The sub menu which contains the "REG-COND(S)" and "REG-COND(E)" items will appear. Move the cursor to either of these items and press the SET key.

About "REG-COND(S)"
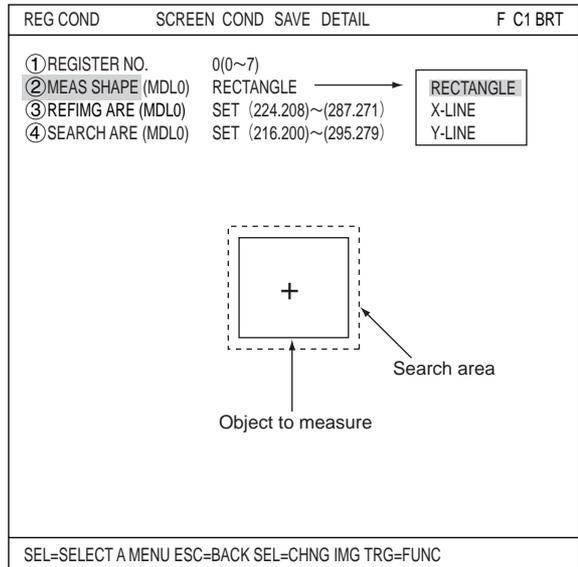⇨ See pages 4-4 to 6.
About "REG-COND(E)"
⇨ See pages 4-7 to 8.

4

```
SELECT OBJECT TYPE COND                          F C1 BRT
OBJECT TYPE COND
  ┌+─ TYPE00                          ①REGISTER NO.
  ├─ TYPE01                           ②MEAS SHAPE(MDL0)
  │       ┌── TYPE RUN COND           ③SEARCH AREA(MDL0)
  │       ├── IMAGE-ADJ               ④DTECT MODE(MDL0)
  │       ├─ MEA-CND(CAMERA1)         ⑤SEARCH DIR(MDL0)
  │       │    ┌+─ MEAS0(POSI-DEVIATION) ⑥THRESHOLDS(MDL0)
  │       │    │    ┌+─ IMG PRE-PROC   ⑦REF COORD(MDL0)
  │       │    │    ├─ MEAS CND        ⑧MEAS SHAPE(MDL1)
  │       │    │    │   ┌─ REG-COND(S) ⑨SEARCH AREA(MDL1)
  │       │    │    │   └─ REG-COND(E) ⑩DTECT MODE(MDL1)
  │       │    ├── EVALUATION COND     ⑪SEARCH DIR(MDL1)
  │       │    ├+─ DISTANCE&ANGLE COND ⑫THRESHOLDS(MDL1)
  │       │    ├── NUM-CALC            ⑬REF COORD(MDL1)
  │       │    └── OUT-COND
  │       └── MEAS(NEW)
  ├─+ MEA-CND(CAMERA2)
  ├── FINAL NUM. CALC
  ├── FINAL OUTPUT COND
  └── OBJ-TYPE I/O
SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

[1] Set the register conditions for a gray search
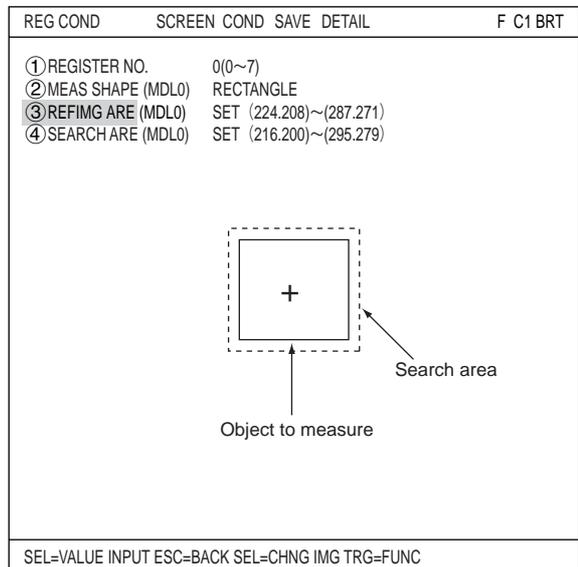
② **MEAS SHAPE**
Select a window shape to be used for the positional deviation measurement.
Select "RECTANGLE," "X-LINE," or "Y-LINE" from the popup menu on the "②MEAS SHAPE" line.

RECTANGLE	Specify coordinates for the upper left and lower right corners. The window will be a rectangular area defined by these coordinates.
X-LINE	Length of a line from the start point to the end point on the X axis.
Y-LINE	Length of a line from the start point to the end point on the Y axis.

```
REG COND      SCREEN COND SAVE DETAIL        F C1 BRT

①REGISTER NO.       0(0~7)
②MEAS SHAPE (MDL0)  RECTANGLE ──────→  ┌─RECTANGLE─┐
③REFIMG ARE (MDL0)  SET (224.208)~(287.271) │ X-LINE   │
④SEARCH ARE (MDL0)  SET (216.200)~(295.279) │ Y-LINE   │
                                            └──────────┘


              ┌ ─ ─ ─ ─ ─ ─ ─ ┐
              │ ┌─────────┐   │
              │ │         │   │
              │ │    +    │   │
              │ │         │   │
              │ └─────────┘   │          Search area
              └ ─ ─ ─ ─↑─ ─ ─ ┘

                Object to measure

SEL=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

③ **REFIMG ARE**
Move the cursor to "③REFIMG ARE(MDL0)" and press the SET key. When the SET item is highlighted, press the SET key again to bring up the setting screen.
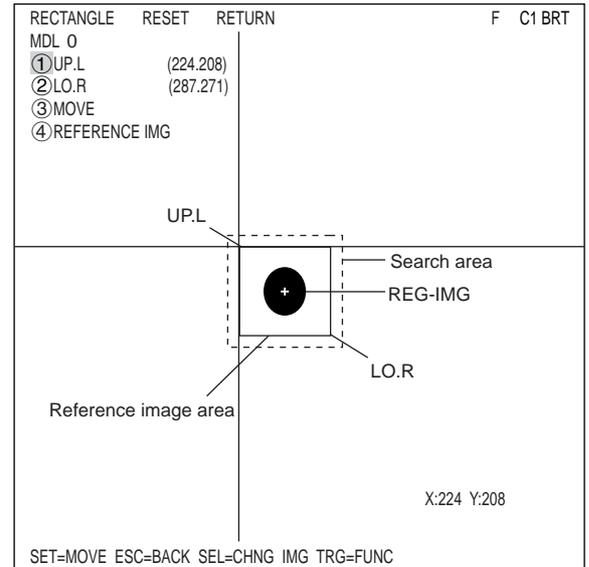
```
REG COND      SCREEN COND SAVE DETAIL        F C1 BRT

①REGISTER NO.       0(0~7)
②MEAS SHAPE (MDL0)  RECTANGLE
③REFIMG ARE (MDL0)  SET (224.208)~(287.271)
④SEARCH ARE (MDL0)  SET (216.200)~(295.279)



              ┌ ─ ─ ─ ─ ─ ─ ─ ┐
              │ ┌─────────┐   │
              │ │         │   │
              │ │    +    │   │
              │ │         │   │
              │ └─────────┘   │          Search area
              └ ─ ─ ─ ─↑─ ─ ─ ┘

                Object to measure


SEL=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

4-4

When a rectangle is selected

Specify the upper left and lower right corners of the reference image area. Move the cursor to the "①UP.L" and press the SET key. Lines for the X and Y axes will appear on the reference image area (shown as a solid line). Move the X and Y lines to the desired position using the up/down/left/right arrow keys to set the coordinates for the upper left corner. When correct, press the SET key.

- To leave the coordinates at their previous position, press the ESC key.

Next, move the cursor to the "②LO.R" and press the SET key to determine the lower right corner of the rectangle. The range inside the rectangle of the solid line becomes the reference image.

● Setting screen (RECTANGLE)

```
RECTANGLE   RESET    RETURN                    F   C1 BRT
MDL 0
①UP.L          (224.208)
②LO.R          (287.271)
③MOVE
④REFERENCE IMG


                UP.L


                                            Search area
                            +               REG-IMG


                                    LO.R
        Reference image area


                                            X:224  Y:208


SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

4

When a horizontal line is selected

Specify the start and end points on the X axis. Specify the start and end points using the up/down/left/right arrow keys. The points will move along the X axis (while keeping the same Y coordinate).
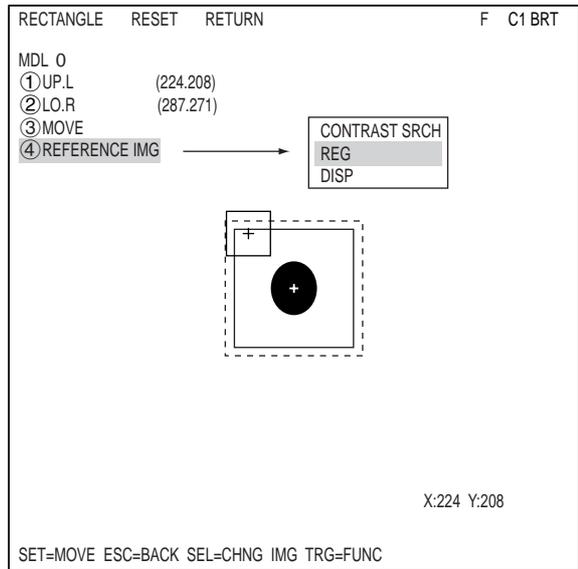
Note: Specify a search area longer than the reference image area. Specifying a shorter search area may cause an error message to be displayed.

● Setting screen (X-LINE)
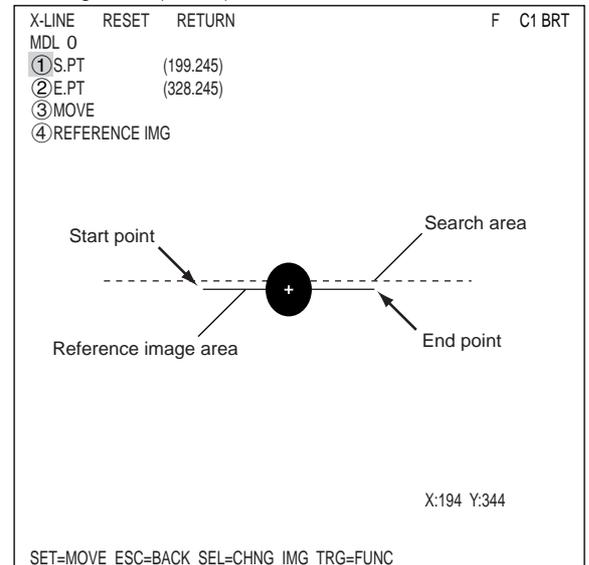
```
X-LINE     RESET    RETURN                     F   C1 BRT
MDL 0
①S.PT          (199.245)
②E.PT          (328.245)
③MOVE
④REFERENCE IMG



                                        Search area
Start point

        - - - - - -       +  - - - - -

        Reference image area          End point



                                        X:194  Y:344


SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

When a vertical line is selected

Specify the start and end points on the Y axis. Specify the start and end points using the up/down/left/right arrow keys. The points will move along the Y axis (while keeping the same X coordinate).

Note: Specify a search area longer than the reference image area. Specifying a shorter search area may cause an error message to be displayed.

● Setting screen (Y-LINE)
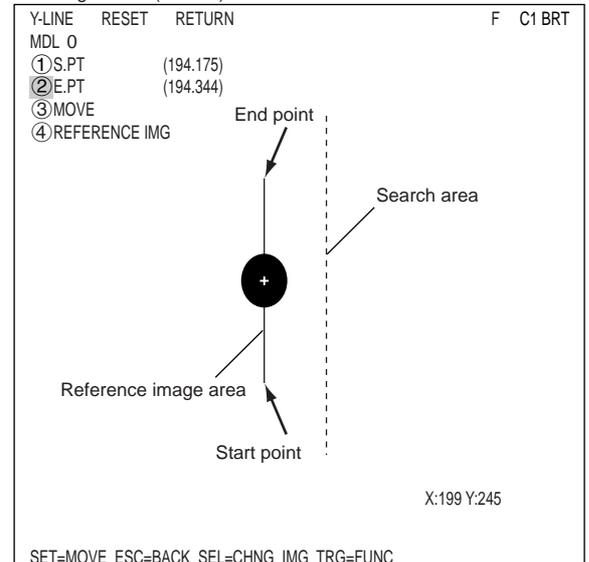
```
Y-LINE     RESET    RETURN                     F   C1 BRT
MDL 0
①S.PT          (194.175)
②E.PT          (194.344)
③MOVE
④REFERENCE IMG          End point

                                Search area

                    +

        Reference image area


                    Start point

                                        X:199  Y:245


SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

4

Register a reference image

After setting the reference image area, store an image in the controller as a reference image. Select "④REFERENCE IMG" using the up/down arrow keys and select "REG" from the popup menu.
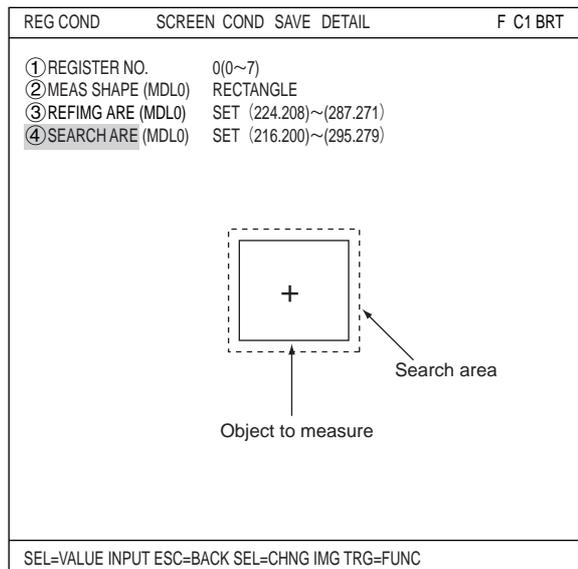
```
RECTANGLE   RESET   RETURN                    F  C1 BRT

MDL 0
①UP.L        (224.208)
②LO.R        (287.271)
③MOVE                              CONTRAST SRCH
④REFERENCE IMG      ──────→        REG
                                   DISP

          ┌─┬───────────────┐
          │+│               ┆
          └─┘      ●        ┆
           ┆       +        ┆
           └ ─ ─ ─ ─ ─ ─ ─ ─┘

                                        X:224  Y:208

SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

CONTRAST SRCH (contrast search)	After changing to a gray search, automatically search for the area with the most features (maximum contrast) in the captured image.
REG (register)	Store the currently displayed image as a reference image.
DISP (display)	Select any one of the registered reference images using the up/down/left/right arrow keys, the selected reference image will be displayed in the lower right of the screen.

④ SEARCH ARE

Specify the search area (inside the dotted lines) on the "④SEARCH ARE (MDL0)" line, using the same procedures used for setting the reference image area.

If you are selecting a 2-point search, also set the points the same way as for MDL1.

```
REG COND        SCREEN COND SAVE DETAIL          F  C1 BRT

①REGISTER NO.        0(0～7)
②MEAS SHAPE (MDL0)   RECTANGLE
③REFIMG ARE (MDL0)   SET (224.208)～(287.271)
④SEARCH ARE (MDL0)   SET (216.200)～(295.279)


            ┌ ─ ─ ─ ─ ─ ─ ─ ┐
            ┆  ┌─────────┐  ┆
            ┆  │         │  ┆
            ┆  │    +    │  ┆
            ┆  │         │──┼──→ Search area
            ┆  └─────────┘  ┆
            └ ─ ─ ─┬─ ─ ─ ─ ┘
                   │
              Object to measure

SEL=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

An example of storing

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

```
                                            Model 1
         Model 0                    ┌ ─ ─ ─ ─ ─ ┐
Reference image              ┌ ─ ─┐ ┆ ┌───────┐ ┆
(Model 0)         ┌ ─ ─ ─ ┐  ┆    ┆ ┆ │  ●    │ ┆ ── Reference image (model 1)
Search area    →  ┆  ┌──┐ ┆     ┆ │  +    │ ┆
(Model 0)         ┆  │● │ ┆  ┆    ┆ ┆ └───────┘ ┆ ── Search area (model 1)
                  ┆  │ +│ ┆     └ ─ ─ ─ ─ ─ ┘
                  ┆  └──┘ ┆
                  └ ─ ─ ─ ┘
```
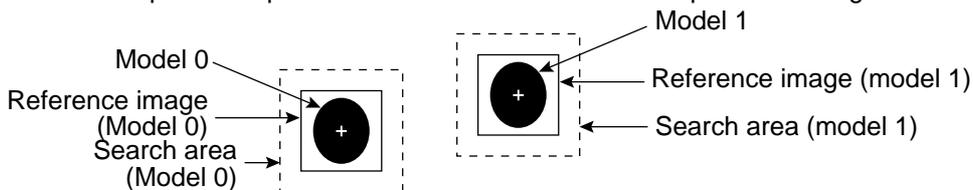
Note: When setting the horizontal and vertical lines, specify the line length as follows:
The reference image must shorter than the search area lines.

⑤ **REFIMG**

Move the cursor to the function menu on the REG COND screen by pressing the TRG/BRT key. Move the cursor to "DETAIL." Press the SET key on the "REFERENCE IMG" line in the popup menu. The white square on the left will change to a black square. Then, the "⑤REF IMG" item will appear on the screen.
- You can use the same procedures to show "DTECT CRD" (detection coordinates) and "CONTR.PIXL" (contraction pixels) on the screen.
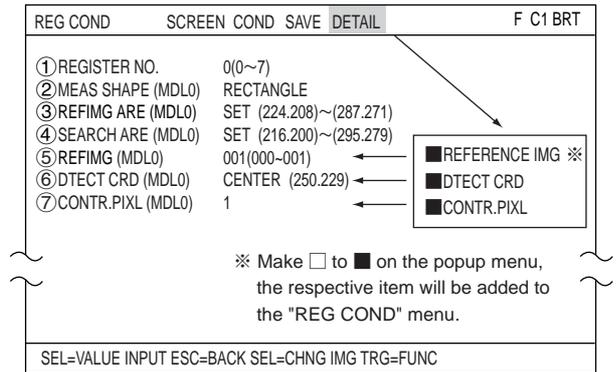
On the "⑤REF IMG" line, select a reference image from the reference images already registered.
Ex : 015 (000 to 026)
Select reference image No. 15 from the 26 registered reference images (000 to 026).

```
REG COND      SCREEN  COND  SAVE  DETAIL        F  C1 BRT

①REGISTER NO.      0(0~7)
②MEAS SHAPE (MDL0)   RECTANGLE
③REFIMG ARE (MDL0)   SET (224.208)~(287.271)
④SEARCH ARE (MDL0)   SET (216.200)~(295.279)        ■REFERENCE IMG ※
⑤REFIMG (MDL0)       001(000~001)                  ■DTECT CRD
⑥DTECT CRD (MDL0)    CENTER (250.229)              ■CONTR.PIXL
⑦CONTR.PIXL (MDL0)   1

                          ※ Make □ to ■ on the popup menu,
                             the respective item will be added to
                             the "REG COND" menu.

SEL=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

⑥ **DTECT CRD (detection coordinates)**

Select whether to use the detection coordinates as the center of the reference area or to allow the point to be set freely.

⑦ **CONTR.PIXL (contraction pixels)**

When "RECTANGLE" was selected at "②MEAS SHAPE," you can select items 1 to 3 below. When " X-LINE" or "Y-LINE" was selected, you can select items 1 or 2 below.
1: Search the image in units of 2 pixels.
2: Search the image in units of 4 pixels.
3: Search the image in units of 8 pixels.

[2] Setting the register conditions for edge detection

② **MEAS SHAPE (MDL 1)**

Select a measurement shape.

RECTANGLE
LINE (straight line) } Select a pattern to be
CIRC-L (circle)   used for image
ELIP-L (ellipse)   processing.
                        ⇨See pages 3-4 to 3-8.

NO ARTF/ARTIF: Select whether to detect edge or not with average density.
                ⇨ See page 3-15.

③ **SEARCH AREA**

Select "③SEARCH AREA (MDL1)" and press the SET key to go to the setting screen.
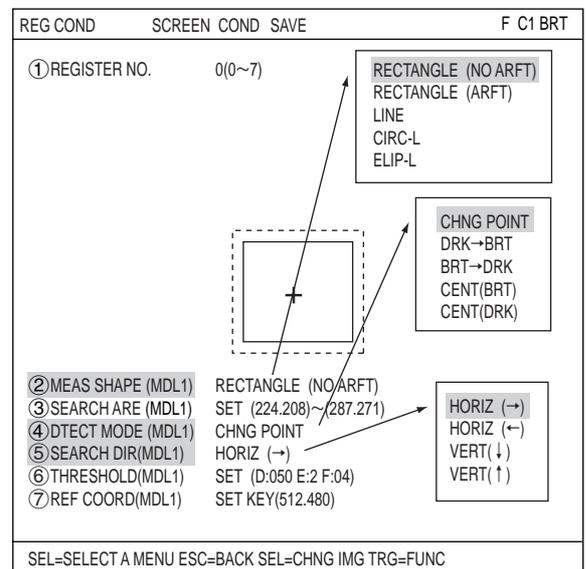
```
REG COND      SCREEN  COND  SAVE              F  C1 BRT

①REGISTER NO.      0(0~7)          RECTANGLE (NO ARFT)
                                   RECTANGLE (ARFT)
                                   LINE
                                   CIRC-L
                                   ELIP-L

                                   CHNG POINT
                                   DRK→BRT
                                   BRT→DRK
                                   CENT(BRT)
                                   CENT(DRK)

②MEAS SHAPE (MDL1)   RECTANGLE (NO ARFT)
③SEARCH ARE (MDL1)   SET (224.208)~(287.271)       HORIZ (→)
④DTECT MODE (MDL1)   CHNG POINT                     HORIZ (←)
⑤SEARCH DIR(MDL1)    HORIZ (→)                      VERT(↓)
⑥THRESHOLD(MDL1)     SET (D:050 E:2 F:04)           VERT(↑)
⑦REF COORD(MDL1)     SET KEY(512.480)

SEL=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

4

When a rectangle is selected

Highlight "①UP.L" and press the SET key. The X and Y axes will appear in the detection area.
Move the X/Y axes using the up/down/left/right arrow keys to identify the upper left corner. When correct, press the SET key.
- To return to the previous coordinates, press the ESC key.

Next, highlight "②LO.R" and press the SET key. Identify the lower right corner the same way.

④ **DTECT MODE**

Select an image processing method for the edges.

CHNG POINT
DRK -> BRT
BRT -> DRK   ⇨ See page 3-14.
CENT (BRT)
CENT (DRK)

● Setting screen (RECTANGLE)

```
RECTANGLE   RESET   RETURN                    F   C1 BRT
MDL 0
①UP.L          (224.208)
②LO.R          (287.271)
③MOVE




                                    ┌ ─ ─ ─ ┐
                                    │ ┌───┐ │
                                    │ │ ● │ + │
                                    │ └───┘ │
                                    └ ─ ─ ─ ┘




                                        X:224  Y:208


SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

⑤ **SEARCH DIR**

Specify a search direction. The direction for searching varies with each detection shape.

● **When "RECTANGLE" is selected**

Horizontal（→）	Scan the reference line from left to right（→）
Horizontal（←）	Scan the reference line from left to right（←）
Vertical（↓）	Scan the reference line from top to bottom（↓）
Vertical（↑）	Scan the reference line from bottom to top（↑）

● **When "LINE" is selected**

Start point → End point	Scan along a straight line from the starting point to the end point
End point → Start point	Scan along a straight line from the end point to the starting point

● **When "CIRC-L" or "ELIP-L" is selected**

Clockwise direction	Scan around the circumference clockwise
Counter-clockwise direction	Scan around the circumference counter-clockwise

⇨ For details, see page 3-14.

⑥ **THRESHOLD**

Specify a threshold value for binary conversion.
⇨ For details, see page 3-10.
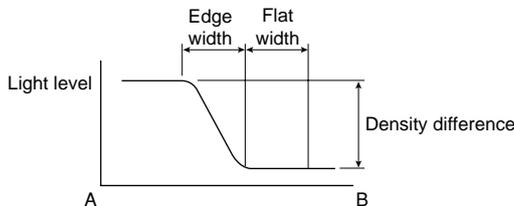
Automatic setting
Select "AUTO-REG" from the upper function menu on the THRESHOLD setting screen. The controller will set the optimum value automatically.
⇨ For details, see page 3-15.

⑦ **REF COORD (reference coordinates)**

You can change the reference coordinates to any desired position.

■ Set the evaluation conditions

● **How to move to the evaluation condition setting screen**
There are two methods for getting to the evaluation condition setting screen.

1) Select "COND" in the upper function menu on the MEAS COND (or REG COND) screen and press the SET key. Select "EVALUATION" on the pop up menu to go to the EVALUAT COND screen.

```
MEAS CND        SCREEN  COND  SAVE              F  C1  BRT
①DTECT PRECISION  STANDARD
②REGISTER NO.     0(0~7)
③MODE             1P-SCH
④DTECT ANGL       NO                    IMG PRE-PROC
⑤ANGLE UNIT                             REG-COND(S)
                                        REG-COND(E)
     REGISTER NO.  00 01 02 03 04 05 06 07 08   POSITION CORRECTION
⑥MDL 0            S  ×  ×  ×  ×  ×  ×  ×         EVALUATION
⑦MDL 1            ×  ×  ×  ×  ×  ×  ×            DST&ANGL
                                        NUM-CALC
                                        OUT




SET=SELECT A MENU FOR  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

2) Move the cursor to the "EVALUATION COND" item on the Menu tree screen and press the SET key.

```
SELECT OBJECT  TYPE  COND                       F  C1  DRK
OBJECT TYPE COND
 ⊞─ TYPE00                           ①REGISTER NO.
      ──TYPE RUN COND                ②CONDITION SET
      ──IMAGE-ADJ                    ③X COORD.(MDL0)
      ⊟─MEA-CND(CAMERA1)             ④Y COORD.(MDL0)
         ⊟─ MEAS0(POSI-DEVIATION)    ⑤x DEVAITE(MDL0)
            ⊞─ IMG PRE-PROC          ⑥y DEVAITE(MDL0)
               MEAS CND              ⑦MATCH LVL(MDL0)
                  ──REG-COND(S)      ⑧TEST
                  ──REG-COND(E)
            ── EVALUATION COND
            ⊞─DISTANCE&ANGLE COND
            ──NUM-CALC
            ──OUT-COND
         ── MEAS(NEW)
      ⊞─ MEA-CND(CAMERA2)
      ── FINAL NUM. CALC
      ── FINAL OUTPUT COND
      ── OBJ-TYPE I/O
      ── OBJ-TYPE SYS.
SET=TO NEXT SUB-MENU  ESC=BACK  SEL=CHNG IMG  TRG=POPUP
```

The "EVALUAT COND" (evaluation conditions) screen will appear.
⇨ For details about the evaluation conditions, see page 3-17.

```
EVALUAT COND  SCREEN  COND  SAVE  EDIT  SEL         F  C1  BRT
①REGISTER NO.      0(0~7)          [TEST RESULT]  [OUTPUT]
②CONDITION SET     AUTO(–10%)
③X COORD.(MDL0)    000.0~511.0      X0=            NO
④Y COORD.(MDL0)    000.0~479.0      Y0=            NO
⑤x DEVAITE(MDL0)   -511.0~+511.0    x0=            NO
⑥y DEVAITE(MDL0)   -479.0~+479.0    y0=            NO
⑦MATCH LVL(MDL0)   -10000~+10000    M0=            NO




⑧TEST              EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)




SET=VALUE INPUT  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

4

4

■ Numeric calculation setting

- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to show the popup menu. Select "NUM-CALC" from the popup menu.
- Select "NUM-CALC" on the menu tree.
  ⇨ See "Chapter 14: Numerical calculations."

■ Output condition setting

- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to display the popup menu. Select "OUT" from the popup menu.
- Select "OUT-COND" on the menu tree.
  ⇨ See "Chapter 16: Setting the Input/Output Conditions.

■ Display the measurement results

Return to the operation screen and press the TRG/BRT key. The measurement results will be displayed on the screen.

● **1P-SCH+1P-EDGE**

```
(TYPE00)                                    F  C1  BRT
                                                  V*.**
OK
MEAS XXXXms
MEASURE 0  CAM1  POSI-DEVIATION
```

Registration number ⟶ REGISTER NO(0~7)

Detection coordinates in the reference image for model 0 ⟶ X0=176.0 OK / Y0=322.0 OK

Amount of deviation from the reference image for model 0 ⟶ x0=+000.0 OK / y0=+000.0 OK

Degree of match with the reference image for model 0 ⟶ M0=+10000 OK

Amount of angular deviation ⟶ B0=+001.7 OK

Detection coordinates in the reference image for model 1 ⟶ X1=534.0 OK / Y1=480.0 OK

Amount of deviation from the reference image for model 1 ⟶ x1=+001.0 OK / y1=+001.0 OK

Degree of match with the reference image for model 1 ⟶ K1=1

```
X0~6 □□□□□□□□   Y0~7 □□□□□□□□   READY ▉
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

⇨ For display examples of measurement results using other modes, see the next page.

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

■ 1-point search

Registration number ——————————→ REGST NO. 0(0~7)

Detection coordinates in the ——————→ ⌈X0=176.0   OK
reference image for model 0   ⌊Y0=322.0   OK

Amount of deviation from ———————→ ⌈x0=+000.0   OK
the reference image for model 0   ⌊y0=+000.0   OK
Degree of match with the
reference image for model 0 ——————→ M0=+10000   OK
* Rotation angle ————————————→ B0=+002.6   OK
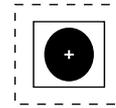
* Angle will be displayed when "DTECT ANGL" is set to "YES."

■ 2-point search

Registration number ——————————→ REGST NO. 0(0~7)

Detection coordinates in the ——————→ ⌈X0=176.0   OK
reference image for model 0   ⌊Y0=322.0   OK

Amount of deviation from ———————→ ⌈x0=+000.0   OK
the reference image for model 0   ⌊y0=+000.0   OK
Degree of match with the
reference image for model 0 ——————→ M0=+10000   OK
Amount of angular deviation ——————→ B0=+001.7   OK

Coordinates in the detect ——————→ ⌈X1=534.0   OK
point for model 1   ⌊Y1=480.0   OK

Amount of deviation in the ——————→ ⌈x1=+001.0   OK
detect point for model 1   ⌊y1=+001.0   OK
The number of the detect ——————→ K1=1   OK
point for model 1

Model 1
Model 0

■ 1-point edge

Registration number ——————————→ REGST NO. 0(0~7)

Coordinates in the detect ——————→ ⌈X0=176.0   OK
point for model 1   ⌊Y0=322.0   OK

Amount of deviation in the ——————→ ⌈x0=+000.0   OK
detect point for model 1   ⌊y0=+000.0   OK
The number of the detect ——————→ K0=1   OK
point for model 1   B0=

■ 2-point edge

Registration number ——————————→ REGST NO. 0(0~7)

Coordinates in the detect ——————→ ⌈X0=176.0   OK
point for model 0   ⌊Y0=322.0   OK

Amount of deviation in the ——————→ ⌈x0=+000.0   OK
detect point for model 0   ⌊y0=+000.0   OK
The number of the detect ——————→ K0=1   OK
point for model 0
Amount of angular deviation ——————→ B0=+001.7   OK

Coordinates in the detect ——————→ ⌈X1=534.0   OK
point for model 1   ⌊Y1=480.0   OK

Amount of deviation in the ——————→ ⌈x1=+001.0   OK
detect point for model 1   ⌊y1=+001.0   OK
The number of the detect ——————→ K1=1   OK
point for model 1

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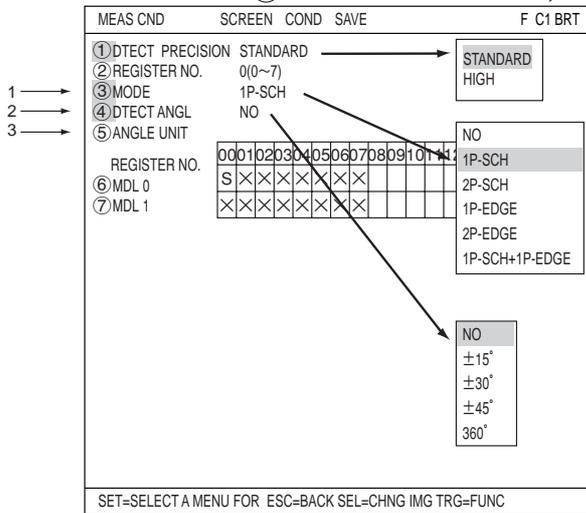
(1) Angle detection by object shape
There are some objects whose angle cannot be detected, due to the shape of the object and the compression level used for the gray scale search, as shown in the table below.

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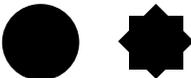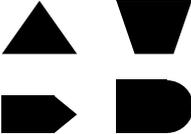
- The information given above is true when the measurement conditions are as follows: the size of the reference image to be registered is approximately 64 X 64, and the search size is approximately 100 X 100.

(2) Setting method
On the [MEAS CND] screen, select the "1P-SCH" or "1P-SCH+1P-EDGE" mode on the "③MODE" and then select the "④DTECT ANGL" item. ⇨ See page 4-2.

```
MEAS CND        SCREEN  COND  SAVE              F C1 BRT

①DTECT PRECISION  STANDARD                    ┌──────────┐
②REGISTER NO.     0(0~7)                       │STANDARD  │
③MODE             1P-SCH                       │HIGH      │
④DTECT ANGL       NO                           └──────────┘
⑤ANGLE UNIT
                                               ┌──────────────┐
  REGISTER NO.   00 01 02 03 04 05 06 07 08 09 10 11 12│NO            │
⑥MDL 0          S ✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕              │1P-SCH        │
⑦MDL 1          ✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕                │2P-SCH        │
                                               │1P-EDGE       │
                                               │2P-EDGE       │
                                               │1P-SCH+1P-EDGE│
                                               └──────────────┘

                                               ┌──────┐
                                               │NO    │
                                               │±15°  │
                                               │±30°  │
                                               │±45°  │
                                               │360°  │
                                               └──────┘

SET=SELECT A MENU FOR  ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Note: When the rotation angle detection is set other than "NO," the "HIGH PRECISION" selection will be invalid. (The detection precision is fixed to the "STANDARD.")

1. Select the "1P-SCH" or "1P-SCH+1P-EDGE" mode on the "③MODE".
2. Select the angle search range (±15˚, ±30˚, ±45˚, ±360˚) on the "④DTECT ANGL" item. The larger the angle search range, the slower the processing will be.
3. Select a rotation step size in degrees in "⑤ANGLE 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

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

   Image to register
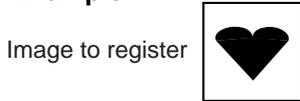
   When triggered to store the reference image, the system will store various views of the object in memory by rotating the image, 10 degrees at a time.
   ● **When the angle range is set to –360˚ (Rotation angle unit : 10)**

   Reference image

   0   10   20 . . . 180 -170 . . -10
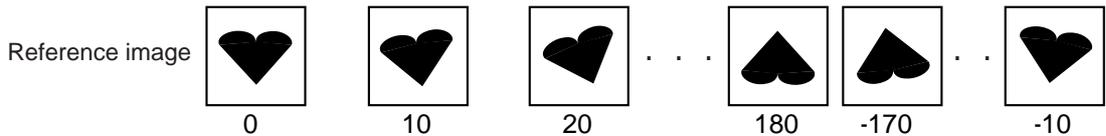
5. Specify a search area that is large enough to include various positional deviations of the object.

   Reference image area

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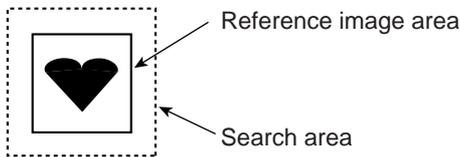
6. When starting the measurement, the system will execute a gray scale search of the captured image based on the stored reference images, which were created by rotating the basic image, 10 degrees at a time in step 3 above.

   Define the position using the curve interpolation.

   Degree of match

   Captured image

   Degree of match curve

   10 20 30 40 50 60 70 → Rotation angle
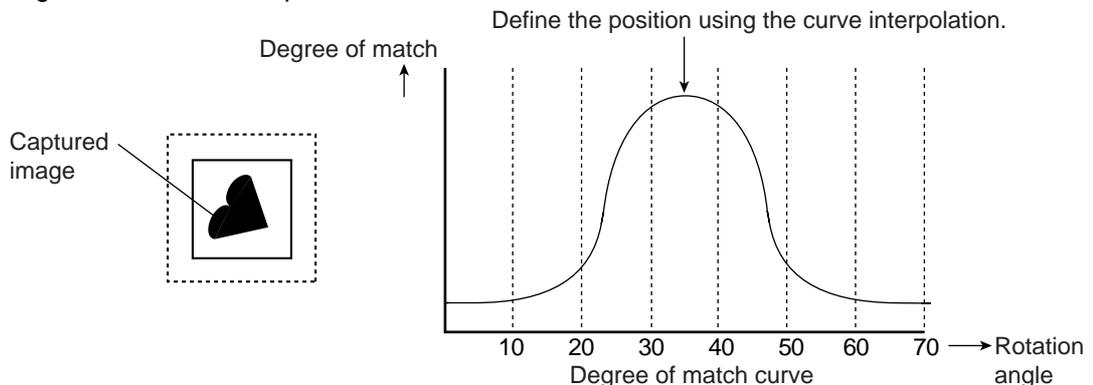
Note: When "NO" is selected for the "DTECT ANGL" (rotation angle detection) in the previous page after registering the reference image, a "Reference image condition mismatch" error will occur when executing the measurement.

Chapter 5: Degree of Match Inspection

5-1 Outline
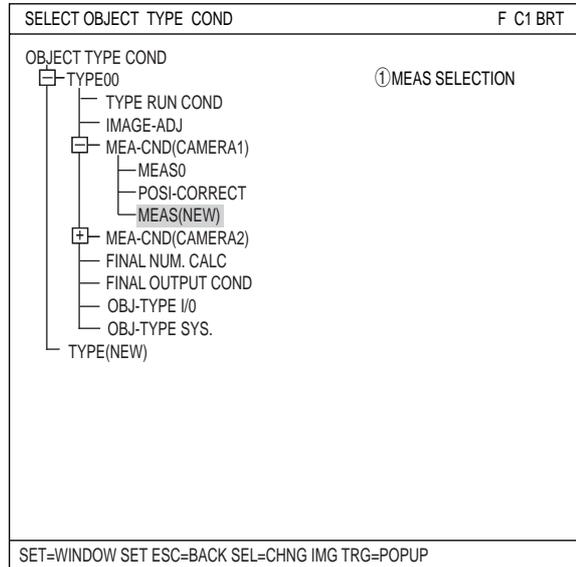
<table>
<tr>
<td>Purpose</td>
<td>The gray search function is capable of finding the differences between the non-defective reference image and the image to be inspected evaluating the degree of match. (The acceptability of the workpiece is evaluated based on its level of similarity to the reference model.)</td>
</tr>
<tr>
<td>Applications</td>
<td>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</td>
</tr>
<tr>
<td>Examples</td>
<td>

[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
① A gray search for the reference image for positioning is made.
② After 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.
③ If the degree of match of the reference image for checking is low, the label is regarded as applied incorrectly.
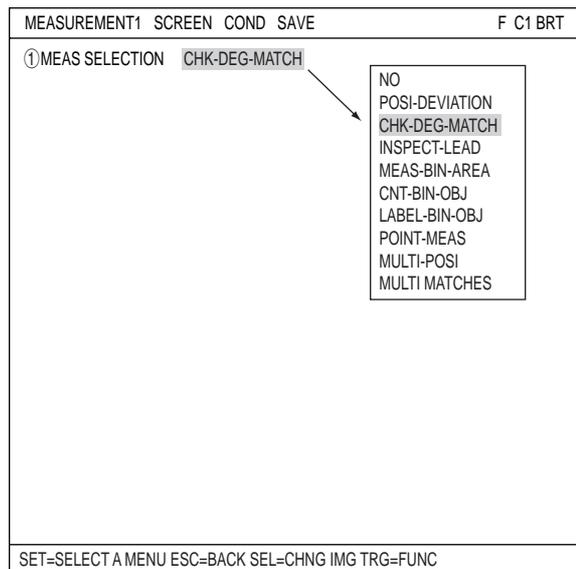
</td>
</tr>
</table>
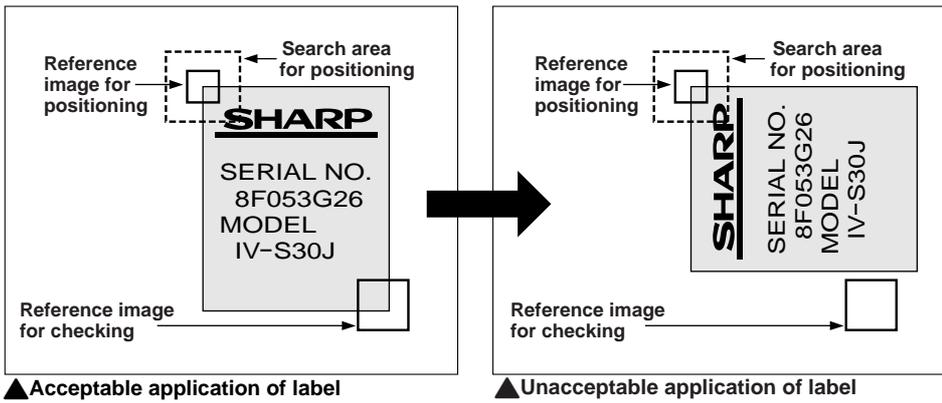
5-2 Setting operation

■ Setting the measurement conditions

● **How to enter the measurement conditions setting screen**

Select "MAIN-COND" -> "OBJECT TYPE COND" (menu tree)-> "TYPE00" ->"MEA-CND (CAMERA1)" -> "MEAS(NEW)," in that order. Then press the SET key to bring up the "MEAS1" screen.

```
SELECT OBJECT  TYPE  COND                          F  C1 BRT

OBJECT TYPE COND
 ⊟ TYPE00                              ①MEAS SELECTION
     ── TYPE RUN COND
     ── IMAGE-ADJ
    ⊟ MEA-CND(CAMERA1)
         ── MEAS0
        ── POSI-CORRECT
         ── MEAS(NEW)
    ⊞ MEA-CND(CAMERA2)
     ── FINAL NUM. CALC
     ── FINAL OUTPUT COND
     ── OBJ-TYPE I/0
     ── OBJ-TYPE SYS.
   ── TYPE(NEW)




SET=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=POPUP
```

Move to the "①MEAS SELECTION" line on the "MEASUREMENT1" screen and select "CHK-DEG-MATCH" from the popup menu.

```
MEASUREMENT1  SCREEN  COND  SAVE                   F  C1 BRT

①MEAS SELECTION   CHK-DEG-MATCH
                                   ┌──────────────┐
                                   │ NO           │
                                   │ POSI-DEVIATION│
                                   │ CHK-DEG-MATCH │
                                   │ INSPECT-LEAD  │
                                   │ MEAS-BIN-AREA │
                                   │ CNT-BIN-OBJ   │
                                   │ LABEL-BIN-OBJ │
                                   │ POINT-MEAS    │
                                   │ MULTI-POSI    │
                                   │ MULTI MATCHES │
                                   └──────────────┘







SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Press the ESC key to return to the OBJECT TYPE COND (menu tree) screen, and select the "MEAS CND" item shown under "MEAS01 (CHK-DEG-MATCH)" to go to the MEAS CND screen.
⇨ For details, see "Chapter 8: Setting Examples Using the Menu Tree" in the Introduction and Hardware.

● **Setting the measurement conditions**

① **DTECT PRECISON**

Select detection precision. You can select one of two levels (standard/high), according to your conditions, the desired precision level for detection results, and the detection speed.
⇨ For details, see page 3-10.

② **REGISTER NO.**

16 registers are available for the degree of match inspection (Registers 0 to 15).
If you want to set the measurement conditions for a different register number, press the SET key to highlight the register number currently selected. Then press the up and down arrow keys to select the register number whose measurement conditions you want to set. Press the SET key to confirm your selection.

```
MEAS CND      SCREEN  COND  SAVE              F C1 BRT
①DTECT PRECISION STANDARD  →  STANDARD    NO
②REGISTER NO.    00(0~15)       HIGH       1P-SCH
③MODE            2P-SCH     ──────────→    2P-SCH
④SEARCH          YES
⑤MATCHING        AVG-GRAYS

   REGISTER NO.  000102030405060708091011121314 15
⑥MDL 0           S ×××××××××××××××
⑦MDL 1           S ×××××××××××××××
                                              YES
                                              NO
           AVG-GRAYS
           DIFF.ABS

SET=SELECT A MENU FOR  ESC=BACK SEL=CHNG IMG TRG=FUNC
```

5
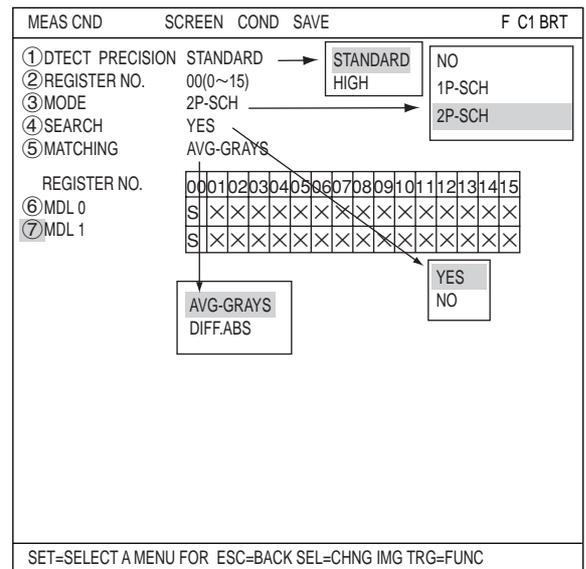
③ **MODE**

Select a detection mode.
Detail of each mode are as follows.

MODE	Details
NO (None)	Does not detect.
1P-SCH (1-point search)	Detect the positional deviation of one point in the scanned image compared to a single reference image, after performing a gray search.
2P-SCH (2-point search)	Detect the positional deviation of two points in the scanned image compared to two reference images, after performing a gray search.

Gray search ⇨ See page 3-9.

④ **SEARCH**

Specify whether or not to use the search function.

⑤ **MATCHING**

Select a density for comparison when inspecting the image. The details are as follows.

	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 = S (Ni — Nt) Ni : Light level of the captured image (contraction 3) Nt : Light level of the reference image (contraction 3)

REGISTER NO. (⑥MDL 0, ⑦MDL 1)

The specified modes are displayed for each register number on these lines. When a 1-point search is specified, only "⑥MDL 0" will be available. When a 2-point search is specified, "⑦MDL 1" is also available. The "S" in the table indicates a gray search. "X" means not used.

● **An example of mode selection**

```
   REGISTER NO.  00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15     S：Gray search
⑥MDL0            S  S  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×      ×：No setting
⑦MDL1            ×  S  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×
```

REGISTER00 : 1P-SCH
REGISTER01 : 2P-SCH

■ How to set the register conditions

● How to enter the REG-COND setting screen
There are three methods for getting to the REG-COND setting screen.

5

1) On the "MEAS CND" setting screen, move the cursor to "⑥MDL 0" or "⑦MDL 1" and press the SET key. The cursor will move into the table. Move the cursor to the "S" column and press the SET key.

   Note: If you press the SET key in the "X" column, the setting will be invalid.

```
MEAS CND          SCREEN  COND  SAVE          F C1 BRT

①DTECT PRECISION  STANDARD              IMG PRE-PROC
②REGISTER NO.     00(0~15)              REG-COND
③MODE            2P-SCH                 EVALUATION
④SEARCH          YES                    DST&ANGL
⑤MATCHING        AVG-GRAYS              NUM-CALC
                                        OUT
  REGISTER NO.
⑥MDL 0           00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑦MDL 1           S × × × × × × × × × × × × × × × ×
                 S × × × × × × × × × × × × × × × ×
```

2) On the "MEAS CND" setting screen, press the TRG/BRT key to move the cursor to the upper function menu. Select the "COND" item and then select the "REG-COND" item and press the SET key.

3) On the menu tree, move the cursor to the "MEAS CND" item, and press the right arrow key. The sub menu which contains the "REG-COND" items will appear. Move the cursor to this item and press the SET key.

```
SELECT OBJECT  TYPE COND                        F C1 DRK
OBJECT TYPE COND
┼─ TYPE00                          ①REGISTER NO.
└─ TYPE01                          ②MEAS SHAPE (MDL0)
     ── TYPE RUN COND              ③REFIMG ARE  (MDL0)
     ── IMAGE-ADJ                  ④SEARCH ARE  (MDL0)
     ┼─ MEA-CND(CAMERA1)           ⑤REFIMG      (MDL0)
        ── MEAS0                   ⑥DTECT CRD   (MDL0)
        ── POSI-CORRECT            ⑦CONTR.PIXL  (MDL0)
        ┼─ MEAS01(CHK-DEG-MATCH)   ⑧MEAS SHAPE (MDL1)
           ── IMG PRE-PROC         ⑨REFIMG ARE  (MDL1)
           ┼─ MEAS CND             ⑩SEARCH ARE  (MDL1)
              └── REG-COND         ⑪REFIMG      (MDL1)
           ── EVALUATION COND      ⑫DTECT CRD   (MDL1)
           ┼─ DISTANCE&ANGLE COND  ⑬CONTR.PIXL  (MDL1)
           ── NUM-CALC
           ── OUT-COND
        ── MEAS(NEW)
     ┼─ MEA-CND(CAMERA2)
     ── FINAL NUM. CALC
     ── FINAL OUTPUT COND
     ── OBJ-TYPE I/O

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

● How to set register conditions

① REGISTER NO.
The currently selected register number is displayed.

If you want to set the measurement conditions for a different register number, press the SET key to highlight the register number currently selected. Then press the up and down arrow keys to select the register number whose measurement conditions you want to set. Press the SET key to confirm your selection.

② MEAS SHAPE(MLD0)
Select a shape (rectangle, horizontal line, or vertical line) for the reference image area and search area.

⇨ For details about each shape, see pages 3-4 to 3-8.

```
REG COND          SCREEN  COND  SAVE  DETAIL       F C1 BRT

①REGISTER NO.      0(0~7)                  RECTANGLE
②MEAS SHAPE (MDL0) RECTANGLE               X-LINE
③REFIMG ARE (MDL0) SET (224.208)~(287.271) Y-LINE
④SEARCH ARE (MDL0) SET (216.200)~(295.279)
⑤REFIMG (MDL0)     001 (000~001)          ■REFERENCE IMG *
⑥DTECT CRD (MDL0)  CENTER (250.229)        ■DTECT COORD
⑦CONTR.PIXL (MDL0) 1                       ■CONTR.PIXEL

⑧MEAS SHAPE (MDL1) RECTANGLE
⑨REFIMG ARE (MDL1) SET (224.208)~(287.271)
⑩SEARCH ARE (MDL1) SET (216.200)~(295.279)
⑪REFIMG (MDL1)     001 (000~001)
⑫DTECT CRD (MDL1)  CENTER (250.229)
⑬CONTR.PIXL (MDL1) 1

                      * Make □ to ■ on the popup menu,
                        the respective item will be added to
                        the "REG COND" menu.

SEL=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

③ **REFIMG ARE (MDL0)**
Move the cursor to "③REFIMG ARE(MDL0)" and press the SET key. When the SET item is highlighted, press the SET key again to bring up the setting screen.

● **When a rectangle is selected**
Specify the upper left and lower right corners of the reference image area.

●Setting screen (RECTANGLE)

```
RECTANGLE   RESET   RETURN                    F  C1 BRT
MDL 0
①UP.L          (224.208)
②LO.R          (287.271)
③MOVE
④REFERENCE IMG
```

Reference image of MDL0
Detection image of MDL0
Search area of MDL0

SHARP
SERIAL NO.
8F053G26
MODEL
IV-S30J

Reference image of MDL1
Detection image of MDL1
Search area of MDL1

X:224 Y:139

SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC

● **When a horizontal line is selected**
Specify the start and end points on the X axis. Specify the start and end points using the up/down/left/right arrow keys. The points will move along the X axis (while keeping the same Y coordinate).

● Setting screen (X-LINE)

```
X-LINE      RESET      RETURN                 F  C1 BRT
MDL 0
①S.PT          (199.245)
②E.PT          (328.245)
③MOVE
④REFERENCE IMG
```

SHARP
SERIAL NO.
8F053G26
MODEL
IV-S30J

Crosshair cursor
(detection coordinate)
Solid line (reference line)
Dotted line (search line)

X:194 Y:245

SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC

5

5

● **When a vertical line is selected**
Specify the start and end points on the Y axis. Specify the start and end points using the up/down/left/right arrow keys. The points will move along the Y axis (while keeping the same X coordinate).

●Setting screen (Y-LINE)

```
Y-LINE    RESET    RETURN                    F  C1 BRT
MDL 0
①S.PT        (194.175)
②E.PT        (194.344)
③MOVE
④REFERENCE IMG




        Crosshair cursor
        (detection coordinate)
        Solid line (reference line)
        Dotted line (search line)


                              SHARP
                           SERIAL NO.
                           8F053G26
                           MODEL
                           IV-S30J



                                    X:194 Y:344


SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Register a reference image
After setting the reference image area, store an image in the controller as a reference image.
Select "④REFERENCE IMG" using the up/down arrow keys and select "REG" from the popup menu.

```
RECTANGLE    RESET    RETURN                 F  C1 BRT
MDL 0
①UP.L        (224.208)
②LO.R        (287.271)
③MOVE                          CONTRAST SRCH
④REFERENCE IMG ───────►        REG
                               DISP


            +
         SHARP
       SERIAL NO.
       8F053G26
       MODEL
       IV-S30J




                                    X:224 Y:208


SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

④ **SEARCH ARE**
Specify the search area (inside the dotted lines) on the "④SEARCH ARE (MDL0)" line, using the same procedures used for setting the reference image area.
Note: Set the menu for MDL1. Setting procedures are the same as MDL0.

```
RECTANGLE    RESET    RETURN                 F  C1 BRT
MDL 0
①UP.L        (224.208)
②LO.R        (287.271)
③MOVE




          +
            SHARP
          SERIAL NO.
          8F053G26
          MODEL
          IV-S30J




                                    X:224 Y:139


SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

5-6

⑤ **REFIMG**

On the "⑤REF IMG (MDL0)" line, select a
reference image from the reference images
already registered.

Ex. 015 (000 to 026)

Select reference image No. 15 from the 26
registered reference images (000 to 026).

Note: This item is displayed only when the
"REFERENCE IMG" is selected on the
"DETAIL" in the upper function menu.
⇨ See page 5-4.

```
REG COND      SCREEN COND  SAVE DETAIL        F C1 BRT

①REGISTER NO.        00 (0~15)
②MEAS SHAPE (MDL0)   RECTANGLE
③REFIMG ARE (MDL0)   SET (131.122)~(217.201)
④SEARCH ARE (MDL0)   SET (119.114~(224.214)
⑤REFIMG (MDL0)       15 (000~026)
⑥DTECT CRD (MDL0)    CENTER (176.164)
⑦CONTR.PIXL (MDL0)   1

⑧MEAS SHAPE (MDL1)   RECTANGLE
⑨REFIMG ARE (MDL1)   SET (224.208)~(372.349)
⑩SEARCH ARE (MDL1)   SET (276.259)~(381.368)
⑪REFIMG (MDL1)       003 (000~026)
⑫DTECT CRD (MDL1)    CENTER (384.313)
⑬CONTR.PIXL (MDL1)   3

SEL=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

⑥ **DTECT CRD (detection coordinates)**

Select whether to use the detection
coordinates as the center of the reference
area or to allow the point to be set freely.

Note: This item is displayed only when the
"DTECT COORD" is selected on the
"DETAIL" in the upper function menu.
⇨ See page 5-4.

```
REG COND      SCREEN COND  SAVE DETAIL        F C1 BRT

①REGISTER NO.        00 (0~15)
②MEAS SHAPE (MDL0)   RECTANGLE
③REFIMG ARE (MDL0)   SET (131.122)~(217.201)
④SEARCH ARE (MDL0)   SET (119.114~(224.214)
⑤REFIMG (MDL0)       003 (000~026)
⑥DTECT CRD (MDL0)    CENTER (176.164)  → CENTER
⑦CONTR.PIXL (MDL0)   1                    SET

⑧MEAS SHAPE(MDL1)    RECTANGLE
⑨REFIMG ARE (MDL1)   SET (224.208)~(372.349)
⑩SEARCH ARE (MDL1)   SET (276.259)~(381.368)
⑪REFIMG (MDL1)       003 (000~026)
⑫DTECT CRD (MDL1)    CENTER (384.313)
⑬CONTR.PIXL (MDL1)   3

SEL=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

⑦ **CONTR.PIXL**

Select "CONTR.PIXL" (pixel contraction).

Note: This item is displayed only when the
"CONTR.PIXEL" is selected on the
"DETAIL" in the upper function menu.
⇨ See page 5-4.

⇨ For detail about the "CONTR.PIXEL," see
page 3-9.

```
REG COND      SCREEN COND  SAVE DETAIL        F C1 BRT

①REGISTER NO.        00 (0~15)
②MEAS SHAPE (MDL0)   RECTANGLE
③REFIMG ARE (MDL0)   SET (131.122)~(217.201)
④SEARCH ARE (MDL0)   SET (119.114~(224.214)
⑤REFIMG (MDL0)       003 (000~026)
⑥DTECT CRD (MDL0)    CENTER (176.164)
⑦CONTR.PIXL (MDL0)   1

⑧MEAS SHAPE(MDL1)    RECTANGLE
⑨REFIMG ARE (MDL1)   SET (224.208)~(372.349)
⑩SEARCH ARE (MDL1)   SET (276.259)~(381.368)
⑪REFIMG (MDL1)       003 (000~026)
⑫DTECT CRD (MDL1)    CENTER (384.313)
⑬CONTR.PIXL (MDL1)   3

SEL=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

5

■ Set the evaluation conditions

- ● **How to move to the evaluation condition setting screen**
  There are two methods for getting to the evaluation condition setting screen.

1) Select "COND" in the upper function menu on the "MEAS COND" (or "REG COND") screen and press the SET key. Select "EVALUATION" on the popup menu to go to the "EVALUAT COND" screen.

```
MEAS CND          SCREEN  COND  SAVE                      F  C1 BRT

①DTECT PRECISION  STANDARD                    IMG PRE-PROC
②REGISTER NO.     00(0~15)                    REG-COND
③MODE            2P-SCH                       EVALUATION
④SEARCH          YES                          DST&ANGL
⑤MATCHING        AVG-GRAYS                    NUM-CALC
                                              OUT
   REGISTER NO.
⑥MDL 0          00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑦MDL 1          S  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×
                ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×

SET=REG COND FOR  ESC=BACK SEL=CHNG IMG TRG=FUNC
```

2) Move the cursor to the "EVALUATION COND" item on the menu tree screen and press the SET key.

```
SELECT OBJECT  TYPE  COND                                 F  C1 DRK

OBJECT TYPE COND
  ⊞─ TYPE00                            ①REGISTER NO.
  ⊟─ TYPE01                            ②CONDITION SET
          ── TYPE RUN COND             ③MATCH LVL(MDL0)
          ── IMAGE-ADJ                 ④XCOORD.(MDL0)
          ⊟─ MEA-CND(CAMERA1)          ⑤Y COORD.(MDL0)
                  ── MEAS0             ⑥GRAY LVL(MDL0)
                  ── POSI-CORRECT      ⑦MATCH LVL(MDL1)
                  ⊟─ MEAS01(CHK-DEG-MATCH)  ⑧X COORD.(MDL1)
                          ── IMG PRE-PROC   ⑨Y COORD.(MDL1)
                          ⊟─ MEAS CND       ⑩GRAY LVL(MDL1)
                                  └─REG-COND ⑪TEST
                          ── EVALUATION COND
                          ⊞─ DISTANCE&ANGLE COND
                          ── NUM-CALC
                          └─ OUT-COND
                  ── MEAS(NEW)
          ⊞─ MEA-CND(CAMERA2)
          ── FINAL NUM. CALC
          ── FINAL OUTPUT COND
          ── OBJ-TYPE I/O

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

The "EVALUAT COND" (evaluation conditions) will appear.
⇨ For details about "EVALUAT COND," see page 3-17.

```
EVALUAT COND  SCREEN  COND  SAVE  EDIT  SEL              F  C1 BRT

①REGISTER NO.      00(0~15)        [TEST RESULT]   [OUTPUT]
②CONDITION SET'    AUTO(–10%)
③MATCH LVL(MDL0)   -10000~+10000   M0=             NO
④X COORD.(MDL0)    000.0~511.0     X0=             NO
⑤Y COORD.(MDL0)    000.0~479.0     Y0=             NO
⑥GRAY LVL(MDL0)    000.0~255.0     G0=             NO

⑦MATCH LVL(MDL1)   -10000~+10000   M1=             NO
⑧X COORD.(MDL1)    000.0~511.0     X1=             NO
⑨Y COORD.(MDL1)    000.0~479.0     Y1=             NO
⑩GRAY LVL(MDL1)    000.0~255.0     G1=             NO
⑪TEST              EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)

SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

5

■ Numeric calculation setting
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to show the popup menu. Select "NUM-CALC" from the popup menu.
- Select "NUM-CALC" on the menu tree.
⇨ See "Chapter 14: Numeric calculation."

■ Output condition setting
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to display the popup menu. Select "OUT" from the popup menu.
- Select "OUT-COND" on the menu tree.
⇨ See "Chapter 15: Set the Input/Output Conditions."

5

■ Display the inspection results
Return to the operation screen and press the TRG/BRT key. The inspection results will be displayed on the screen.

■ When a 2 point search has been specified

Final evaluation result → **OK**

Measuring time → MEAS XXXXms

Measurement program number → MEASUREMENT 1 CHK-DEG-MATCH

Registration number → REGISTER N00(0~15)

Degree of match with the reference image for model 0 → M0=+09878 OK

Detection coordinates for model 0 → X0= 288.0 OK / Y0= 190.0 OK

Average gray level in the reference image for model 0* → G0= 023.0 OK

Degree of match with the reference image for model 1 → M1=+09306 OK

Detection coordinates for model 1 → X1= 389.0 OK / Y1= 355.0 OK

Average gray level in the reference image for model 1* → G1= 023.0 OK

(TYPE00) F C1 DRK V*.**

Model 0

Model 1

SHARP SERIAL NO. 8F053G26 MODEL IV-S60J

X0~6 □□□□□□□□   Y0~7 □□□□□□□□   READY □

MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE

Chapter 6: Lead Inspection

6-1 Outline

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 measurement limit line / Lead / Reference line D0 D1 D2 K0 L0 K1 L1 K2 L2 K3 L3 W0 W1 W2 W3 **[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.
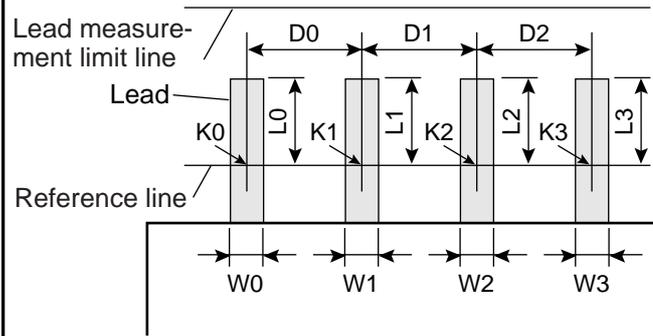
6

6-2 Setting operation

■ Setting the measurement conditions

● How to enter the measurement conditions setting screen

Select "MAIN-COND" -> "OBJECT TYPE COND" -> "TYPE00" ->"MEA-CND (CAMERA1) " -> "MEAS(NEW)," in that order. Then press the SET key to bring up the "MEAS1" screen.

```
SELECT OBJECT TYPE COND                          F  C1 BRT

OBJECT TYPE COND
  ┌─TYPE00                              ①MEAS SELECTION
  │      ─ TYPE RUN COND
  │      ─ IMAGE-ADJ
  ┌─ MEA-CND(CAMERA1)
  │      ─ MEAS0
  │      ─ POSI-CORRECT
  │      ─ MEAS(NEW)
  ┌─ MEA-CND(CAMERA2)
  │      ─ FINAL NUM. CALC
  │      ─ FINAL OUTPUT COND
  │      ─ OBJ-TYPE I/0
  │      ─ OBJ-TYPE SYS.
  └─ TYPE(NEW)




SET=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=POPUP
```
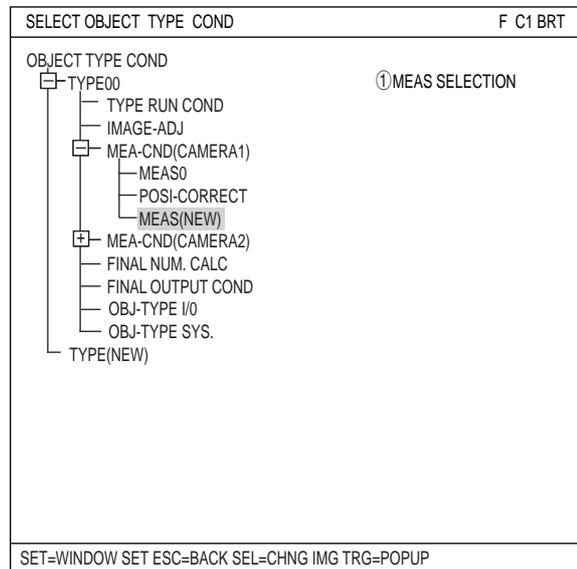
Move to the "①MEAS SELECTION" line on the "MEASUREMENT1" screen and select "INSPECT-LEAD" from the popup menu.
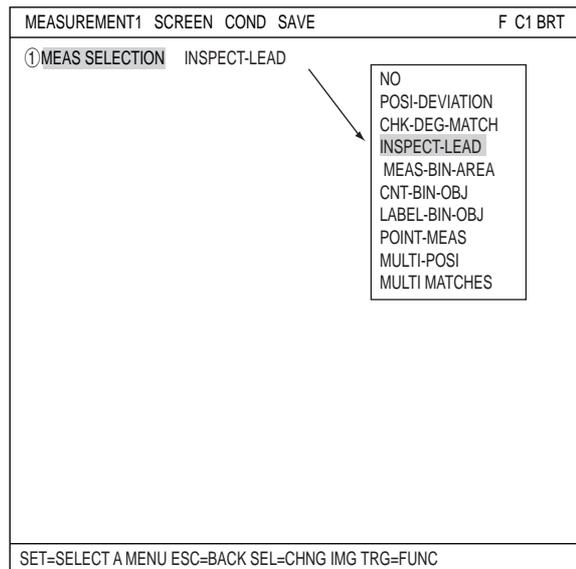
```
MEASUREMENT1  SCREEN  COND  SAVE                  F  C1 BRT

①MEAS SELECTION    INSPECT-LEAD
                                    ┌──────────────┐
                                    │ NO           │
                                    │ POSI-DEVIATION│
                                    │ CHK-DEG-MATCH │
                                    │ INSPECT-LEAD  │
                                    │  MEAS-BIN-AREA│
                                    │ CNT-BIN-OBJ   │
                                    │ LABEL-BIN-OBJ │
                                    │ POINT-MEAS    │
                                    │ MULTI-POSI    │
                                    │ MULTI MATCHES │
                                    └──────────────┘




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Press the ESC key to return to the "OBJECT TYPE COND" (menu tree) screen, and select the "MEAS CND" item shown under "MEAS01 (INSPECT-LEAD)" to go to the "MEAS CND" screen.
⇨ For details, see "Chapter 8: Setting Examples Using the Menu Tree" in Introduction and Hardware.

● **Setting the measurement conditions**

① **REGISTER NO.**
16 registers are available for the lead inspection (Registers 0 to 15).
If you want to set the measurement conditions for a different register number, press the SET key to highlight the register number currently selected. Then press the up and down arrow keys to select the register number whose measurement conditions you want to set. Press the SET key to confirm your selection.

② **REGISTER EXIST**
Select whether to register or not.

③ **DTECT PRECISON**
Select detection precision. You can select one of two levels (standard/high), according to your conditions, the desired precision level for detection results, and the detection speed.
⇨ For details, see page 3-9.
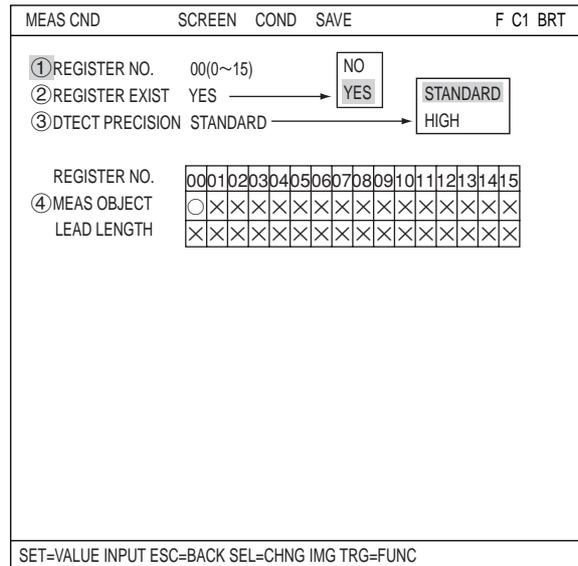
REGISTER NO. (④MEAS OBJECT, LEAD LENGTH)
Register setting conditions are shown for each register number. Circles mean that "REGISTER NO." has set to "YES."

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

REGISTER NO.
④MEAS OBJECT
LEAD LENGTH

X : No setting

When item "②REGISTER EXIST" has set "YES," a circle is displayed.
On the "REG COND" screen, when the "⑦EXTENSION MEAS" is set to "LEAD-LENGTH," or "BALL-WIDTH," a circle is displayed.

■ **How to set the register conditions**

● **How to enter the REG-COND setting screen**
There are three methods for getting to the REG-COND setting screen.

1) On the MEAS CND setting screen, move the cursor to "④MEAS OBJECT" and press the SET key. The cursor will move into the table. Move the cursor to the "○" column and press the SET key.
Note: If you press the SET key in the "X" column, the setting will be invalid.

2) On the "MEAS CND" setting screen, press the TRG/BRT key to move the cursor to the upper function menu. Select the "COND" item and then select the "REG-COND" item and press the SET key.

3) On the menu tree, move the cursor to the "MEAS CND" item, and press the right arrow key. The sub menu which contains the "REG COND" item will appear. Move the cursor to either of these items and press the SET key.

```
SELECT OBJECT TYPE COND                            F C1 BRT
OBJECT TYPE COND
  ┌─ TYPE00                              ①REGISTER NO.
  │      ─TYPE RUN COND                  ②DTECT SHAPE
  │      ─IMAGE-ADJ                      ③SEARCH AREA
  ├─MEA-CND (CAMERA1)                    ④DTECT MODE
  │      ─ MEAS0                         ⑤SEARCH DIRECT
  │      ─ POSI-CORRECT                  ⑥THRESHOLD
  │      ├─ MEAS01 (INSPECT-LEAD)
  │      │   ─ IMG PRE-PROC
  │      ├─ MEAS CND
  │      │      └─ REG-COND
  │      │   ─ EVALUATION COND
  │      │   ─ NUM-CALC
  │      │   └─ OUT-COND
  │      ─ MEAS(NEW)
  ├─ MEA-CND(CAMERA2)
  │  ─ FINAL NUM. CALC
  │  ─ FINAL OUTPUT COND
  │  ─ OBJ-TYPE I/O
  │  ─ OBJ-TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

● **Set the register conditions**

① **REGISTER NO.**
The currently selected register number is displayed.
If you want to set the measurement conditions for a different register number, press the SET key to highlight the register number currently selected. Then press the up and down arrow keys to select the register number whose measurement conditions you want to set. Press the SET key to confirm your selection.

```
REG COND          SCREEN  COND  SAVE  DATAIL      F C1 BRT

①REGISTER NO.    00(0~15)                    ┌──────────────┐
②DTECT SHAPE     RECT(ARTIFACT)              │RECT(ARTIFACT)│
③SEARCH AREA     SET(224,208)~(287,271)      │LINE          │
④DTECT MODE      CENT(BRT)                   │CIRC-L        │
⑤SEARCH DIRECT   HORIZ(→)                    └──────────────┘
⑥THRESHOLD       SET(D:050 E:2 F:04)         ┌──────────┐
⑦EXTENSION       LEAD-LENGTH                 │CENT(BRT) │
⑧EXT.MEAS DIRECT VERTY=+000                  │CENT(DRK) │
                                             └──────────┘
                                             ┌──────────┐
                                             │HORIZ(→)  │
                                             │HORIZ(←)  │
                                             │VERT( ↓ ) │
                                             │VERT( ↑ ) │
                                             └──────────┘
                                             ┌──────────┐
                                             │NO        │
                                             │LEAD-LENGTH│
                                             │BALL-WIDTH│
                                             └──────────┘

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

② **DTECT SHAPE**
Select a detection shape. Three shapes are available: "RECT(ARTIFACT)," "LINE," and "CIRC-L." Depending on which item is selected, the choices on lines "③SEARCH AREA" and "⑤SEARCH DIRECT" will change.
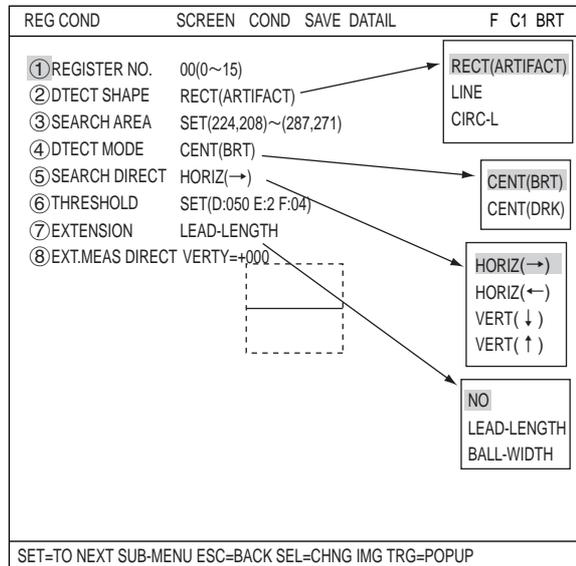
|	
RECT (ARTIFACT)	Specify the coordinates of the upper left and lower right corners. The controller will detect an edge inside this rectangle. For details about processing artifacts, see page 3-15.
LINE	Specify the coordinates of the starting and end points. The controller will detect an edge along this straight line.
CIRC-L	Specify the coordinates of the center and radius. The controller will detect an edge inside this circle.

③ **SEARCH AREA**
Specify a search area. Move the cursor to this line and press the SET key. The currently SET item will be highlighted. Press the SET key again to enter the setting screen.

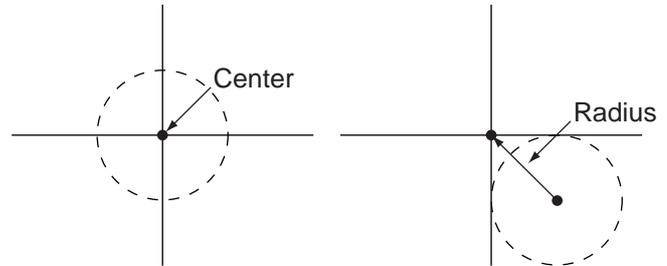● **When the "RECT (ARTIFACT)" is selected**
Specify the upper left and lower right corners of the rectangular search area.
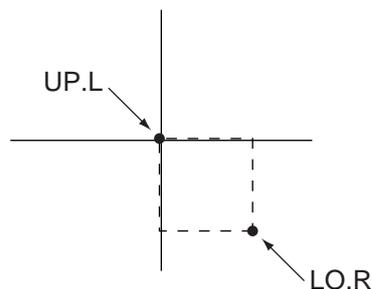
● **When the "LINE" is selected**
Specify the coordinates of the
starting and end points.

Start point → ● ‾ ‾ ‾ ‾ End point
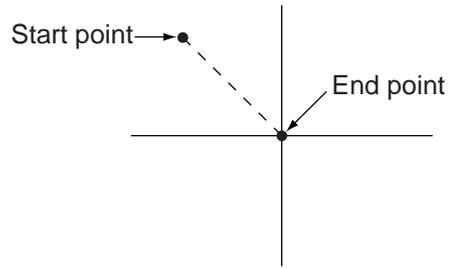
● **When the "CIRC-L" is selected**
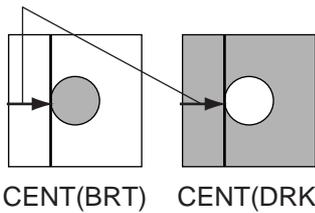Specify the coordinates of the
center, radius, and starting point.

Center

Radius

6

④ **DTECT MODE**
Select a detection mode.

CENT(DRK)	Detect the center of a dark area found by the detection search.
CENT(BRT)	Detect the center of a bright area found by the detection search.

Search direction

CENT(BRT)   CENT(DRK)

⑤ **SEARCH DIRECT (search direction)**
Specify a search direction. The direction for searching varies with each detection shape.

● **When "RECTANGLE" is selected**

Horizontal （→）	Scan along the reference line from left to right （→）
Horizontal （←）	Scan along the reference line from left to right （←）
Vertical （↓）	Scan along the reference line from top to bottom （↓）
Vertical （↑）	Scan along the reference line from bottom to top （↑）

● **When "LINE" is selected**

Start point → End point	Scan along a straight line from the starting point to the end point
End point → Start point	Scan along a straight line from the end point to the starting point

● **When "CIRC-L" or "ELIP-L" is selected**

Clockwise direction	Scan around the circumference clockwise
Counter-clockwise direction	Scan around the circumference counter-clockwise

■ **Example of settings**

- Example when ⑥DTECT MODE (detection mode) is set to "CENT (BRT)" (center dark) and ⑤SEARCH DIRECT (search direction) is set to "HORIZ (horizontal)."
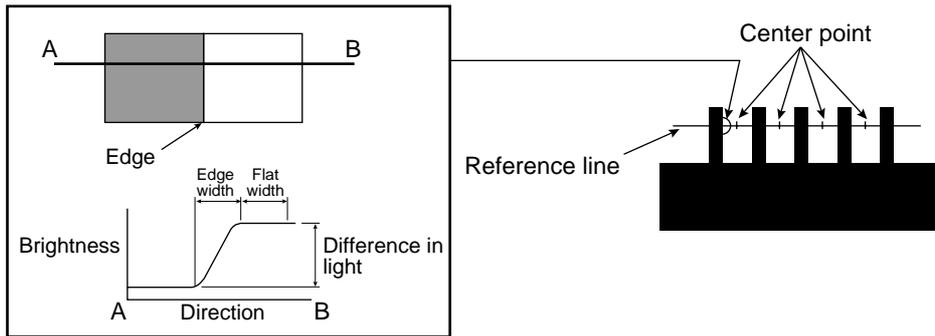
- Example when ⑥DTECT MODE (detection mode) is set to "CENT (DRK)" (center dark) and ⑤SEARCH DIRECT (search direction) is set to "HORIZ (horizontal)."
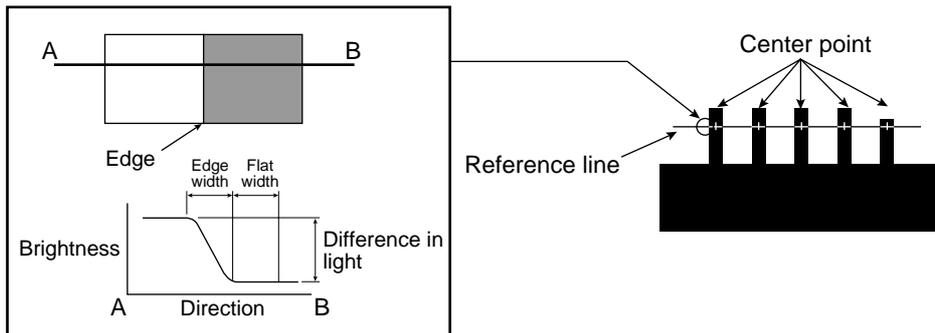
6

⑥ **THRESHOLD**

Specify a threshold value. Move the cursor to this line and press the SET key. The currently SET item will be highlighted. Press the SET key again to enter the setting screen.

Move to each of the following items and press the SET key: "①GRYS." (difference of gray level) "②EDGE.W" (edge width), and "③FLAT.W" (flat width). The current value for that item will be highlighted and it can be changed using the up and down keys. After the value is correct, press the ESC key to confirm it.

The values above can be reset to an appropriate level automatically. Move the cursor to the upper function menu by pressing the TRG/BRT key and select "AUTO-REG". Then press the SET key to set the levels automatically.

⇨ For details, see page 3-15.

⑦ **EXTENSION MEAS,** ⑧ **EXT. MEAS DIRECT**

Extension measurements can be made for "LEAD-LENGTH" or "BALL-WIDTH" in line "⑦ EXTENSION MEAS. Then, the "⑧EXT. MEAS DIRECT" item will appear. At the "⑧EXT. MEAS DIRECT" item, set the position for the extension measurement direction, relative to the reference line.
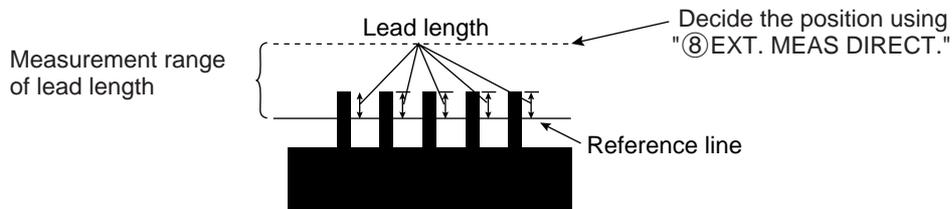
Note: This line is only displayed when "RECT" or "LINE" was selected for the "DTECT SHAPE." To display this line, move the cursor to the upper function menu and select "DETAIL." Press the SET key and select "EXTENSION MEAS" from the popup menu. Then press the SET key.

■ Set the evaluation conditions

● **How to move to the evaluation condition setting screen**
There are two methods for getting to the evaluation condition setting screen.

1) Select "COND" in the upper function menu on the "MEAS CND" (or "REG COND") screen and press the SET key. Select "EVALUATION" on the pop up menu to go to the "EVALUAT COND" screen.

```
MEAS CND        SCREEN  COND  SAVE              F C1 BRT

①REGISTER NO.      00(0~15)
②REGISTER EXIST    YES
③DTECT PRECISION   STANDARD

   REGISTER NO.   00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
④MEAS OBJECT       ○ × × × × × × × × × × × × × × ×
   LEAD LENGTH      × × × × × × × × × × × × × × × ×

                                    IMG PRE-PROC
                                    REG-COND
                                    EVALUATION
                                    NUM-CALC
                                    OUT

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

2) Move the cursor to the "EVALUATION COND" item on the menu tree screen and press the SET key.

```
SELECT OBJECT TYPE  COND                        F C1 BRT
OBJECT TYPE COND
  ⊞  TYPE00                          ①REGISTER NO.
      ├ TYPE RUN COND                ②CONDITION SET
      ├ IMAGE-ADJ                    ③NUMBER OF OBJ
      ⊟ MEA-CND (CAMERA1)            ④DISTANCE
         ├ MEAS0                     ⑤LEAD WIDTH
         ├ POSI-CORRECT              ⑥LEAD LENGTH
         ⊟ MEAS01 (INSRECT-LEAD)     ⑦TEST
            ├ IMG PRE-PROC
            ⊞ MEAS CND
              EVALUATION COND
            ├ NUM-CALC
            └ OUT-COND
         └ MEAS(NEW)
  ⊞ MEA-CND(CAMERA2)
   ├ FINAL NUM. CALC
   ├ FINAL OUTPUT COND
   ├ OBJ-TYPE I/O
   └ OBJ-TYPE SYS.
  └ TYPE(NEW)

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

The "EVALUAT COND" (evaluation conditions) screen will appear.
⇨ For details about the evaluation conditions, see page 3-17.

```
EVALUAT COND  SCREEN  COND  SAVE  EDIT  SEL      F C1 BRT

①REGISTER NO.      00(0~15)      [TEST RESULT]  [OUTPUT]
②CONDITION SET     AUTO(±10%)
③NUMBER OF OBJ     000~128        K=             NO

④DISTANCE          000.0~702.0    D=             NO

⑤LEAD WIDTH        000.0~702.0    W=             NO

⑥LEAD LENGTH       000.0~702.0    L=             NO

⑦TEST              EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)

SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

■ **Numeric calculation setting**
  - Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to show the popup menu. Select "NUM-CALC" from the popup menu.
  - Select "NUM-CALC" on the menu tree.
  ⇨ See "Chapter 14: Numeric calculation."

■ **Output condition setting**
  - Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to display the popup menu. Select "OUT" from the popup menu.
  - Select "OUT-COND" on the menu tree.
  ⇨ See "Chapter 16: Set the Input/Output Conditions."

6

■ **Display the measurement results**
Return to the operation screen and press the TRG/BRT key. The measurement results will be displayed on the screen.

■ **Example when a straight line is selected as measurement shape**

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

```
(TYPE00)                              F  C1 DRK
                                            V*.**
OK
MEAS  XXXXms
MEASUREMENT 1  INSPECT-LEAD

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




X0~6 □□□□□□□□  Y0~7 □□□□□□□□  READY □
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

6-8

Chapter 7: Area Measurement by Binary Conversion
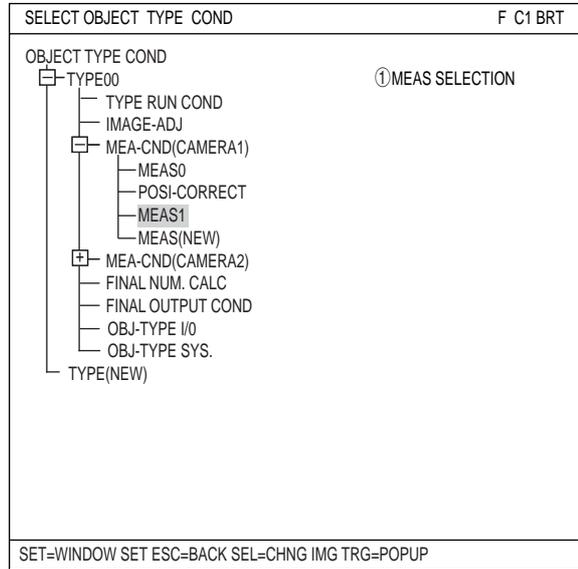
7-1 Outline

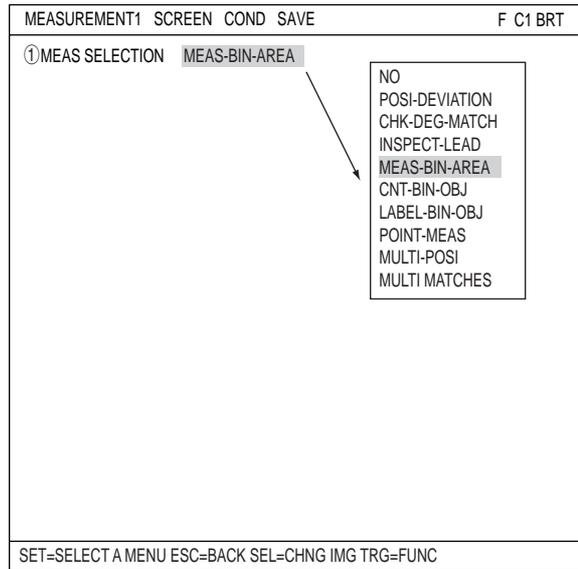|	
Purpose	This function is used to determine the existence and or size of a workpiece when the workpiece is always found in the same place or when it has a fixed measurement position. - This function measures the area of the white field after the image has been converted to binary values (i.e. black 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	 Workpiece **[Measurement result]** - The area of the workpiece **- Checking sequence** Capture an image → Convert it to binary → Measure (area)
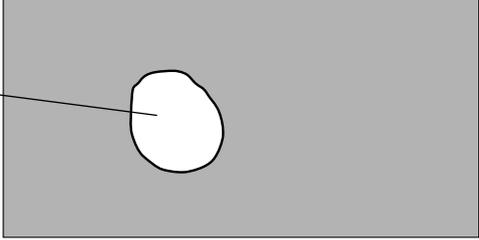
7

7-2 Setting operation

■ Setting the measurement conditions

● How to enter the measurement conditions setting screen

Select "MAIN-COND" -> "OBJECT TYPE COND" (menu tree)-> "TYPE00" ->"MEA-CND (CAMERA1)" -> "MEAS(NEW)," in that order. Then press the SET key to bring up the "MEAS1" screen.

```
SELECT OBJECT  TYPE  COND                              F  C1 BRT

OBJECT TYPE COND
  ┌─ TYPE00                            ①MEAS SELECTION
  │     ├─ TYPE RUN COND
  │     ├─ IMAGE-ADJ
  │     ├─ MEA-CND(CAMERA1)
  │     │      ├─ MEAS0
  │     │      ├─ POSI-CORRECT
  │     │      ├─ MEAS1
  │     │      └─ MEAS(NEW)
  │     ├─ MEA-CND(CAMERA2)
  │     ├─ FINAL NUM. CALC
  │     ├─ FINAL OUTPUT COND
  │     ├─ OBJ-TYPE I/0
  │     └─ OBJ-TYPE SYS.
  └─ TYPE(NEW)




SET=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=POPUP
```

Move to the "①MEAS SELECTION" line on the "MEASUREMENT1" screen and select "MEAS-BIN-AREA" from the popup menu.

```
MEASUREMENT1  SCREEN  COND  SAVE                       F  C1 BRT

①MEAS SELECTION    MEAS-BIN-AREA
                                      ┌─────────────────┐
                                      │ NO              │
                                      │ POSI-DEVIATION  │
                                      │ CHK-DEG-MATCH   │
                                      │ INSPECT-LEAD    │
                                      │ MEAS-BIN-AREA   │
                                      │ CNT-BIN-OBJ     │
                                      │ LABEL-BIN-OBJ   │
                                      │ POINT-MEAS      │
                                      │ MULTI-POSI      │
                                      │ MULTI MATCHES   │
                                      └─────────────────┘





SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Press the ESC key to return to the OBJECT TYPE COND (menu tree) screen, and select the "MEAS CND" item shown under "MEAS01(MEAS-BIN-AREA)" to go to the MEA-CND screen.
⇨ For details, see "Chapter 8: Setting Examples Using the Menu Tree" in the Introduction and Hardware.

① **WINDOW**
Select a window type. On the popup menu, move the cursor any of "NUM-OF-MASK1,2,4," "BINARY-IMG-MASK," or "POLYGON," and press the SET key to select the item.

```
MEA-CND        SCREEN  COND  SAVE              F  C1 BRT

①WINDOW          NUM-OF-MASK 1  ──→   NUM-OF-MASK 1
②REGISTER NO.     00(0～15)            NUM-OF-MASK 2
③REGISTER EXIST   NO                  NUM-OF-MASK 4
                                      BINARY-IMG-MASK
                                      POLYON

REGISTER NO.     00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
④BIN AREA COND   ○ × × × × × × × × × × × × × × ×




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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NUM-OF-MASK 1	Bring one mask area inside the measuring area.
NUM-OF-MASK 2	Bring two mask areas inside the measuring area.
NUM-OF-MASK 4	Bring four mask areas inside the measuring area.
BINARY-IMG-MASK	Select this item if the captured image is other than a rectangle, circle, or ellipse. This function masks the captured image using a stored binary image. ⇨ For details, see pages 3-25 to 29.
POLYGON	You can manually create any freeform polygon for the measurement area.

② **REGISTER NO.**
Select register number to measure. Number of selectable registers varies with window shape selected.

NUM-OF-MASK 1	0 to 15
NUM-OF-MASK 2	0 to 7
NUM-OF-MASK 4	0 to 4
BIMARY-IMG-MASK	0 only
POLYGON	0 only

To save the measurement conditions using a different register number, press the SET key and highlight the number. Change this number by pressing the up and down arrow keys.

③ **REGISTER EXIST**
Select whether to register or not.

REGISTER NO. (④BIN AREA COND)
Register setting conditions are shown for each register number. Circles mean that "REGISTER EXIST" has set to "YES."

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

```
 REGISTER NO.     00 01 02 03
 ④BIN AREA COND   ○ × ×          ----- When item "③REGISTER EXIST" is
                  × : No setting        set to "YES," a circle is displayed.
```
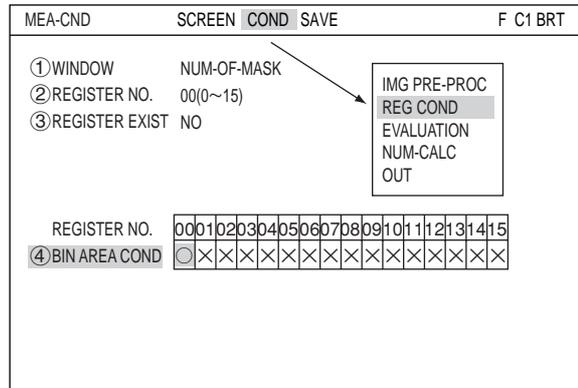
■ How to set the register conditions

● **How to enter the REG-COND setting screen**
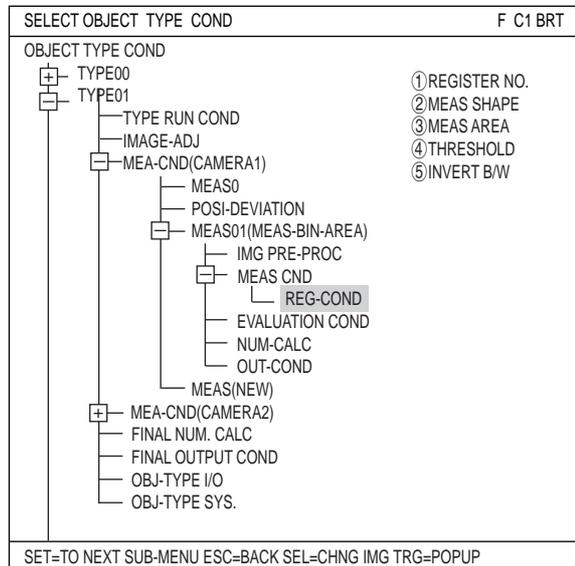There are three methods for getting to the REG-COND setting screen.

1) On the "MEA-CND" setting screen, move the cursor to the "④BIN AREA COND" and press the SET key. The cursor will move into the table. Move the cursor to the "○" column and press the SET key.
Note: If you press the SET key in the "X" column, the setting will be invalid.

```
MEA-CND          SCREEN COND SAVE                F C1 BRT

①WINDOW         NUM-OF-MASK
②REGISTER NO.   00(0~15)                    ┌────────────┐
③REGISTER EXIST NO                          │IMG PRE-PROC│
                                            │REG COND    │
                                            │EVALUATION  │
                                            │NUM-CALC    │
                                            │OUT         │
                                            └────────────┘
    REGISTER NO.  00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
④BIN AREA COND    ○  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×
```

2) On the "MEA-CND" setting screen, press the TRG/BRT key to move the cursor to the upper function menu. Select the "COND" item and then select the "REG COND" item and press the SET key.

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3) On the menu tree, move the cursor to the "MEAS CND" item, and press the right arrow key. The sub menu which contains the "REG COND" item will appear. Move the cursor to this item and press the SET key.
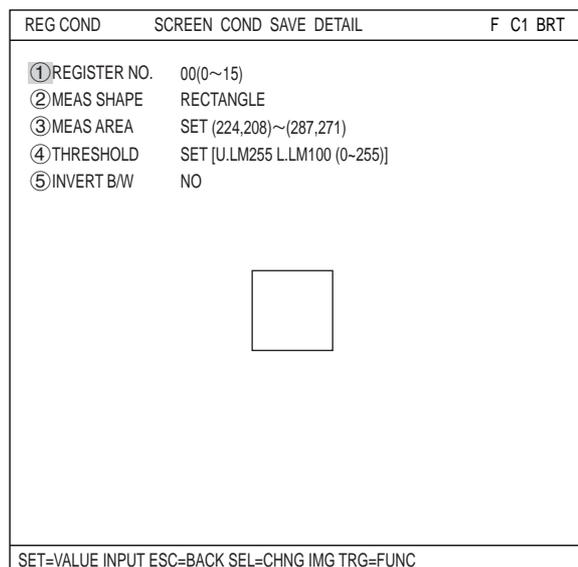
```
SELECT OBJECT TYPE COND                          F C1 BRT
OBJECT TYPE COND
 ┼─ TYPE00                              ①REGISTER NO.
 ┼─ TYPE01                              ②MEAS SHAPE
    │    ├── TYPE RUN COND              ③MEAS AREA
    │    ├── IMAGE-ADJ                  ④THRESHOLD
    │    ┼── MEA-CND(CAMERA1)           ⑤INVERT B/W
    │    │    ├── MEAS0
    │    │    ├── POSI-DEVIATION
    │    │    ┼── MEAS01(MEAS-BIN-AREA)
    │    │    │    ├── IMG PRE-PROC
    │    │    │    ┼── MEAS CND
    │    │    │    │    └── REG-COND
    │    │    │    ├── EVALUATION COND
    │    │    │    ├── NUM-CALC
    │    │    │    └── OUT-COND
    │    │    └── MEAS(NEW)
    │    ┼─ MEA-CND(CAMERA2)
    │    ├─ FINAL NUM. CALC
    │    ├─ FINAL OUTPUT COND
    │    ├─ OBJ-TYPE I/O
    │    └─ OBJ-TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

● **Set the register conditions**

① **REGISTER NO.**
The currently selected register number is displayed.
If you want to set the measurement conditions for a different register number, press the SET key to highlight the register number currently selected. Then press the up and down arrow keys to select the register number whose measurement conditions you want to set. Press the SET key to confirm your selection.
Note: When the "BINARY-IMG-MASK" or the "POLYGON" is selected at "①WINDOW" on the "MEA-CND" screen, the "①REGISTER NO." line will not be displayed and the other item numbers are decrement by one since the register number for "BINARY-IMG-MASK" and "POLYGON" is fixed.

```
REG COND       SCREEN COND SAVE DETAIL           F C1 BRT

①REGISTER NO.   00(0~15)
②MEAS SHAPE     RECTANGLE
③MEAS AREA      SET (224,208)~(287,271)
④THRESHOLD      SET [U.LM255 L.LM100 (0~255)]
⑤INVERT B/W     NO



                      ┌──────┐
                      │      │
                      │      │
                      └──────┘




SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

② **MEAS SHAPE**
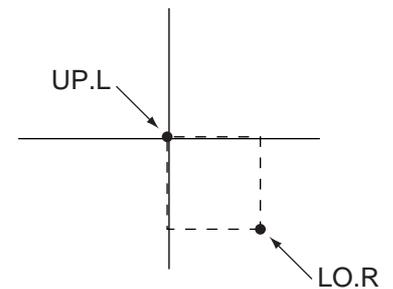Specify shape of measuring range.

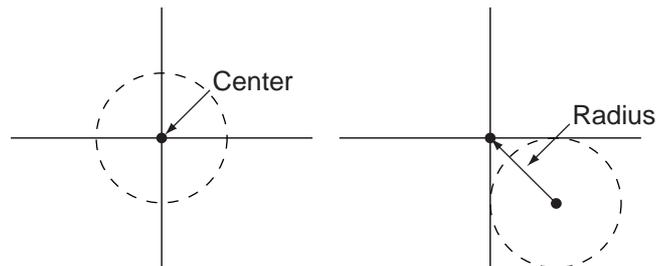|	
RECTANGLE	Specify the coordinates for the upper left and lower right corners. The measurement area will be the area enclosed by this rectangle.
CIRCLE	Specify the center and the radius. The measurement area will be the area enclosed by this circle.
ELLIPSE	Specify the center and the radius. The measurement area will be the area enclosed by this ellipse.

③ **MEAS AREA**
Specify a search area.

● **When "RECTANGLE" is selected**
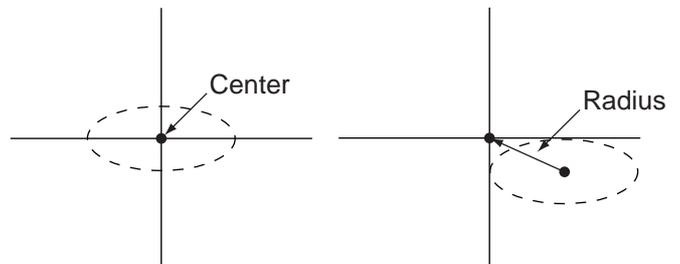Specify the upper left and lower right corners of the rectangular search area.

UP.L

LO.R

● **When "CIRCLE" is selected**
Specify the center and the radius.

Center

Radius

● **When "ELLIPSE" is selected**
Specify the center and the radius.

Center

Radius

④ **THRESHOLD**
Specify a threshold value.
Move the cursor to "①U.LM" and press the SET key. Then move the cursor to "②L.LM" and press the SET key again. The current value will be highlighted for each item. You can increase or decrease the value by pressing the up and down arrow keys. Press the ESC key to confirm the value you want.

The values above can be reset to an appropriate level automatically. Move the cursor to the upper function menu by pressing the TRG/BRT key and select "AUTO-REG". Then press the SET key to set the levels automatically.

⑤ **INVERT B/W**
Select whether to invert the display of black and white inside the measurement area.

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Setting the mask details

On the "REG COND" screen, move the cursor to the upper function menu by pressing the TRG/BRT key. Select "DETAIL" by pressing the left and right arrow keys and then press the SET key. On the popup menu, you can select "MASK REGIST.," "BINARY PROCESS," and "BINRY NOISE FILT." The items selected here will be displayed on the "MEA-CND" menu.

⑥ **MASK NO.**

Select a mask number.

Note: This line is displayed when "NO. OF MASK 2" or "NO. OF MASK 4" is selected at "①WINDOW" on the "MEA-CND" screen.

⑦ **MASK SHAPE**

Select mask shape.

- Select "NO," "RECTANGLE," "CIRCLE," or "ELLIPSE."
- When "BINARY-IMG-MASK" is selected on the "①WINDOW" line, this line will not appear, since this is already selected on the "MASK BINARY IMG" screen.
- When "POLYGON" is selected on the "①WINDOW" line, specify the polygonal shape of the mask.

⑧ **BINARY PROCESS**

Select a binary processing method. Move the cursor to "FIXED," "THRES-ADJ (VAR-DIFF)" {adjustable threshold value (variation difference)}, or "THRES-ADJ (VAR-RATE)" {adjustable threshold (variation rate)}, and press the SET key to continue.
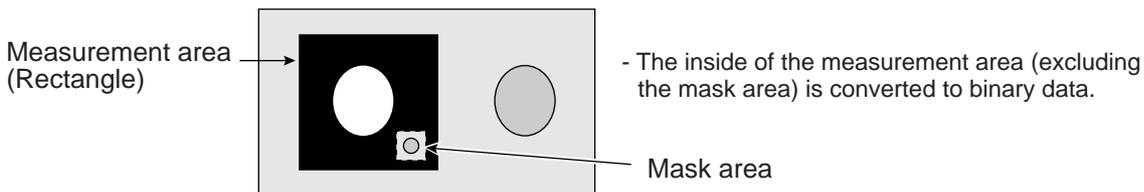⇨ For details, see page 3-12.

.

⑨ **BINARY NOISE FILTER**

Select a binary noise filter type. Move the cursor to "NO," "EXPD. → CONTR." (expansion → contraction), or "CONTR. → EXPD" (contraction → expansion), and press the SET key to continue.
⇨ For details, see page 3-13.

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

```
MEA-CND          SCREEN  COND  SAVE  DETAIL         F C1 BRT

①REGISTER NO.    0(0~7)
②MEAS SHAPE      RECTANGLE                    ☐MASK REGIST.
③MEAS AREA       SET (224,208)~(287,271)      ☐BINARY PROCESS
④THRESHOLD       SET [U.LM255 L.LM100(0~255)] ☐BINRY NOISE FILT
⑤INVERT B/W      NO
⑥MASK NO.        0(0~1)                    NO
⑦MASK SHAPE      NO                        RECTANGLE
                                           CIRCLE
⑧BIMARY PROCESS  FIXED                     ELLIPSE
⑨BIMARY NOISE FILT NO
                                           FIXED
                                           THRES-ADJ(VAR-DIFF)
                                           THRES-ADJ(VAR-RATE)

                                           NO
                                           EXPD.→CONTR.
                                           CONTR.→EXPD.

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

■ Setting example of measurement area and mask area

Measurement area (Rectangle)

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

Mask area

■ Set the evaluation conditions

● **How to move to the evaluation condition setting screen**
There are two methods for getting to the evaluation condition setting screen.

1) Select "COND" in the upper function menu on the MEAS COND (or REG COND) screen and press the SET key. Select "EVALUATION" on the pop up menu to go to the EVALUAT COND screen.

```
MEA-CND          SCREEN  COND  SAVE              F  C1  BRT

①WINDOW          BINARY-IMG-MASK        ┌─────────────┐
②REGISTER NO.    0                      │ IMG PRE-PROC │
③REGISTER EXIST  YES                    │ REG COND     │
④MASK BINARY IMG REF-IMG                │ EVALUATION   │
⑤BIN IMG MASK    (TO NEXT SUB-MENU)     │ NUM-CALC     │
                                        │ OUT          │
                                        └─────────────┘
  REGISTER NO.    00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑥BIN AREA COND   ○

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

2) Move the cursor to the "EVALUATION COND" item on the menu tree screen and press the SET key.

```
SELECT OBJECT  TYPE  COND                        F  C1 BRT
OBJECT TYPE COND
  ⊞─ TYPE00                              ①CHNG REG
  ⊟─ TYPE01                              ②CONDITION SET
       ├──TYPE RUN COND                  ③REGISTER 00
       ├──IMAGE-ADJ                      ④REGISTER 01
       ⊟─MEA-CND(CAMERA1)               ⑤REGISTER 02
          ├── MEAS0                      ⑥REGISTER 03
          ├── POSI-DEVIATION             ⑦REGISTER 04
          ⊟─MEAS01(MEAS-BIN-AREA)       ⑧REGISTER 05
             ├── IMG PRE-PROC            ⑨REGISTER 06
             ⊟─ MEAS CND                ⑩REGISTER 07
                └─ REG-COND              ⑪TEST
             ├── EVALUATION COND
             ├── NUM-CALC
             └── OUT-COND
          └── MEAS(NEW)
  ⊞─ MEA-CND(CAMERA2)
       ├── FINAL NUM. CALC
       ├── FINAL OUTPUT COND
       ├── OBJ-TYPE I/O
       └── OBJ-TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

The "EVALUAT COND" (evaluation conditions) screen will appear.
⇨ For details about the evaluation conditions, see page 3-17.

```
EVALUAT COND  SCREEN  COND  SAVE  EDIT  SEL        F  C1 BRT

①CHNG REG                              [TEST RESULT]  [OUTPUT]
②CONDITION SET    AUTO(±10%)
③REGISTER 00      000000~245760  A00=            NO
④REGISTER 01      000000~245760
⑤REGISTER 02      000000~245760
⑥REGISTER 03      000000~245760
⑦REGISTER 04      000000~245760
⑧REGISTER 05      000000~245760
⑨REGISTER 06      000000~245760
⑩REGISTER 07      000000~245760
⑪TEST             EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)

SET=EXEC ESC=BACK SEL=CHNG IMG TRG=FUNC
```

● **Set the evaluation conditions**
The display details vary with the setting of each window.

• **When WINDOW has been set to "NUM-OF-MASK 1" and "NUM-OF-MASK 2"**

```
EVALUAT COND   SCREEN  COND  SAVE  EDIT  SEL          F  C1  BRT

①CHNG REG  - - - - - - - - - - -        [TEST RESULT]   [OUTPUT]
②CONDITION SET RESET  AUTO(+10%)
③REGISTER00        000000~245760    A00=000200    OK   NO
④REGISTER01        000000~245760    A01=000201    OK   NO
⑤REGISTER02        000000~245760    A02=000202    OK   NO
⑥REGISTER03        000000~245760    A03=000203    OK   NO
⑦REGISTER04        000000~245760    A04=000204    OK   NO
⑧REGISTER05        000000~245760    A05=000205    OK   NO
⑨REGISTER06        000000~245760    A06=000206    OK   NO
⑩REGISTER07        000000~245760    A07=000207    OK   NO
⑪TEST             EXEC(WITH-POSI.ADJ  WITHOUT-POSI.ADJ)
```

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-MASK 4"**

```
EVALUAT COND   SCREEN  COND  SAVE  EDIT  SEL          F  C1  BRT

①CHNG REG                         [TEST RESULT]   [OUTPUT]
②CONDITION SET RESET  AUTO(+10%)
③REGISTER00        000000~245760    A00=000200    OK   NO
④REGISTER01        000000~245760    A01=000201    OK   NO
⑤REGISTER02        000000~245760    A02=000202    OK   NO
⑥REGISTER03        000000~245760    A03=000203    OK   NO
⑦TEST             EXEC(WITH-POSI.ADJ  WITHOUT-POSI.ADJ)
```

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 or "POLYGON"**

```
EVALUAT COND   SCREEN  COND  SAVE  EDIT  SEL          F  C1  BRT

①CHNG REG                         [TEST RESULT]   [OUTPUT]
②CONDITION SET RESET  AUTO(+10%)
③REGISTER00        000000~245760    A00=000200    OK   NO


④TEST       EXEC(WITH-POSI.ADJ  WITHOUT-POSI.ADJ)
```

You can set the output destinations using the up and down keys.
(NO, Y0 to Y7, C000 to C127)
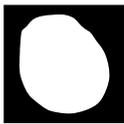
■ **Numeric calculation setting**
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to show the popup menu. Select "NUM-CALC" from the popup menu.
- Select "NUM-CALC" on the menu tree.
⇨ See "Chapter 14: Numerical calculation."

■ **Output condition setting**
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to display the popup menu. Select "OUT" from the popup menu.
- Select "OUT-COND" on the menu tree.
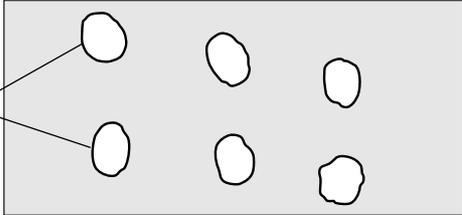⇨ See "Chapter 16: Setting the Input/Output Conditions."

■ **Display the measurement results**
Return to the operation screen and press the TRG/BRT key. The measurement results will be displayed on the screen.

Final evaluation result ──────→ OK

Measuring time ──────→ MEAS XXXXms

Measurement program number ──────→ MEASUREMENT 1 MEAS-BIN-AREA

Area for registration number 00 ──────→ A00=005253 OK
" 01 ──────→ A01=002674 OK
" 02 ──────→ A02=003200 OK
" 03 ──────→ A03=001884 OK
" 04 ──────→ A04=
" 05 * ──────→ A05=
" 06 ──────→ A06=
" 07 ──────→ A07=

in the measurement condition
(Number of pixels)

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

(TYPE00)   F C1 BRT
V*.**

X0~6□□□□□□ Y0~7□□□□□□ READY □
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE

7

7-9

Chapter 8: Object Counting by Binary Conversion

8-1 Outline

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 Objects **- Inspection sequence** Capture an image → Convert it to a binary image → Measure the number of objects/total area

8

8-2 Setting operation

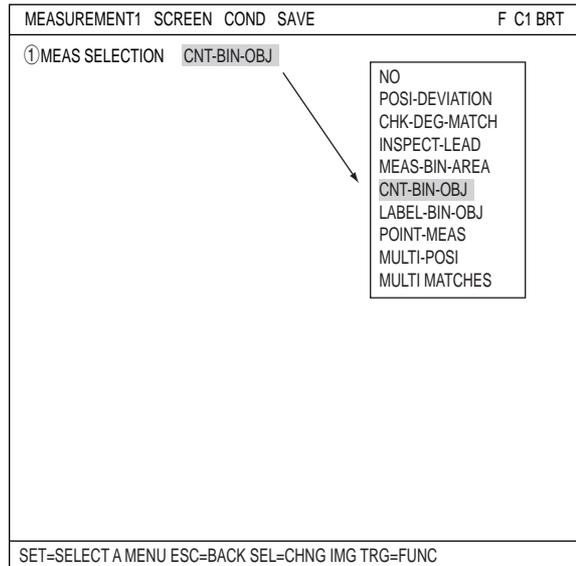### ■ Setting the measurement conditions

● How to enter the measurement conditions setting screen

Select "MAIN-COND" -> "OBJECT TYPE COND" (menu tree)-> "TYPE00" ->"MEA-CND (CAMERA1)" -> "MEAS(NEW)," in that order. Then press the SET key to bring up the "MEAS1" screen.

```
SELECT OBJECT TYPE COND                          F  C1 BRT

OBJECT TYPE COND
 ├─TYPE00                            ①MEAS SELECTION
 │   ├─ TYPE RUN COND
 │   ├─ IMAGE-ADJ
 │   ├─ MEA-CND(CAMERA1)
 │   │   ├─MEAS0
 │   │   ├─POSI-CORRECT
 │   │   └─MEAS(NEW)
 │   ├─ MEA-CND(CAMERA2)
 │   ├─ FINAL NUM. CALC
 │   ├─ FINAL OUTPUT COND
 │   ├─ OBJ-TYPE I/0
 │   └─ OBJ-TYPE SYS.
 └─ TYPE(NEW)




SET=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=POPUP
```
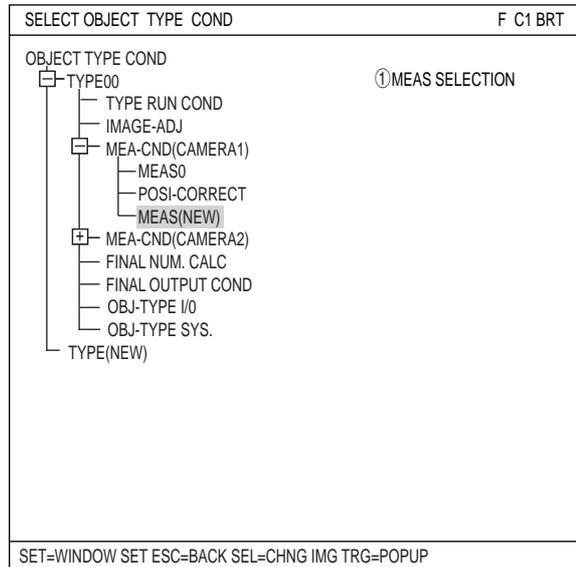
Move to the "①MEAS SELECTION" line on the "MEASUREMENT1" screen and select "CNT-BIN-OBJ" from the popup menu.

```
MEASUREMENT1  SCREEN  COND  SAVE                 F  C1 BRT

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






SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Press the ESC key to return to the OBJECT TYPE COND (menu tree) screen, and select the "MEAS CND" item shown under "MEAS01 (CNT-BIN-OBJ)" to go to the MEA-CND screen.
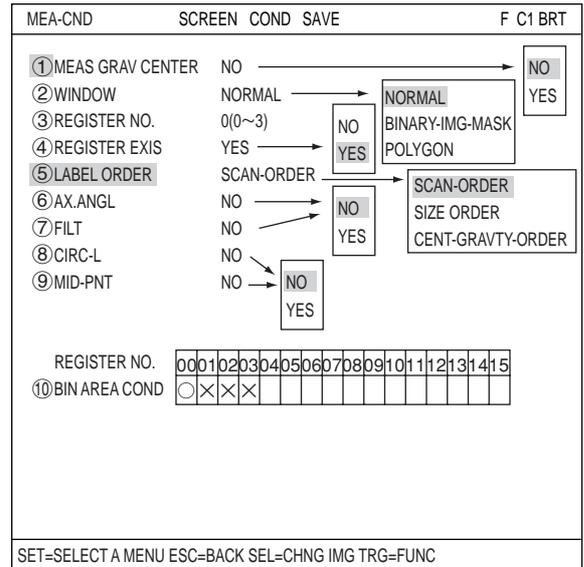⇨ For details, see "Chapter 8: Setting Examples Using the Menu Tree" in the Introduction and Hardware.

● **Setting the measurement conditions**

① **WINDOW**
Select a window type. On the popup menu, move the cursor to "NORMAL," "BINARY-IMG-MASK," or "POLYGON," and press the SET key to select the item.

NORMAL	Normal window
BINARY-IMG-MASK	Select this item if the captured image is other than a rectangle, circle, or ellipse. This function masks the captured image using a stored binary image. ⇨ For details, see pages 3-25 to 29.
POLYGON	You can manually create any freeform polygon for the measurement area.

```
MEA-CND         SCREEN  COND  SAVE              F  C1 BRT

① MEAS GRAV CENTER   NO ──────────────────────→  NO
② WINDOW             NORMAL ──────→  NORMAL        YES
③ REGISTER NO.       0(0~3)    NO   BINARY-IMG-MASK
④ REGISTER EXIS      YES ──→  YES   POLYGON
⑤ LABEL ORDER        SCAN-ORDER ──────→  SCAN-ORDER
⑥ AX.ANGL            NO ──→  NO      SIZE ORDER
⑦ FILT               NO          YES CENT-GRAVTY-ORDER
⑧ CIRC-L             NO
⑨ MID-PNT            NO ─→  NO
                            YES

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

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

8

② **REGISTER NO.**
Select register number to measure. Number of selectable registers varies with window shape selected.

NORMAL	0 to 3
BINARY-IMG-MASK	0 only
POLYGON	0 only

To save the measurement conditions using a different register number, press the SET key and highlight the number. Change this number by pressing the up and down arrow keys.

③ **REGISTER EXIST**
Select whether to register or not.

REGISTER NO. (④BIN AREA COND)
Register setting conditions are shown for each register number. Circles mean that "REGISTER EXIST" has set to "YES."

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

```
REGISTER NO.    00 01 02 03
④ BIN AREA COND  ○ × ×       ----- When item "③REGISTER EXIST" is
             × : No setting       set to "YES," a circle is displayed.
```
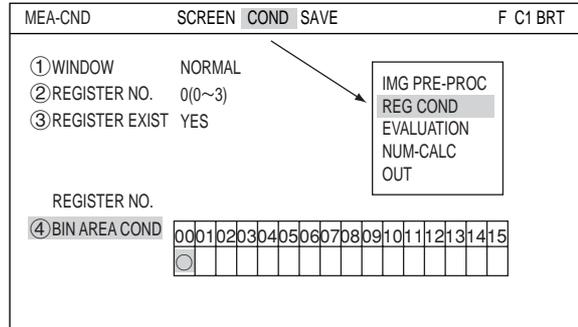
■ How to set the register conditions

● How to enter the REG-COND setting screen
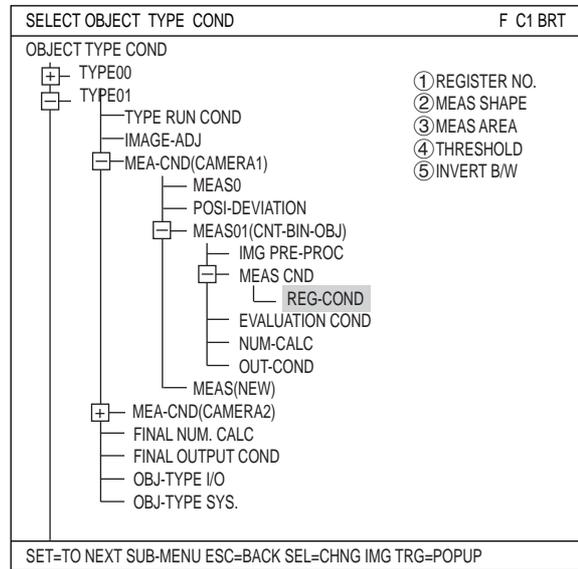There are three methods for getting to the REG-COND setting screen.

1) On the "MEA-CND" setting screen, move the cursor to the "④BIN AREA COND" and press the SET key. The cursor will move into the table. Move the cursor to the "○" column and press the SET key.
Note: If you press the SET key in the "X" column, the setting will be invalid.

```
MEA-CND          SCREEN COND SAVE           F C1 BRT

①WINDOW          NORMAL
②REGISTER NO.    0(0~3)                  ┌──────────────┐
③REGISTER EXIST  YES                     │ IMG PRE-PROC │
                                         │ REG COND     │
                                         │ EVALUATION   │
                                         │ NUM-CALC     │
    REGISTER NO.                         │ OUT          │
④BIN AREA COND   00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
                 ○
```

2) On the "MEA-CND" setting screen, press the TRG/BRT key to move the cursor to the upper function menu. Select the "COND" item and then select the "REG COND" item and press the SET key.

3) On the menu tree, move the cursor to the "MEAS CND" item, and press the right arrow key. The sub menu which contains the "REG COND" item will appear. Move the cursor to this item and press the SET key.

```
SELECT OBJECT TYPE COND                    F C1 BRT
OBJECT TYPE COND
  ⊞─ TYPE00                          ①REGISTER NO.
  ⊟─ TYPE01                          ②MEAS SHAPE
      ─ TYPE RUN COND                ③MEAS AREA
      ─ IMAGE-ADJ                    ④THRESHOLD
    ⊟─ MEA-CND(CAMERA1)              ⑤INVERT B/W
        ─ MEAS0
        ─ POSI-DEVIATION
      ⊟─ MEAS01(CNT-BIN-OBJ)
          ─ IMG PRE-PROC
        ⊟─ MEAS CND
            └ REG-COND
          ─ EVALUATION COND
          ─ NUM-CALC
          ─ OUT-COND
        ─ MEAS(NEW)
  ⊞─ MEA-CND(CAMERA2)
    ─ FINAL NUM. CALC
    ─ FINAL OUTPUT COND
    ─ OBJ-TYPE I/O
    ─ OBJ-TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```
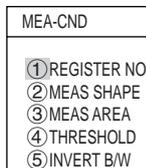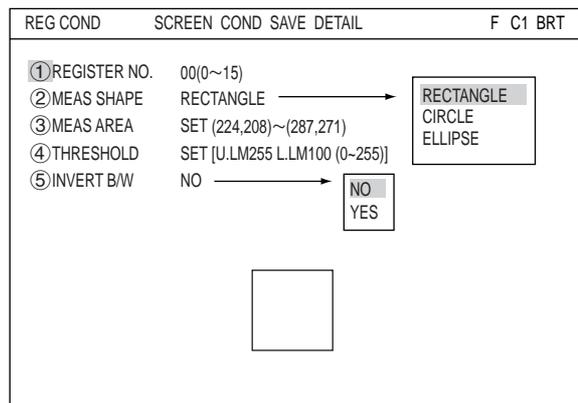
① REGISTER NO.
The currently selected register number is displayed.
If you want to set the measurement conditions for a different register number, press the SET key to highlight the register number currently selected. Then press the up and down arrow keys to select the register number whose measurement conditions you want to set. Press the SET key to confirm your selection.
Note: When the "BINARY-IMG-MASK" or the "POLYGON" is selected at "①WINDOW" on the "MEA-CND" screen, the "①REGISTER NO." line will not be displayed and the other item numbers are decrement by one since the register number for "BINARY-IMG-MASK" and "POLYGON" is fixed.

```
REG COND    SCREEN COND SAVE DETAIL       F C1 BRT

①REGISTER NO.  00(0~15)
②MEAS SHAPE    RECTANGLE ─────────→  ┌───────────┐
③MEAS AREA     SET (224,208)~(287,271) │ RECTANGLE │
④THRESHOLD     SET [U.LM255 L.LM100 (0~255)] │ CIRCLE    │
⑤INVERT B/W    NO ──────→ ┌────┐     │ ELLIPSE   │
                          │ NO │     └───────────┘
                          │ YES│
                          └────┘
                     ┌──────┐
                     │      │
                     │      │
                     └──────┘
```

```
MEA-CND
─────────
①REGISTER NO
②MEAS SHAPE
③MEAS AREA
④THRESHOLD
⑤INVERT B/W
```

② **MEAS SHAPE**
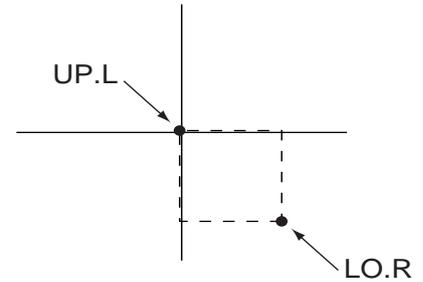Specify shape of measuring range.

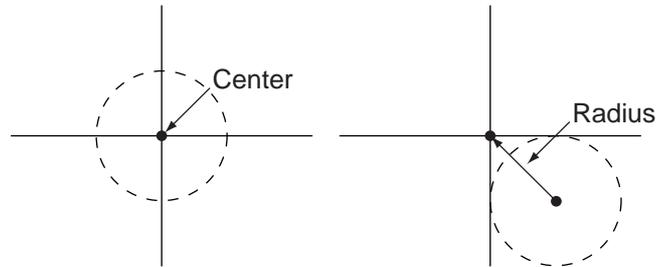|	
RECTANGLE	Specify the coordinates for the upper left and lower right corners. The measurement area will be the area enclosed by this rectangle.
CIRCLE	Specify the center and the radius. The measurement area will be the area enclosed by this circle.
ELLIPSE	Specify the center and the radius. The measurement area will be the area enclosed by this ellipse.

③ **MEAS AREA**
Specify a search area.

● **When "RECTANGLE" is selected**
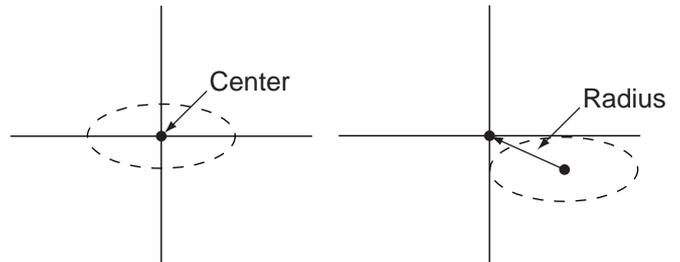Specify the upper left and lower right corners of the rectangular search area.

UP.L

LO.R

8

● **When "CIRCLE" is selected**
Specify the center and the radius.

Center

Radius

● **When "ELLIPSE" is selected**
Specify the center and the radius.

Center

Radius

④ **THRESHOLD**
Specify a threshold value.
Move the cursor to "①U.LM" and press the SET key. Then move the cursor to "②L.LM" and press the SET key again. The current value will be highlighted for each item. You can increase or decrease the value by pressing the up and down arrow keys. Press the ESC key to confirm the value you want.

The values above can be reset to an appropriate level automatically. Move the cursor to the upper function menu by pressing the TRG/BRT key and select "AUTO-REG." Then press the SET key to set the levels automatically.
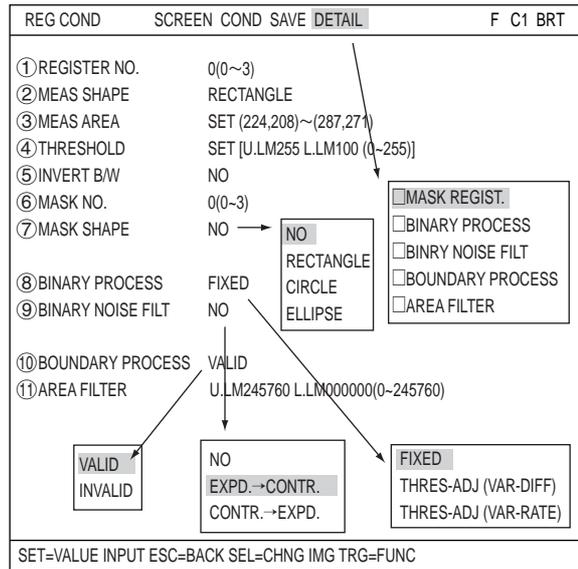⇨ For details, see page 3-15.

⑤ **INVERT B/W**
Select whether to invert the display of black and white inside the measurement area.

Setting the mask details
On the "REG COND" screen, move the cursor to the upper function menu by pressing the TRG/BRT key. Select "DETAIL" by pressing the left and right arrow keys and then press the SET key. On the popup menu, you can select "MASK REGIST.," "BINARY PROCESS," "BINRY NOISE FILT," "BOUNDARY PROCESS, " and "AREA FILTER." The items selected here will be displayed on the "REG COND" menu.

⑥ **MASK NO.**
Select a mask number.
Note: This is available when "NORMAL" is selected on the "①WINDOW" line.

8

⑦ **MASK SHAPE**
Select mask shape.
- Select "NO," "RECTANGLE," "CIRCLE," or "ELLIPSE."
- When "BINARY-IMG-MASK" is selected on the "①WINDOW" line, this line will not appear, since this is already selected on the "MASK BINARY IMG" screen.
- When "POLYGON" is selected on the "①WINDOW" line, specify the polygonal shape of the mask.

⑧ **BINARY PROCESS**
Select a binary processing method. Move the cursor to "FIXED," "THRES-ADJ (VAR-DIFF)" {adjustable threshold value (variation difference)}, or "THRES-ADJ (VAR-RATE)" {adjustable threshold (variation rate)}, and press the SET key to continue.
⇨ For details, see page 3-12.

⑨ **BINARY NOISE FILTER**
Select a binary noise filter type. Move the cursor to "NO," "EXPD. → CONTR." (expansion → contraction), or "CONTR. → EXPD" (contraction → expansion), and press the SET key to continue.
⇨ For details, see page 3-13.
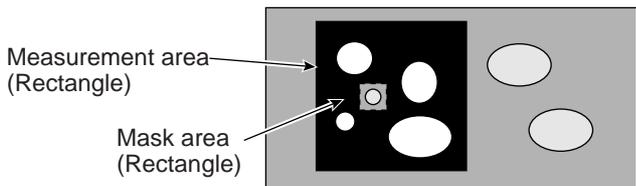
⑩ **BOUNDARY PROCESS**
Select whether objects crossing the boundary of the window will be "VALID" or "INVALID."
⇨ For details, see page 3-11.

⑪ **AREA FILTER**
This function is used to exclude an object from measurement if its area is outside of the upper or lower limits. Specify a number from 0 to 245760.

■ **Example of register measurement area and area mask**

Measurement area (Rectangle)

Mask area (Rectangle)

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

Screen panel (right side):

REG COND   SCREEN COND SAVE DETAIL   F C1 BRT

① REGISTER NO.   0(0~3)
② MEAS SHAPE   RECTANGLE
③ MEAS AREA   SET (224,208)~(287,271)
④ THRESHOLD   SET [U.LM255 L.LM100 (0~255)]
⑤ INVERT B/W   NO
⑥ MASK NO.   0(0~3)

☐ MASK REGIST.
☐ BINARY PROCESS
☐ BINRY NOISE FILT
☐ BOUNDARY PROCESS
☐ AREA FILTER

⑦ MASK SHAPE   NO → NO
                            RECTANGLE
                            CIRCLE
⑧ BINARY PROCESS   FIXED   ELLIPSE
⑨ BINARY NOISE FILT   NO

⑩ BOUNDARY PROCESS   VALID
⑪ AREA FILTER   U.LM245760 L.LM000000(0~245760)

VALID   NO   FIXED
INVALID   EXPD.→CONTR.   THRES-ADJ (VAR-DIFF)
             CONTR.→EXPD.   THRES-ADJ (VAR-RATE)

SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC

■ Set the evaluation conditions

● **How to move to the evaluation condition setting screen**
There are two methods for getting to the evaluation condition setting screen.

1) Select "COND" in the upper function menu on the MEA-CND (or REG COND) screen and press the SET key. Select "EVALUATION" on the pop up menu to go to the EVALUAT COND screen.

```
MEA-CND          SCREEN  COND  SAVE              F  C1 BRT

①WINDOW           BINARY-IMG-MASK        IMG PRE-PROC
②REGISTER NO.     0                      REG COND
③REGISTER EXIST   YES                    EVALUATION
④MASK BINARY IMG  REF-IMG                NUM-CALC
⑤BIN IMG MASK     (TO NEXT SUB-MENU)     OUT

   REGISTER NO.      00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑥BIN AREA COND      ○

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

2) Move the cursor to the "EVALUATION COND" item on the menu tree screen and press the SET key.

```
SELECT OBJECT  TYPE  COND                        F  C1 BRT

OBJECT TYPE COND
 ┼─ TYPE00                            ①REGISTER NO.
 ┼─ TYPE01                            ②CONDITION SET
       ── TYPE RUN COND               ③NUMBER OF OBJ
       ── IMAGE-ADJ                   ④TOTAL AREA
       ┼─ MEA-CND(CAMERA1)            ⑤TEST
             ── MEAS0
             ── POSI-DEVIATION
             ┼─ MEAS01(CNT-BIN-OBJ)
                   ── IMG PRE-PROC
                   ┼─ MEAS CND
                         └─ REG-COND
                      EVALUATION COND
                   ── NUM-CALC
                   ── OUT-COND
             ── MEAS(NEW)
 ┼─ MEA-CND(CAMERA2)
  ── FINAL NUM. CALC
  ── FINAL OUTPUT COND
  ── OBJ-TYPE I/O
  ── OBJ-TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

The "EVALUAT COND"(evaluation conditions) screen will appear.
➪ For details about the evaluation conditions, see page 3-17.

```
EVALUAT COND  SCREEN  COND  SAVE  EDIT  SEL      F  C1 BRT

①REGISTER NO.    0(0~3)          [TEST RESULT]  [OUTPUT]
②CONDITION SET   AUTO(±10%)
③NUMBER OF OBJ   0000~3000        K=            NO
④TOTAL AREA      000000~245760    A=            NO
⑤TEST            EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)

SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

8

■ Numeric calculation setting

- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to show the popup menu. Select "NUM-CALC" from the popup menu.
- Select "NUM-CALC" on the menu tree.
⇨ See "Chapter 14: Numerical calculation."

■ Output condition setting

- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to display the popup menu. Select "OUT" from the popup menu.
- Select "OUT-COND" on the menu tree.
⇨ See "Chapter 16: Setting the Input/Output Conditions."

■ Display the measurement results

Return to the operation screen and press the TRG/BRT key. The measurement results will be displayed on the screen.

8

Final evaluation result ⟶ OK

Measuring time ⟶ MEAS XXXXms

Measurement program ⟶ MEASUREMENT 1 CNT-BIN-OBJ

[K] of registration number 0 ⟶ K0=00006 OK
[A] " 0 ⟶ A0=015781 OK
[K] " 1 ⟶ K1=00020 OK
[A] " 1 ⟶ A1=087620 OK
[K] " 2 ⟶ K2=00010 OK
[A] " 2 ⟶ A2=042680 OK
[K] " 3 ⟶ K3=
[A] " 3 ⟶ A3=

in the measurement condition
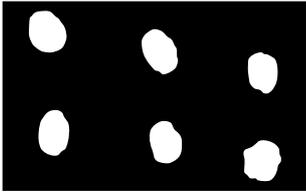[K]=NUMBER OF OBJECTS
[A]=TOTAL AREA
(Number of pixels)

- Areas will not be displayed for unspecified registration numbers.
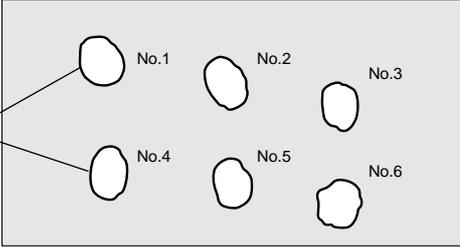
(TYPE00)   F C1 BRT
V*.**

X0~6 □□□□□□□   Y0~7 ■□□□□□□   READY □
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE

Chapter 9: Object Identification by Binary Conversion

9-1 Outline

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]** Objects No.1 No.2 No.3 No.4 No.5 No.6 **[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

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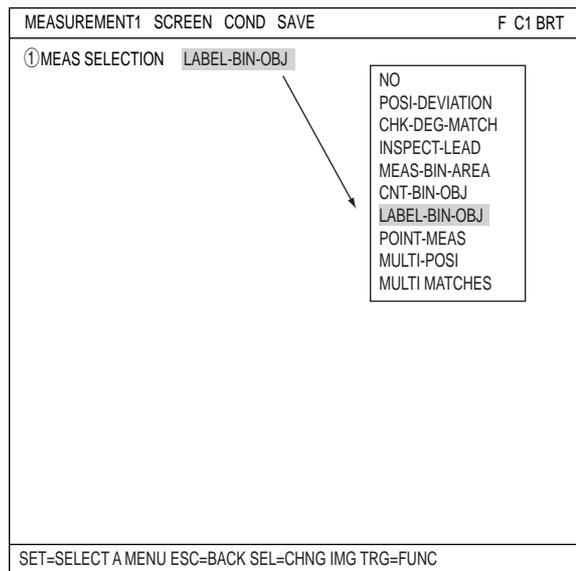## 9-2 Setting operation

■ Setting the measurement conditions

● How to enter the measurement conditions setting screen

Select "MAIN-COND" -> "OBJECT TYPE COND" (menu tree)-> "TYPE00" ->"MEA-CND (CAMERA1)" -> "MEAS(NEW)," in that order. Then press the SET key to bring up the "MEAS1" screen.

```
SELECT OBJECT  TYPE  COND                              F  C1 BRT

OBJECT TYPE COND
  ┌─TYPE00                              ①MEAS SELECTION
  │    ├─ TYPE RUN COND
  │    ├─ IMAGE-ADJ
  │    ├─ MEA-CND(CAMERA1)
  │    │    ├─MEAS0
  │    │    ├─POSI-CORRECT
  │    │    └─MEAS(NEW)
  │    ├─ MEA-CND(CAMERA2)
  │    ├─ FINAL NUM. CALC
  │    ├─ FINAL OUTPUT COND
  │    ├─ OBJ-TYPE I/0
  │    └─ OBJ-TYPE SYS.
  └─ TYPE(NEW)




SET=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=POPUP
```

9
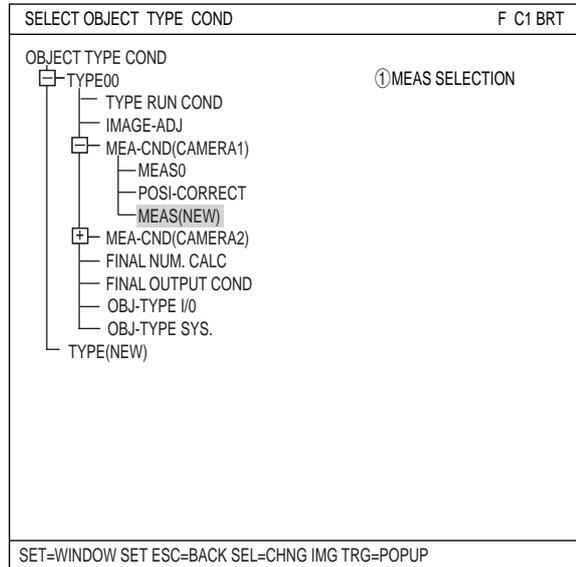
Move to the "①MEAS SELECTION" line on the "MEASUREMENT1" screen and select "LABEL-BIN-OBJ" from the popup menu.

```
MEASUREMENT1  SCREEN  COND  SAVE                       F  C1 BRT

①MEAS SELECTION    LABEL-BIN-OBJ
                                        ┌──────────────────┐
                                        │ NO               │
                                        │ POSI-DEVIATION   │
                                        │ CHK-DEG-MATCH    │
                                        │ INSPECT-LEAD     │
                                        │ MEAS-BIN-AREA    │
                                        │ CNT-BIN-OBJ      │
                                        │ LABEL-BIN-OBJ    │
                                        │ POINT-MEAS       │
                                        │ MULTI-POSI       │
                                        │ MULTI MATCHES    │
                                        └──────────────────┘




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```
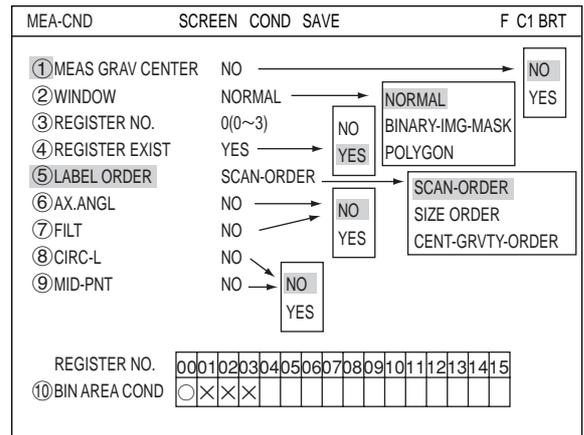
Press the ESC key to return to the OBJECT TYPE COND (menu tree) screen, and select the "MEAS CND" item shown under "MEAS01 (LABEL-BIN-OBJ)" to go to the "MEA-CND" screen.

⇨ For details, see "Chapter 8: Setting Examples Using the Menu Tree" in the Introduction and Hardware.

● **Setting the measurement conditions**

① **MEAS GRAV CENTR**
Select whether or not to measure the center of gravity.

```
MEA-CND        SCREEN  COND  SAVE              F C1 BRT

①MEAS GRAV CENTER   NO ─────────────────────→  NO
②WINDOW             NORMAL ───→  NORMAL           YES
③REGISTER NO.       0(0~3)   NO  BINARY-IMG-MASK
④REGISTER EXIST     YES ───→  YES  POLYGON
⑤LABEL ORDER        SCAN-ORDER ─────→  SCAN-ORDER
⑥AX.ANGL            NO ───→  NO          SIZE ORDER
⑦FILT               NO          YES     CENT-GRVTY-ORDER
⑧CIRC-L             NO
⑨MID-PNT            NO ─→  NO
                           YES

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

② **WINDOW**
Select a window type. On the popup menu, move the cursor to "NORMAL," "BINARY-IMG-MASK," or "POLYGON," and press the SET key to select the item.

NORMAL	Normal window
BINARY-IMG-MASK	Select this item if the captured image is other than a rectangle, circle, or ellipse. This function masks the captured image using a stored binary image. ⇨ For details, see pages 3-25 to 29.
POLYGON	You can manually create any freeform polygon for the measurement area.

③ **REGISTER NO.**
Select register number to measure. Number of selectable registers varies with window shape selected.

NORMAL	0 to 3
BINARY-IMG-MASK	0 only
POLYGON	0 only

To save the measurement conditions using a different register number, press the SET key and highlight the number. Change this number by pressing the up and down arrow keys.

④ **REGISTER EXIST**
Select whether or not to register the measurement conditions. When "YES" is selected, items ⑤ to ⑨ will be displayed on the "MEA-CND" menu.

⑤ **LABEL ORDER**
Set the order for displaying the measured results. Select "SCAN-ORDER," "SIZE-ORDER," or "CENT-GRVTY-ORDER" and then press the SET key.

| SCAN-ORDER	Assigns label numbers in the order in which objects were scanned (from top to bottom) in the measurement range.
SIZE-ORDER	Assigns label numbers by the size of the objects found in the measurement range, from largest to smallest.
CENT-GRVTY-ORDER	Assigns label numbers by the of center gravity of the objects found in the measurement range, from heaviest to lightest.

9
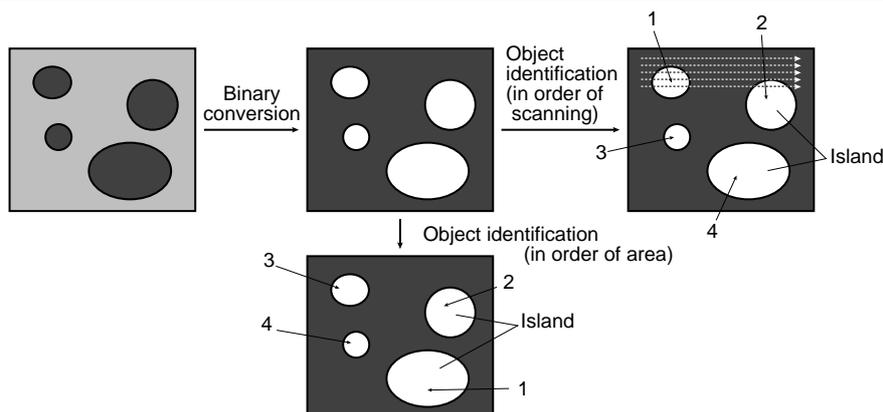
⑥ **AX.ANGL (axis angle)**
Select whether to measure the angle of the longitudinal line (drawn through the gravity center of the workpiece) to the horizontal.
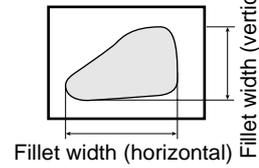
・Main axis angle

Gravity center

Main axis angle
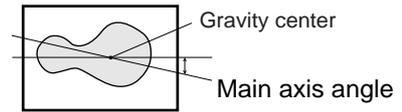
⑦ **FILT (fillet diameter)**
Select whether to measure the diameters of horizontal and vertical fillets on the workpiece.

・Fillet width

Fillet width (vertical)

Fillet width (horizontal)

⑧ **CIRC-L (peripheral length)**
Select whether to count the number of pixels in the perimeter of the workpiece.

・Peripheral
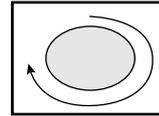
The number of pixels in the boundary line of an object
(stepped are counted as x $\sqrt{2}$ pixels)

⑨ **MID-PNT (middle point)**
Select whether to measure the center point of the workpiece.

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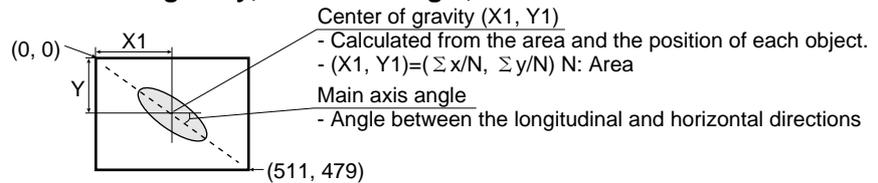
Center of gravity (X1, Y1)
- Calculated from the area and the position of each object.
- (X1, Y1)=(Σx/N, Σy/N) N: Area

(0, 0) X1

Y

Main axis angle
- Angle between the longitudinal and horizontal directions

(511, 479)
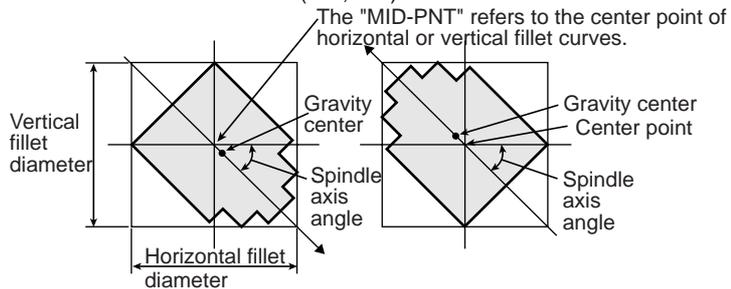
The "MID-PNT" refers to the center point of horizontal or vertical fillet curves.

Vertical fillet diameter

Gravity center

Spindle axis angle

Gravity center
Center point

Spindle axis angle

Horizontal fillet diameter

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

REGISTER NO. (⑩BIN AREA COND)
Register setting conditions are shown for each register number. Circles mean that "REGISTER EXIST" has set to "YES."

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

REGISTER NO.

00	01	02	03
○	×	×	

⑩BIN AREA COND
× : No setting

When item "④REGISTER EXIST" is set to "YES," a circle is displayed.

■ How to set the register conditions

● How to enter the REG-COND setting screen
There are three methods for getting to the REG-COND setting screen.

1) On the "MEA-CND" setting screen, move the cursor to the "⑩BIN AREA COND" and press the SET key. The cursor will move into the table. Move the cursor to the "○" column and press the SET key.
   Note: If you press the SET key in the "X" column, the setting will be invalid.

```
MEA-CND          SCREEN COND SAVE           F C1 BRT

①MEAS GRAV CENTER   NO          ┌─────────────┐
②WINDOW             NORMAL      │ IMG PRE-PROC │
③REGISTER NO.       0(0~3)      │ REG COND     │
④REGISTER EXIST     YES         │ EVALUATION   │
⑤LABEL ORDER        SCAN-ORDER  │ DST&ANGL     │
⑥AX.ANGL            NO          │ NUM-CALC     │
⑦FILT               NO          │ OUT          │
⑧CIRC-L             NO          └─────────────┘
⑨MID-PNT            NO

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

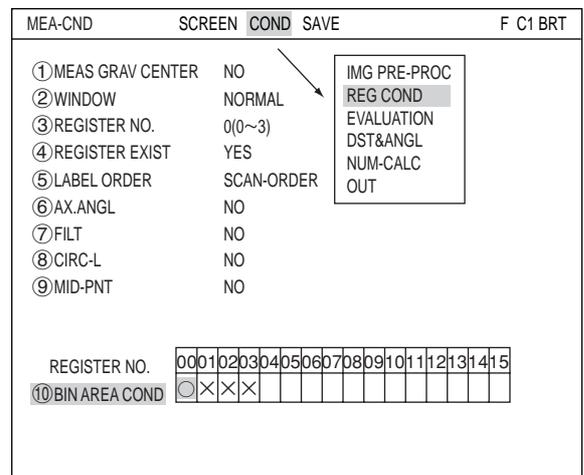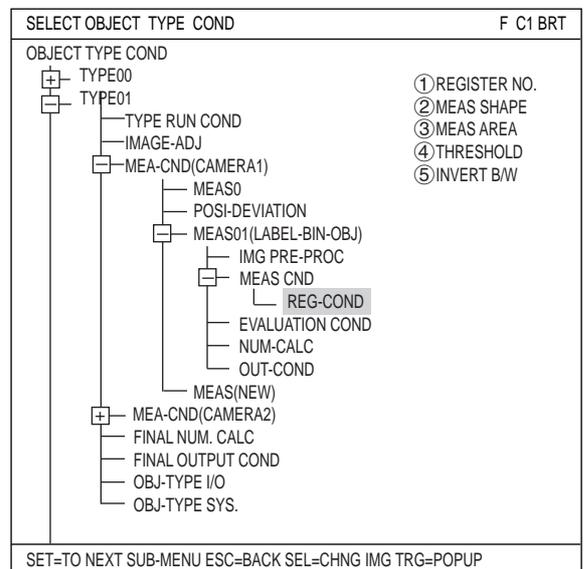2) On the "MEA-CND" setting screen, press the TRG/BRT key to move the cursor to the upper function menu. Select the "COND" item and then select the "REG COND" item and press the SET key.

3) On the menu tree, move the cursor to the "MEAS CND" item, and press the right arrow key. The sub menu which contains the "REG COND" item will appear. Move the cursor to this item and press the SET key.

```
SELECT OBJECT TYPE COND                F C1 BRT
OBJECT TYPE COND
 ⊞─ TYPE00                       ①REGISTER NO.
 ⊟─ TYPE01                       ②MEAS SHAPE
      ─ TYPE RUN COND            ③MEAS AREA
      ─ IMAGE-ADJ                ④THRESHOLD
     ⊟─ MEA-CND(CAMERA1)         ⑤INVERT B/W
         ─ MEAS0
         ─ POSI-DEVIATION
        ⊟─ MEAS01(LABEL-BIN-OBJ)
            ─ IMG PRE-PROC
           ⊟─ MEAS CND
              └─ REG-COND
            ─ EVALUATION COND
            ─ NUM-CALC
            └─ OUT-COND
         ─ MEAS(NEW)
 ⊞─ MEA-CND(CAMERA2)
  ─ FINAL NUM. CALC
  ─ FINAL OUTPUT COND
  ─ OBJ-TYPE I/O
  ─ OBJ-TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

9

① REGISTER NO.
The currently selected register number is displayed.
If you want to set the measurement conditions for a different register number, press the SET key to highlight the register number currently selected. Then press the up and down arrow keys to select the register number whose measurement conditions you want to set. Press the SET key to confirm your selection.
Note: When the "BINARY-IMG-MASK" or the "POLYGON" is selected at

```
REG COND      SCREEN COND SAVE DETAIL     F C1 BRT

①REGISTER NO.   00(0~15)
②MEAS SHAPE     RECTANGLE ──────→  ┌──────────┐
③MEAS AREA      SET (224,208)~(287,271) │ RECTANGLE │
④THRESHOLD      SET [U.LM255 L.LM100 (0~255)] │ CIRCLE │
⑤INVERT B/W     NO ──────→        │ ELLIPSE  │
                                  └──────────┘
                                  ┌────┐
                                  │ NO │
                                  │ YES│
                                  └────┘
```

"①WINDOW" on the "MEA-CND" screen, the "①REGISTER NO." line will not be displayed and the other item numbers are decrement by one since the register number for "BINARY-IMG-MASK" and "POLYGON" is fixed.

```
MEA-CND

①MEAS SHAPE
②MEAS AREA
③THRESHOLD
④INVERT B/W
```

② **MEAS SHAPE**
Specify shape of measuring range.

RECTANGLE	Specify the coordinates for the upper left and lower right corners. The measurement area will be the area enclosed by this rectangle.
CIRCLE	Specify the center and the radius. The measurement area will be the area enclosed by this circle.
ELLIPSE	Specify the center and the radius. The measurement area will be the area enclosed by this ellipse.

③ **MEAS AREA**
Specify a search area.

● **When "RECTANGLE" is selected**
Specify the upper left and lower right corners of the rectangular search area.

UP.L

LO.R

● **When "CIRCLE" is selected**
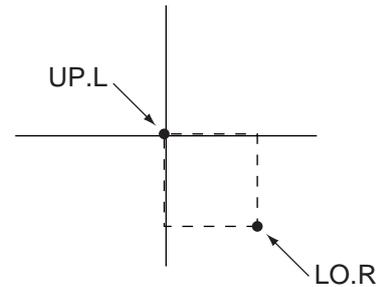Specify the center and the radius.

Center

Radius

● **When "ELLIPSE" is selected**
Specify the center and the radius.

Center

Radius

④ **THRESHOLD**
Specify a threshold value.
Move the cursor to "①U.LM" and press the SET key. Then move the cursor to "②L.LM" and press the SET key again. The current value will be highlighted for each item. You can increase or decrease the value by pressing the up and down arrow keys. Press the ESC key to confirm the value you want.

The values above can be reset to an appropriate level automatically. Move the cursor to the upper function menu by pressing the TRG/BRT key and select "AUTO-REG". Then press the SET key to set the levels automatically.

⑤ **INVERT B/W**
Select whether to invert the display of black and white inside the measurement area.

Setting the mask details
On the "REG COND" screen, move the cursor to the upper function menu by pressing the TRG/BRT key. Select "DETAIL" by pressing the left and right arrow keys and then press the SET key. On the popup menu, you can select "MASK REGIST.," "BINARY PROCESS," "BINRY NOISE FILT," "BOUNDARY PROCESS, " and "AREA FILTER." The items selected here will be displayed on the "REG COND" menu.

⑥ **MASK NO.**
Select a mask number.
Note: This is available when "NORMAL" is selected on the "①WINDOW" line.

⑦ **MASK SHAPE**
Select mask shape.
- Select "NO," "RECTANGLE," "CIRCLE," or "ELLIPSE."
- When "BINARY-IMG-MASK" is selected on the "①WINDOW" line, this line will not appear, since this is already selected on the "MASK BINARY IMG" screen.
- When "POLYGON" is selected on the "①WINDOW" line, specify the polygonal shape of the mask.

⑧ **BINARY PROCESS**
Select a binary processing method. Move the cursor to "FIXED," "THRES-ADJ (VAR-DIFF)" {adjustable threshold value (variation difference)}, or "THRES-ADJ (VAR-RATE)" {adjustable threshold (variation rate)}, and press the SET key to continue.
⇨ For details, see page 3-12.
.

⑨ **BINARY NOISE FILTER**
Select a binary noise filter type. Move the cursor to "NO," "EXPD. → CONTR." (expansion → contraction), or "CONTR. → EXPD" (contraction → expansion), and press the SET key to continue.
⇨ For details, see page 3-13.

⑩ **BOUNDARY PROCESS**
Select whether objects crossing the boundary of the window will be "VALID" or "INVALID."
⇨ For details, see page 3-11.

⑪ **AREA FILTER**
This function is used to exclude an object from measurement if its area is outside of the upper or lower limits. Specify a number from 0 to 245760.

■ Example of register measurement area and area mask

Measurement area
(Rectangle)

Mask area
(Rectangle)

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

9

■ Set the evaluation conditions

● **How to move to the evaluation condition setting screen**
There are two methods for getting to the evaluation condition setting screen.

1) Select "COND" in the upper function menu on the MEA-CND (or REG COND) screen and press the SET key. Select "EVALUATION" on the pop up menu to go to the EVALUAT COND screen.

```
MEA-CND          SCREEN COND SAVE              F C1 BRT

①MEAS GRAV CENTER    NO              ┌─────────────┐
②WINDOW              NORMAL          │ IMG PRE-PROC │
③REGISTER NO.        0(0~3)          │ REG COND     │
④REGISTER EXIST      NO              │ EVALUATION   │
⑤LABEL ORDER         SCAN-ORDER      │ DST&ANGL     │
⑥AX.ANGL             NO              │ NUM-CALC     │
⑦FILT                NO              │ OUT          │
⑧CIRC-L              NO              └─────────────┘
⑨MID-PNT             NO


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


SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

2) Move the cursor to the "EVALUATION COND" item on the menu tree screen and press the SET key.

```
SELECT OBJECT TYPE COND                        F C1 BRT
OBJECT TYPE COND
 ⊞  TYPE00                          ①REGISTER NO.
 ⊟  TYPE01                          ②CONDITION SET
        TYPE RUN COND               ③NUMBER OF OBJ
        IMAGE-ADJ                   ④TOTAL AREA
     ⊟ MEA-CND(CAMERA1)             ⑤TEST
          MEAS0
          POSI-DEVIATION
       ⊟ MEAS01(CNT-BIN-OBJ)
            IMG PRE-PROC
         ⊟ MEAS CND
              REG-COND
          EVALUATION COND
          NUM-CALC
          OUT-COND
        MEAS(NEW)
 ⊞ MEA-CND(CAMERA2)
      FINAL NUM. CALC
      FINAL OUTPUT COND
      OBJ-TYPE I/O
      OBJ-TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

The "EVALUAT COND"(evaluation conditions) screen will appear.
⇨ For details about the evaluation conditions, see page 3-19.

```
EVALUAT COND  SCREEN COND SAVE EDIT SEL        F C1 BRT

①REGISTER NO.      0(0~3)        [TEST RESULT]  [OUTPUT]
②CONDITION SET     AUTO(±10%)
③NUMBER OF OBJ     000~128        K=            NO
④TOTAL AREA        000000~245760  A=            NO
⑤LABEL NO.         000(0~000)
⑥OBJECT AREA       000000~245760  R=            NO
  MAIN AXIS ANGL                  B=
  FILLET WIDTH                    FX=
                                  FY=
  PERIPHERAL                      CR=
  MID POINT                       CX=
                                  CY=
⑦TEST              EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)






SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

9

■ **Numeric calculation setting**
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to show the popup menu. Select "NUM-CALC" from the popup menu.
- Select "NUM-CALC" on the menu tree.
⇨ See "Chapter 14: Numerical calculation."

■ **Output condition setting**
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to display the popup menu. Select "OUT" from the popup menu.
- Select "OUT-COND" on the menu tree.
⇨ See "Chapter 16: Setting the Input/Output Conditions."

■ **Display the measurement results**
Return to the operation screen and press the TRG/BRT key. The measurement results will be displayed on the screen.

Label	Value
Final evaluation result	**OK**
Measuring time	MEAS XXXXms
Measurement program	MEASUREMENT 1 LABEL-BIN-OBJ
Registration number in the measurement condition	REGISTER NO.0(0~3)
NUMBER OF OBJECTS	K=004 OK
TOTAL AREA	A=006168 OK
LABEL NUMBER	LABEL NUMBER 000(000~003)
OBJECT AREA	R=001542 OK
CENTER OF GRAVITY	GX=206.0 OK / GY=303.0
COORDINATE	B=+028.0˚
MAIN AXIS ANGLE	FX=042 / FY=037
FILLET DIA	CR=00138.8
PERIPHERAL	CX= / CY=

(TYPE00)   F C1 BRT
V*.**

X0~6 □□□□□□□   Y0~7 ■□□□□□□   READY□
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE

- 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).

9

Chapter 10: Existence Inspection by Point Measurement

10-1 Outline

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** Image capture → Binary image conversion → Black/white evaluation of points → Average light level → Light level evaluation of points
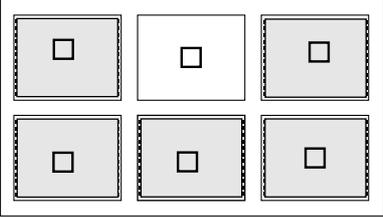
10

10-2 Setting operation

■ Setting the measurement conditions

● How to enter the measurement conditions setting screen

Select "MAIN-COND" -> "OBJECT TYPE COND" (menu tree)-> "TYPE00" ->"MEA-CND (CAMERA1)" -> "MEAS(NEW)," in that order. Then press the SET key to bring up the "MEAS1" screen.

```
SELECT OBJECT  TYPE  COND                          F  C1 BRT

OBJECT TYPE COND
  ├─ TYPE00                              ①MEAS SELECTION
  │    ├─ TYPE RUN COND
  │    ├─ IMAGE-ADJ
  │    ├─ MEA-CND(CAMERA1)
  │    │    ├─ MEAS0
  │    │    ├─ POSI-CORRECT
  │    │    └─ MEAS(NEW)
  │    ├─ MEA-CND(CAMERA2)
  │    ├─ FINAL NUM. CALC
  │    ├─ FINAL OUTPUT COND
  │    ├─ OBJ-TYPE I/0
  │    └─ OBJ-TYPE SYS.
  └─ TYPE(NEW)




SET=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=POPUP
```
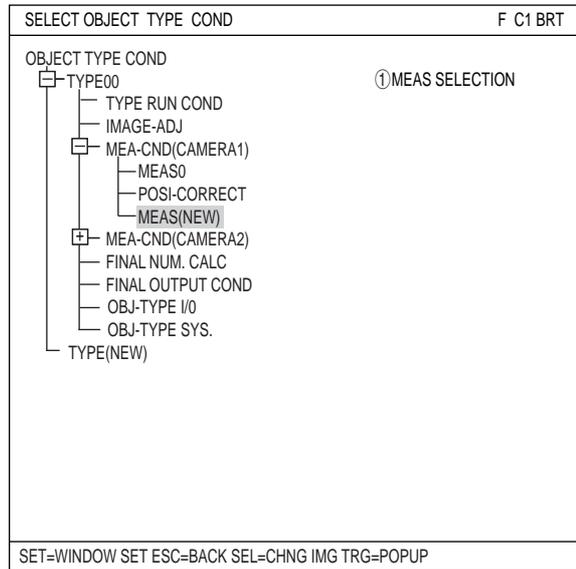
Move to the "①MEAS SELECTION" line on the "MEASUREMENT1" screen and select "POINT-MEAS" from the popup menu.
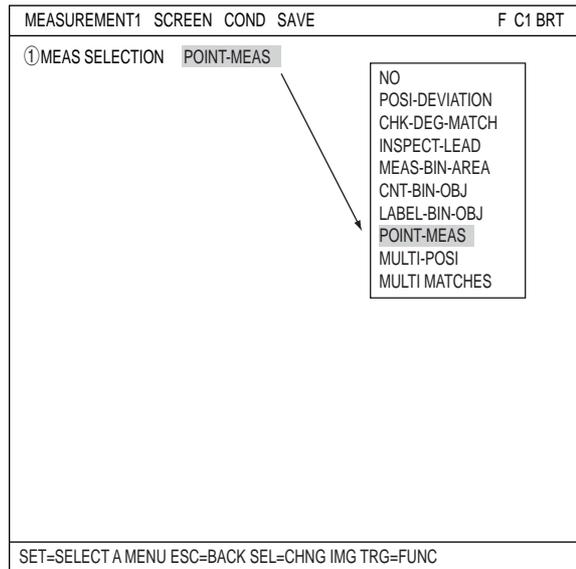
```
MEASUREMENT1  SCREEN  COND  SAVE                    F  C1 BRT

①MEAS SELECTION    POINT-MEAS
                                     ┌────────────────┐
                                     │ NO             │
                                     │ POSI-DEVIATION │
                                     │ CHK-DEG-MATCH  │
                                     │ INSPECT-LEAD   │
                                     │ MEAS-BIN-AREA  │
                                     │ CNT-BIN-OBJ    │
                                     │ LABEL-BIN-OBJ  │
                                     │ POINT-MEAS     │
                                     │ MULTI-POSI     │
                                     │ MULTI MATCHES  │
                                     └────────────────┘




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Press the ESC key to return to the "OBJECT TYPE COND" (menu tree) screen, and select the "MEAS CND" item shown under "MEAS01 (POINT-MEAS)" to go to the "MEA-CND" screen.
⇨ For details, see "Chapter 8: Setting Examples Using the Menu Tree" in the Introduction and Hardware.

10

● **Setting conditions (mode selection)**

Select a mode on the "①MODE" line. By selecting either "BINARY" or "AVG-GRAYS," the details of the settings will vary.

When the "BINARY" mode is selected

② **BINARY PROCESS**
Select a binary processing procedure. Select "FIXED," "THRES-ADJ(VAR-DIFF)," or "THRES-ADJ(VAR-RATE)."

```
MEA-CND        SCREEN  COND  SAVE            F  C1  DRK

①MODE              BINARY ──────────→   ┌─────────────┐
②BINARY PROCESS    FIXED ──────┐        │ BINARY      │
③THRESHOLD         SET [U.LM255 L.LM100(0~255)]  AVG-GRAYS
                                        │ FIXED       │
④CHNG-REG          CHNG-REG             │ THRES-ADJ(VAR-DIFF)
   REGISTER NO.    000001002003004005006007
⑤POINT COND        │×│×│×│×│×│×│×│×│     THRES-ADJ(VAR-RATE)
```

FIXED	Does not correct the threshold value.
THRES-ADJ(VAR-DIFF)	Effective in preventing binary processing failures since it applies adjustments according to changes in the lighting conditions for individual workpieces.
THRES-ADJ(VAR-RATE)	

⇨ For details, see page 3-12.

③ **THRESHOLD**
Specify a threshold value. Select this line and press the SET key to enter the "THRESHOLD" screen. Move the cursor to "①U.LM" and "②L.LM" each, then press the SET key. The current value will be highlighted for each item. You can increase or decrease the value by pressing the up and down arrow keys. Press the ESC key to confirm the value you want.
⇨ For details, see page 3-10.

AUTO SETTING
The values above can be reset to an appropriate level automatically. Move the cursor to the upper function menu by pressing the TRG/BRT key and select "AUTO-REG". Then press the SET key to set the levels automatically.

When the "AVG-GRAYS" mode is selected

② **AVG. GRAY PROC**
Select an average gray processing method. Select "FIXED," "GRAY-ADJ (VAR-DIFF)," or "GRAY-ADJ(VAR-RATE)."

```
MEA-CND        SCREEN  COND  SAVE            F  C1  DRK

①MODE              AVG-GRAYS
②AVG.GRAY PROC     FIXED ──────────→   ┌─────────────┐
                                        │ FIXED       │
                                        │ GRAY-ADJ(VAR-DIFF)
③CHNG-REG          CHNG-REG             │ GRAY-ADJ(VAR-RATE)
   REGISTER NO.    000001002003004005006007
④POINT COND        │×│×│×│×│×│×│×│×│
```
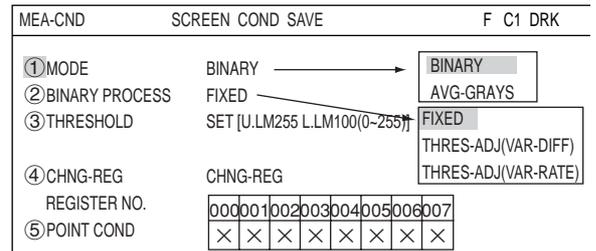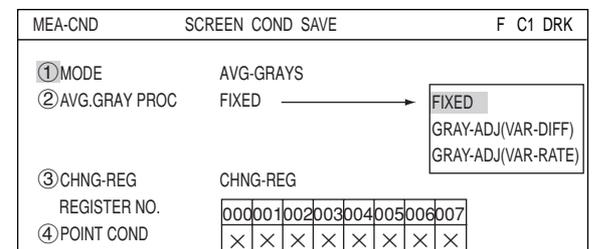
FIXED	Does not correct the gray level.
GRAY-ADJ(VAR-DIFF)	Corrects the gray level by adding a specified threshold value to the reference for variation in the light level. (Measured light level) - (reference light level) + (specified threshold value)
GRAY-ADJ(VAR-RATE)	Corrects the gray level by multiplying a specified threshold value times the reference for variation in the light level. (Measured light level) / (reference light level) x (specified threshold value)

③ **CHNG-REG**
Changes the display of the registration numbers for the "④POINT COND." Move the cursor to this line and press the SET key. "CHNG-REG" will be highlighted. Then, press the up and down arrow keys to change the register number series shown in the table as follows "000 to 007," "008 to 015," "016 to 023," ... up to "248 to 255".
- If the "BINARY" mode was selected, a maximum of 256 points (0 to 255) can be registered.
- If the "AVG-GRAYS" mode was selected, a maximum of 128 points (0 to 127) can be registered.

```
000001002003004005006007
│×│×│×│×│×│×│×│×│
        ↓
008009010011012013014015
│×│×│×│×│×│×│×│×│
        ↓
016017018019020021022023
│×│×│×│×│×│×│×│×│
```
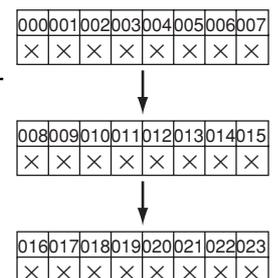
④ **POINT COND**
Points which have been registered are marked with an "O."
- After being registered on the point condition setting screen, an "O" will be displayed in the
  corresponding cells.
⇨ For details, see next page.

■ Setting the conditions (by selecting the point conditions)

● How to enter the REG COND setting screen
This paragraph describes the setting for each point condition.
There are three ways to bring up the "REG COND" screen.

1) On the "MEA-CND" setting screen, move the
   cursor to the "⑤POINT COND" and press
   the SET key. The cursor will move into the
   table. Move the cursor to the "X" column and
   press the SET key.
   Note: After being registered, the "X" mark in a
         corresponding cell is changed to "O."

2) On the "MEA-CND" setting screen, press the
   TRG/BRT key to move the cursor to the
   upper function menu. Select the "COND" item
   and then select the "REG COND" item and
   press the SET key.

```
MEA-CND          SCREEN COND SAVE              F  C1 DRK

①MODE            BINARY                 IMG PRE-PROC
②BINARY PROCESS  FIXED                  REG COND
③THRESHOLD       SET [U.LM255 L.LM100(0~255)]  EVALUATION
                                        NUM-CALC
④CHNG-REG        CHNG-REG               OUT
  REGISTER NO.   000 001 002 003 004 005 006 007
⑤POINT COND       X   X   X   X   X   X   X   X



SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

3) On the menu tree, move the cursor to the
   "MEAS CND" item, and press the right arrow
   key. The sub menu which contains the "REG
   COND" item will appear. Move the cursor to
   this item and press the SET key.

```
SELECT OBJECT TYPE COND                        F  C1 BRT
OBJECT TYPE COND
 +- TYPE00                              ①SIZE
    - TYPE RUN COND                     ②EVALUATION
    - IMAGE-ADJ                         ③EVAL-SPEC(RATIO %)
    - MEA-CND(CAMERA1)                  ④REGISTER NO.
       +- MEAS01(POINT-MEAS)
          - IMG PRE-PROC
          +- MEAS CND
             L- REG-COND
          - EVALUATION COND
          - NUM-CALC
          - OUT-COND
       - POSI-CORRECT
       - MEAS(NEW)
 +- MEA-CND(CAMERA2)
    - FINAL NUM. CALC
    - FINAL OUTPUT COND
    - OBJ-TYPE I/O
    - OBJ-TYPE SYS.



SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

10
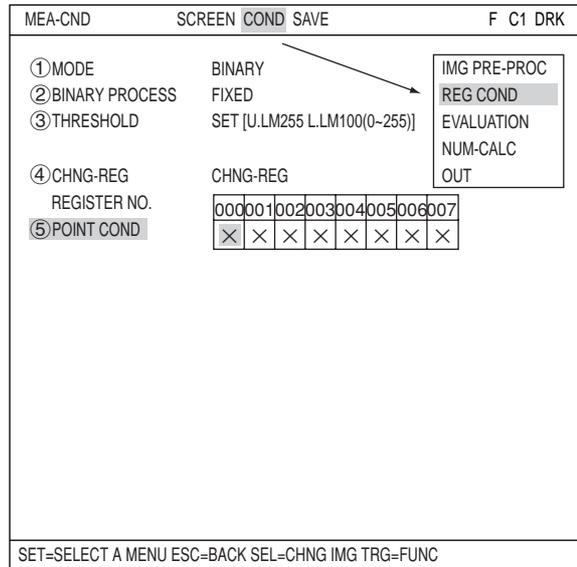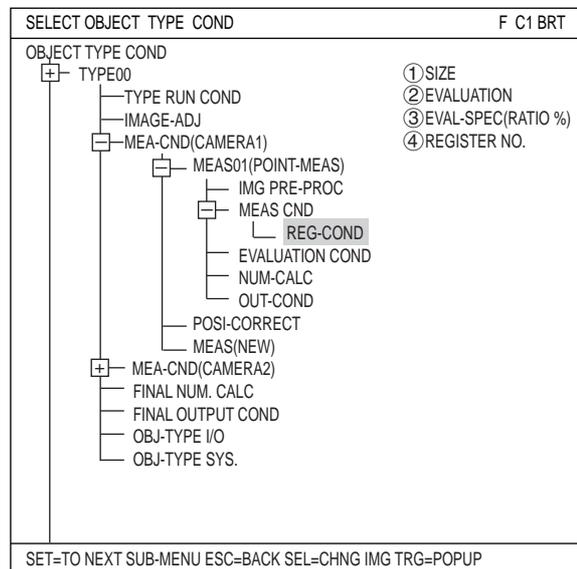
● **Setting the point measurement conditions**

① **SIZE**
Specify the point size. Highlight the numbers next to "X" and "Y" and increase or decrease the value using the up and down arrow keys. To confirm the new value, press the SET key twice. When the settings are complete, press the ESC key. The point size can be set between 2 and 32, in units of one pixel.

```
REG COND        SCREEN  COND  SAVE  DETAIL              F  C1  BRT

①SIZE                  Y08 ✕ X08(2~32)
②EVALUATION            MAJORITY    ────────▶    MAJORITY
③EVAL-SPEC(RATIO %)    050%                      AND
④REGISTER NO.          000(0~255)NO              OR
```
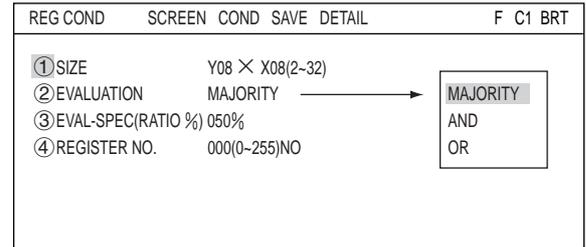
② **EVALUATION**
Set the evaluation condition. Select "MAJORITY," "AND," or "OR."
The details for the evaluation settings are as follows.

②EVALUATION	Description
MAJORITY	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.

③ **EVAL-SPEC**
Select the number and highlight it. Then increase or decrease the number using the up and down arrow keys. To confirm the new value, press the SET key twice. When the changes are complete, press the ESC key.

④ **REGISTER NO.**
When you want to change the number already registered, highlight the number and increase or decrease the number by pressing the up and down arrow keys. Next, move the cursor to the "NO" position and press the SET key. A popup menu will appear. Select "YES" on this popup menu to store this register number.

Specify the position of the point
After storing the register number using "④REGISTER NO.," a point will appear on the screen. Move the cursor on the "⑤UPPER LEFT" line and press the SET key. Then highlight the "MOVE" item and press the SET key. Now you can move the point anywhere on the screen using the up/down, left/right arrow keys.

```
REG COND        SCREEN  COND  SAVE  DETAIL              F  C1  BRT

①SIZE                  Y08 ✕ X08(2~32)
②EVALUATION            MAJORITY
③EVAL-SPEC(RATIO %)    050%
④REGISTER NO.          000(0~255)YES
⑤UPPER LEFT            MOVE(224.208)
```

10
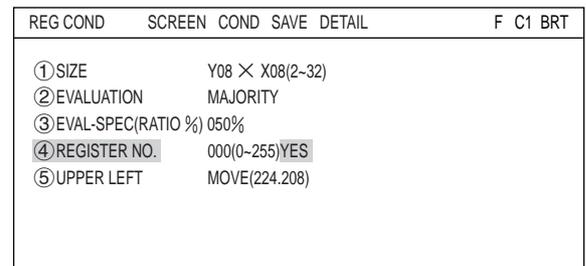
● **STORE BLOCK COND**

Press the TRG/BRT key to move the cursor to the upper function menu. Select "DETAIL" and press the SET key. Select "STORE BLCK OF PNTS" from the popup menu and press the SET key. Now, items ⑥ to ⑩ will be displayed on the "REG COND" menu.

This function is used to set a group of points at the same time, after specifying the number of points horizontally and vertically and their spacing.

④ **REGISTER NO.**

When "AND" or "OR" is selected on the "②EVALUATION" line, select "YES" at the ④REGISTER NO" item. Then, "⑤UPPER LEFT" will be displayed.

⑤ **UPPER LEFT**

Specify the coordinates of the upper left corner of the block you want to register.

⑥ **BLOCK ARRANGEMENT**

Enter the number of points along the X (horizontal) and Y (vertical) axes.

⑦ **BLOCK SPACING**

Specify the distance between the points in the horizontal and vertical rows.

```
REG COND      SCREEN  COND  SAVE  DETAIL          F  C1  BRT

①SIZE                    Y08 ✕ X08(2~32)
②EVALUATION              MAJORITY
③EVAL-SPEC(RATIO %)      050%              ┌──────────────────┐
④REGISTER NO.            000(0~255)YES     │ STORE BLCK OF PNTS│
⑤UPPER LEFT             MOVE(224.208)     └──────────────────┘
⑥BLOCK ARRANGEMENT       Y001 ✕ X001       ┌────┐
⑦BLOCK  SPACING          Y004 ✕ X004       │ NO │
⑧STORE BLCK OF PTS       EXEC              │ YES│
⑨DEL BLOCK OF PTS        EXEC              └────┘
⑩MOVE BLOCK OF PTS       MOVE(224.208)

SEL=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

⑧ **STORE BLCK OF PTS**

Select "EXEC" and press the SET key to register the block.

⑨ **DEL BLOCK OF PTS**

Delete all the points that were registered at the same time.

⑩ **MOVE BLOCK OF PTS**

Move the group of points that were registered at the same time.
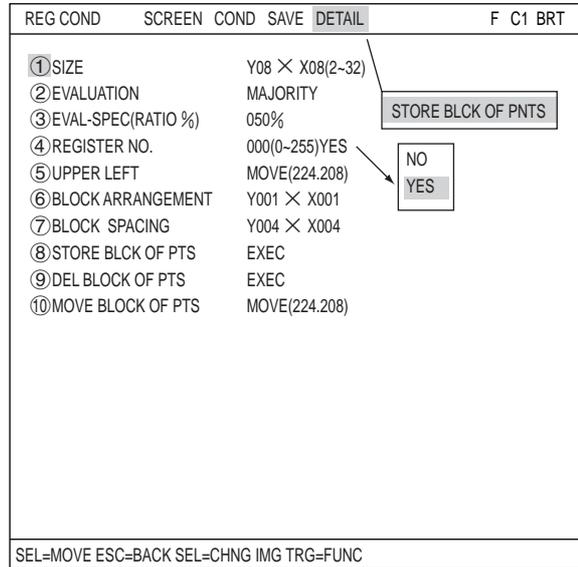
■ **Example of a block registration**

Set the starting point in item ⑤ above.
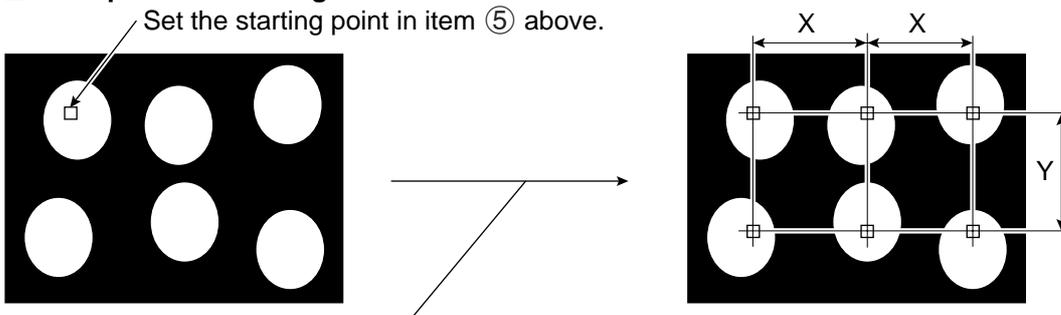
Enter 002 (vertical) · 003 (horizontal) in item "⑥BLOCK ARRANGEMENT," and enter the vertical (Y) and horizontal (X) intervals in item "⑦BLOCK SPACING." Then select item "⑧STORE BLOCK OF PTS" to store the settings for the block.

■ Set the evaluation conditions

● **How to move to the evaluation condition setting screen**
There are two methods for getting to the evaluation condition setting screen.

1) Select "COND" in the upper function menu on the MEA-CND (or REG COND) screen and press the SET key. Select "EVALUATION" on the pop up menu to go to the EVALUAT COND screen.

```
MEA-CND          SCREEN COND SAVE              F  C1  DRK

①MODE               BINARY                   IMG PRE-PROC
②BINARY PROCESS     FIXED                    RED COND
③THRESHOLD          SET [U.LM255 L.LM100(0~255)]  EVALUATION
                                             NUM-CALC
④CHNG-REG           CHNG-REG                 OUT
  REGISTER NO.      000001002003004005006007
⑤POINT COND          ×  ×  ×  ×  ×  ×  ×  ×
```
SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC

2) Move the cursor to the "EVALUATION COND" item on the menu tree screen and press the SET key.

```
SELECT OBJECT TYPE COND                        F  C1  BRT
OBJECT TYPE COND
 ├─ TYPE00                          ①PAGE CHNG
 ├─ TYPE01                          ②P001
 │   ├─ TYPE RUN COND               ③P002
 │   ├─ IMAGE-ADJ                   ④P003
 │   ├─ MEA-CND(CAMERA1)            ⑤P004
 │   │   ├─ MEAS0                   ⑥P005
 │   │   ├─ POSI-CORRECT            ⑦P006
 │   │   ├─ MEAS01(POINT-MEAS)      ⑧P007
 │   │   │   ├─ IMG PRE-PROC        ⑨P008
 │   │   │   ├─ MEAS CND            ⑩TEST
 │   │   │   │   └─ REG-COND
 │   │   │   ├─ EVALUATION COND
 │   │   │   ├─ NUM-CALC
 │   │   │   └─ OUT-COND
 │   │   └─ MEAS(NEW)
 ├─ MEA-CND(CAMERA2)
 ├─ FINAL NUM. CALC
 ├─ FINAL OUTPUT COND
 ├─ OBJ-TYPE I/O
 └─ OBJ-TYPE SYS.
```
SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP

10

The "EVALUAT COND"(evaluation conditions) screen will appear.
⇨ For details about the evaluation conditions, see page 3-17.

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.
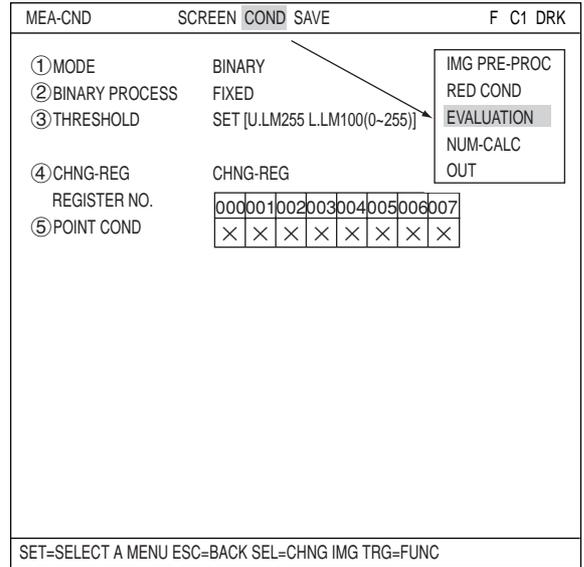
・ **When MODE has been set to "BINARY"**

EVALUAT COND SCREEN COND SAVE EDIT SEL			F C1 DRK
①PAGE CHNG	˙	[TEST RESULT]	[OUTPUT]
②P000	WHITE	OK	NO
③P001	WHITE	OK	NO
④P002	WHITE	OK	NO
⑤P003	WHITE	OK	NO
⑥P004	WHITE	OK	NO
⑦P005			
⑧P006			
⑨P007			
⑩TEST	EXEC (WITH-POSI.ADJ WITHOUT-POSI.ADJ)		

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**

EVALUAT COND SCREEN COND SAVE EDIT SEL			F C1 DRK
①PAGE CHNG		[TEST RESULT]	[OUTPUT]
②CONDITION SET	REST(+10%)		
③P000	200~210	200 OK	NO
④P001	200~210	200 OK	NO
⑤P002	200~210	200 OK	NO
⑥P003	200~210	200 OK	NO
⑦P004	200~210	200 OK	NO
⑧P005			
⑨P006			
⑩P007			
⑪TEST	EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)		

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

Average light level for each point

10

■ **Numeric calculation setting**
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using
the left and right arrow keys. Press the SET key to show the popup menu. Select "NUM-CALC" from
the popup menu.
- Select "NUM-CALC" on the menu tree.
⇨ See "Chapter 14: Numerical calculation."

■ **Output condition setting**
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using
the left and right arrow keys. Press the SET key to display the popup menu. Select "OUT" from the
popup menu.
- Select "OUT-COND" on the menu tree.
⇨ See "Chapter 16: Setting the Input/Output Conditions."

■ Display the measurement results

Return to the operation screen and press the TRG/BRT key. The measurement results will be displayed on the screen.

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

```
(TYPE00)                                    F  C1  DRK
                                                V*.**
Final evaluation result ──────────▶ OK
Measuring time ───────────────────▶ MEAS  XXXXms
Measurement program number ───────▶ MEASUREMENT 1  POINT-MEAS

Evaluation of the correct black or white
color detected at registration No.000 ──▶ P000=WHITE  OK
                              001 ──────▶ P001=WHITE  OK
                              002 ──────▶ P002=WHITE  OK
                              003 ──────▶ P003=WHITE  OK
                              004 ──────▶ P004=WHITE  OK
                              005 ──────▶ P005=
                              006 ──────▶ P006=
                              007 ──────▶ P007=

- Areas will not be displayed for
  unspecified registration numbers.

X0～6 □□□□□□□   Y0～7 □□□□□□□□   READY□
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```
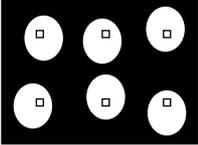
● **When MODE has been set to AVG-GRAYS**

```
(TYPE00)                                    F  C1  DRK
                                                V*.**
OK
MEAS  XXXXms
MEASUREMENT 1  POINT-MEAS

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

X0～6 □□□□□□□   Y0～7 □□□□□□□□   READY□
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```
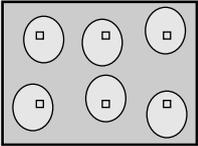
10

Chapter 11: Multiple Positional Measurements

11-1 Outline

Purpose	The IV-S30J 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 ⇨ Four workpieces detected **[Measurement results]** - Number of images detected - Coordinates and degree of match detected for each image ● **Edge detection** **[Measurement results]** - Number of images detected - Coordinates detected L1　L2　L3 This is useful for obtaining the distance between the coordinates of a position. - L1 to L3 can be calculated by measuring distances and angles.
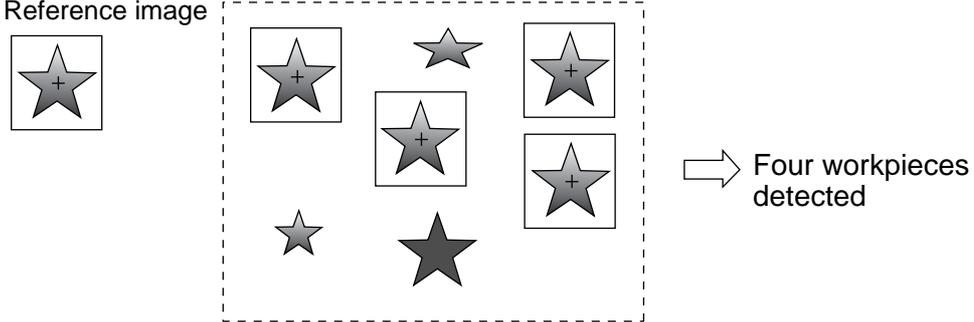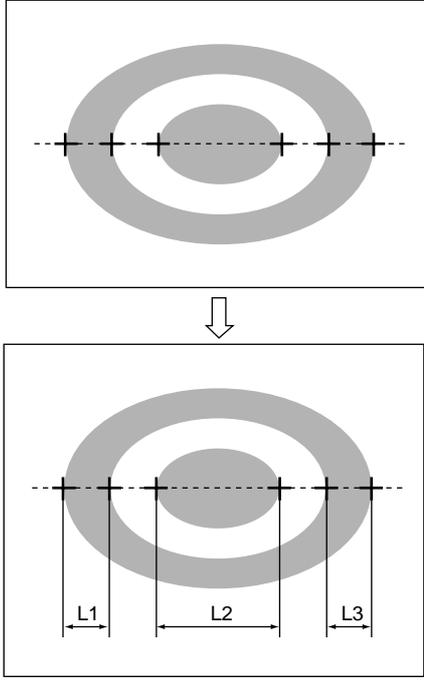
11

11-2 Setting operation

■ Setting the measurement conditions

● How to enter the measurement conditions setting screen

Select "MAIN-COND" -> "OBJECT TYPE COND" (menu tree)-> "TYPE00" ->"MEA-CND (CAMERA1)" -> "MEAS(NEW)," in that order. Then press the SET key to bring up the "MEAS1" screen.

```
SELECT OBJECT TYPE COND                           F  C1 BRT

OBJECT TYPE COND
   ┌─ TYPE00                          ①MEAS SELECTION
   │     ├── TYPE RUN COND
   │     ├── IMAGE-ADJ
   │     ├─ MEA-CND(CAMERA1)
   │     │     ├── MEAS0
   │     │     ├── POSI-CORRECT
   │     │     └── MEAS(NEW)
   │     ├─ MEA-CND(CAMERA2)
   │     ├── FINAL NUM. CALC
   │     ├── FINAL OUTPUT COND
   │     ├── OBJ-TYPE I/0
   │     └── OBJ-TYPE SYS.
   └─ TYPE(NEW)




SET=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=POPUP
```
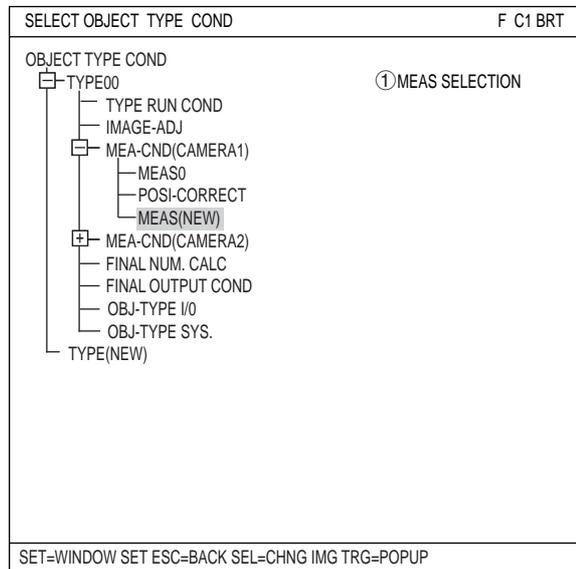
Move to the "①MEAS SELECTION" line on the "MEASUREMENT1" screen and select "MULTI-POSI" from the popup menu.
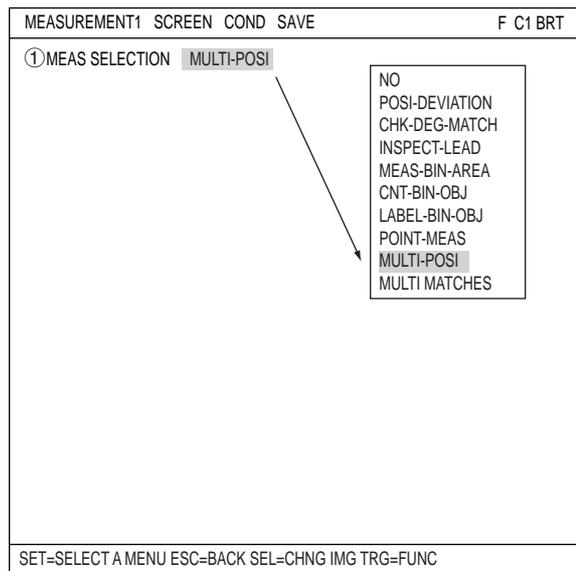
```
MEASUREMENT1  SCREEN  COND  SAVE              F  C1 BRT

①MEAS SELECTION   MULTI-POSI
                                  ┌──────────────────┐
                                  │ NO               │
                                  │ POSI-DEVIATION   │
                                  │ CHK-DEG-MATCH    │
                                  │ INSPECT-LEAD     │
                                  │ MEAS-BIN-AREA    │
                                  │ CNT-BIN-OBJ      │
                                  │ LABEL-BIN-OBJ    │
                                  │ POINT-MEAS       │
                                  │ MULTI-POSI       │
                                  │ MULTI MATCHES    │
                                  └──────────────────┘




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Press the ESC key to return to the "OBJECT TYPE COND" (menu tree) screen, and select the "MEAS CND" item shown under "MEAS01 (MULTI-POSI)" to go to the "MEAS CND" screen.
⇨ For details, see "Chapter 8: Setting Examples Using the Menu Tree" in the Introduction and Hardware.

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① **DTECT PRECISION**

Select detection precision. You can select one of two levels (standard/high), according to your conditions, the desired precision level for detection results, and the detection speed.
⇨ For details, see page 3-9.

② **REGISTER NO.**

4 registers are available for the multiple position measurement (Registers 0 to 3).
If you want to set the measurement conditions for a different register number, press the SET key to highlight the register number currently selected. Then press the up and down arrow keys to select the register number whose measurement conditions you want to set. Press the SET key to confirm your selection.

```
MEAS CND        SCREEN  COND  SAVE         F  C1 DRK

①DTECT PRECISION   STANDARD  ──→   STANDARD
②REGISTER NO.      0(0~3)            HIGH
③MODE             GRAY-SRC
④DETECT ORDER     SCAN-ORDER

  REGISTER NO.    00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑤DTECT OBJECT     S  ✕  ✕  ✕
                                              NO
                            SCAN-ORDER        GRAY-SRC
                            MATCH LVL         EDGE DTECT

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

③ **MODE**

Select a mode.
The details of each mode are as follows.

NO	No measurement is made.
GRAY-SRC	Uses the gray search function to detect a shape in the captured images that matches the reference image.
EDGE DTECT	Uses the edge detection function to look for shapes in the captured images that have a value larger than the specified threshold value.

④ **DETECT ORDER (when GRAY-SRC is selected)**

When "GRAY-SRC" is selected on line "③MODE," select "SCAN-ORDER" or "MATCH LVL" on the "④DETECT ORDER" line.
SCAN-ORDER (in the order scanned): Searches in the order scanned.
MATCH LVL (degree of match):   Searches by comparing levels with the reference image.

11

REGISTER NO. (⑤DTECT OBJECT)

Shows the specified mode(s) for each register.
S: gray search E: edge detection ✕: means no setting

00	01	02	03
S	E	S	✕

■ How to set the register conditions

- **How to enter the REG-COND setting screen**
  There are three methods for getting to the REG-COND setting screen.

  1) On the "MEAS CND" setting screen, move the cursor to "⑤DTECT OBJECT" and press the SET key. The cursor will move into the table. Move the cursor to the "S" or "E" column and press the SET key.
     Note: If you press the SET key in the "X" column, the setting will be invalid.

     About "S" ⇨ See pages 11-5 to 7.
     About "E" ⇨ See pages 11-7 to 9.

  2) On the "MEAS CND" setting screen, press the TRG/BRT key to move the cursor to the upper function menu. Select the "COND" item and then select the "REG-COND(S)" or "REG-COND(E)" item and press the SET key.

     About "REG-COND(S)"
     ⇨ See pages 11-5 to 7.

     About "REG-COND(E) "
     ⇨ See pages 11-7 to 9.

```
MEAS CND        SCREEN  COND  SAVE           F C1 DRK

①DTECT PRECISION   STANDARD
②REGISTER NO.      0(0~3)
③MODE              GRAY-SRC
④DETECT ORDER      SCAN-ORDER


  REGISTER NO.    00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑤DTECT OBJECT     S  E  S  X

                              IMG PRE-PROC
                              REG-COND(S)
                              REG-COND(E)
                              EVALUATION
                              DST&ANGL
                              NUM-CALC
                              OUT

SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

  3) On the menu tree, move the cursor to the "MEAS CND" item, and press the right arrow key. The sub menu which contains the "REG-COND(S)" and "REG-COND(E)" items will appear. Move the cursor to either of these items and press the SET key.

     About "REG-COND(S)"
     ⇨ See pages 11-5 to 7.

     About "REG-COND(E)"
     ⇨ See pages 11-7 to 9.

11

```
SELECT OBJECT TYPE COND                      F C1 DRK
OBJECT TYPE COND
├ TYPE00                         ①REGISTER NO.
│  ├ TYPE RUN COND
│  ├ IMAGE-ADJ
│  ├ MEA-CND(CAMERA1)
│  │  ├ MEAS0
│  │  ├ POSI-CORRECT
│  │  ├ MEAS01(MULTI-POSI)
│  │  │  ├ IMG PRE-PROC
│  │  │  ├ MEAS CND
│  │  │  │  ├ REG-COND(S)
│  │  │  │  └ REG-COND(E)
│  │  │  ├ EVALUATION COND
│  │  │  ├ DISTANCE&ANGLE COND
│  │  │  ├ NUM-CALC
│  │  │  └ OUT-COND
│  │  └ MEAS(NEW)
│  ├ MEA-CND(CAMERA2)
│  ├ FINAL NUM. CALC
│  ├ FINAL OUTPUT COND
│  ├ OBJ-TYPE I/O
│  └ OBJ TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```
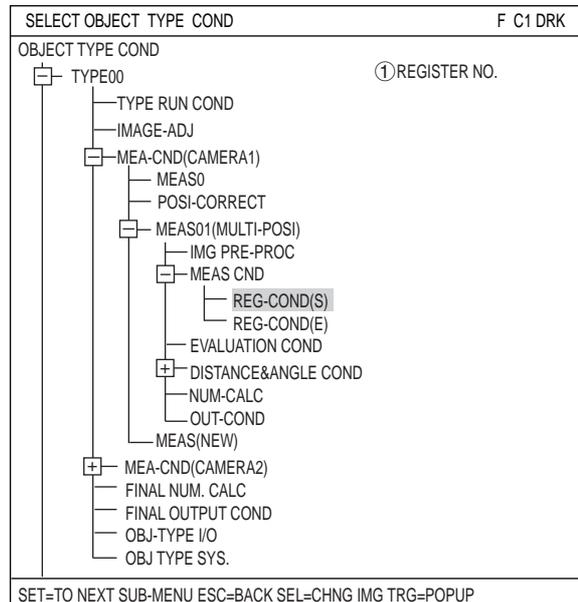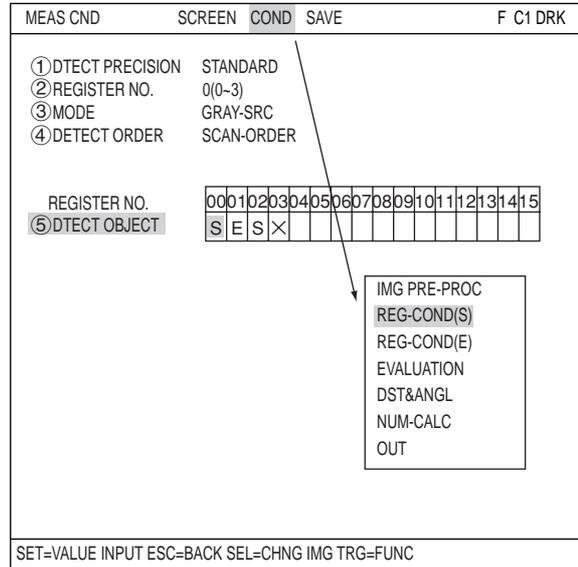
[1] Set the register conditions for a gray search

Set a reference image
Move the cursor to "②REF-IMG AREA" and press the SET key. When the SET item is highlighted, press the SET key again to bring up the setting screen.

```
REG COND      SCREEN COND  SAVE  DETAIL          F  C1 DRK

①REGISTER NO.        0(0~3)

②REF-IMG AREA        SET (224.208)~(287.271)
③SEARCH AREA         SET (216.200)~(295.279)

④MATCH LVL(CONTR)    +05000
⑤MATCH LVL           +07000
```

- Object to measure
- Search area
- Search direct

```
SEL=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Set the coordinates for "①UP.L" and "② LO.R." The rectangle inside the solid lines is the reference image.

```
RECTANGLE    RESET    RETURN                     F  C1 BRT

①UP.L          (224.208)
②LO.R          (287.271)
③MOVE
④REFERENCE IMG
```

```
                                                X:224 Y:208

SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Register a reference image
After setting the reference image area, store an image in the controller as a reference image. Select "④REFERENCE IMG" using the up/down arrow keys and select "REG" from the popup menu.

```
RECTANGLE    RESET    RETURN                     F  C1 BRT

MDL 0
①UP.L          (224.208)
②LO.R          (287.271)
③MOVE
④REFERENCE IMG  ──────→  CONTRAST SRCH
                         REG
                         DISP
```

```
                                                    X:224

SET=DECISION ESC=BACK SEL=CHNG IMG TRG=FUNC
```

11-5

Select a reference image
Move the cursor to the function menu on the "REG COND" screen by pressing the TRG/BRT key. Move the cursor to "DETAIL." Press the SET key on the "REFERENCE IMG" line in the popup menu. The white square on the left will change to a black square. Then, the "②REFERENCE IMG" item will appear on the screen.
You can use the same procedures to show "DETECT CRD" (detection coordinates) and "CONTR.PIXL" (contraction pixels) on the screen.
On the "②REFERENCE IMG" line, select a reference image from the reference images already registered.
Ex : 015 (000 to 026)
     Select reference image No. 15 from the 26 registered reference images (000 to 026).

```
REG COND      SCREEN  COND  SAVE  DETAIL        F  C1 BRT

①REGISTER NO.      0(0~3)
②REFERENCE IMG     015(000~026)
③REF-IMG AREA      SET (224.208)~(287.271)
④SEARCH AREA       SET (216.200)~(295.279)
⑤DIRECT COORD      CENTER (234.219)
⑥CONTR.PIXEL       3
⑦MATCH LVL(CONTR)  +05000
⑧MATCH LVL         +07000
```
※
■REFERENCE IMG
■DETECT CRD
■CONTR.PIXL

※ Make □ to ■ on the popup menu, the respective item will be added to the "REG COND" menu.

SEL=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC

④ **SEARCH ARE**
Specify the search area (inside the dotted lines) on the "④SEARCH AREA (MDL0)" line, using the same procedures used for setting the reference image area.
■An example
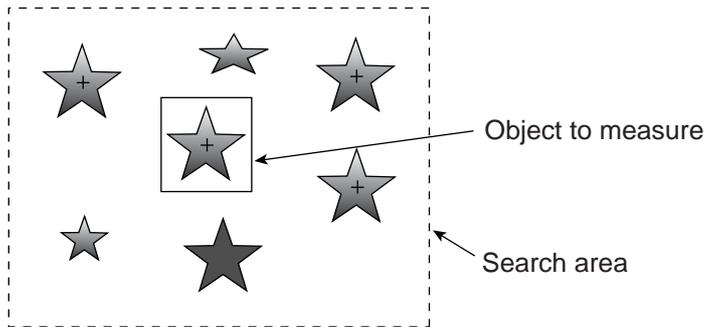
Object to measure

Search area

⑤ **DTECT COORD (detection coordinates)**
Select whether to use the detection coordinates as the center of the reference area or to allow the point to be set freely.

⑥ **CONTR.PIXEL (contraction pixels)**
1: Search the image in units of 2 pixels.
2: Search the image in units of 4 pixels.
3: Search the image in units of 8 pixels.

```
REG COND      SCREEN  COND  SAVE  DETAIL        F  C1 BRT

①REGISTER NO.      0(0~3)
②REFERENCE IMG     015(000~026)
③REF-IMG AREA      SET (224.208)~(287.271)
④SEARCH AREA       SET (216.200)~(295.279)
⑤DTECT COORD       CENTER (234.219)
⑥CONTR.PIXEL       3
⑦MATCH LVL(CONTR)  +05000
⑧MATCH LVL         +07000
```
CENTER
SET

SEL=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=FUNC

11

Set degree of match

⑦ **MATCH LVL (CONTR)**
Specify the degree of match used for detection in the contracted images (detects contracted shapes in images whose value is larger than the specified reference value).

⑧ **MATCH LVL**
Specify a degree of match used for detection in the original images of the contracted images that were detected in the search at line "⑦MATCH LVL" (detects original images which are larger than the specified value).

```
REG COND      SCREEN  COND  SAVE  DETAIL        F C1 BRT

①REGISTER NO.      0(0~3)
②REFERENCE IMG     015(000~026)
③REF-IMG AREA      SET (224.208)~(287.271)
④SEARCH AREA       SET (216.200)~(295.279)
⑤DIRECT COORD      CENTER (234.219)
⑥CONTR.PIXEL       3
⑦MATCH LVL(CONTR)  +05000
⑧MATCH LVL         +07000

              ┌ ─ ─ ─ ─ ─ ┐
              │     +     │
              └ ─ ─ ─ ─ ─ ┘



SEL=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```
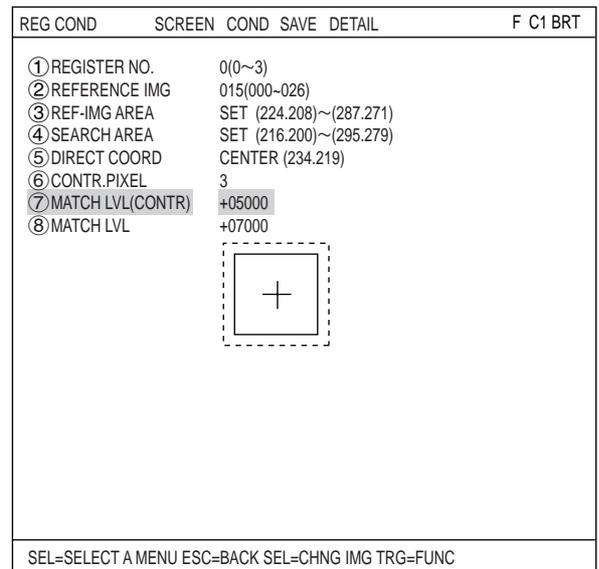
[2] Setting the register conditions for edge detection

② **MEAS SHAPE**
Select a measurement shape.

RECTANGLE
(NO ARTF)   ⎤ Select a pattern to be
RECTANGLE   │ used for image
(ARTIF)   │ processing.
LINE (straight line) │ ⇨See pages 3-4 to 3-8.
CIRC-L (circle)   │
ELIP-L (ellipse)   ⎦

NO ARTF/ARTIF: Select whether to detect edge or not with average density.
⇨ See page 3-15.

```
REG COND      SCREEN COND  SAVE            F C1 BRT

①REGISTER NO.   0(0~3)                  ┌─────────────────┐
②MEAS SHAPE     RECTANGLE (NO ARFT)     │RECTANGLE (NO ARFT)│
③SEARCH AREA    SET (224.208)~(287.271) │RECTANGLE (ARFT) │
④DTECT MODE     CHNG POINT              │LINE             │
⑤SEARCH DIRECT  HORIZ (→)               │CIRC-L           │
⑥THRESHOLD      SET (D:050 E:2 F:04)    │ELIP-L           │
                                        └─────────────────┘

                                        ┌─────────────┐
                                        │CHNG POINT   │
              ┌ ─ ─ ─ ─ ─ ┐             │DRK→BRT      │
              │     +     │             │BRT→DRK      │
              └ ─ ─ ─ ─ ─ ┘             │CENT(BRT)    │
                                        │CENT(DRK)    │
                                        └─────────────┘

                                        ┌─────────────┐
                                        │HORIZ (→)    │
                                        │HORIZ (←)    │
                                        │VERT(↓)      │
                                        │VERT(↑)      │
                                        └─────────────┘

SEL=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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11-7

③ **SEARCH AREA**
Select "③SEARCH AREA" and press the SET key to go to the setting screen.

● When "RECTANGLE" is selected
Highlight "①UP.L" and press the SET key.
The X and Y axes will appear in the search
area. Move the X/Y axes using the up/down/
left/right arrow keys to identify the upper left
corner. When correct, press the SET key.
 - To return to the previous coordinates, press
   the ESC key.
Next, highlight "②LO.R" and press the SET
key. Identify the lower right corner the same
way.

```
RECTANGLE   RESET   RETURN              F   C1 BRT

①UP.L                    (224.208)
②LO.R                    (287.271)
③MOVE


                                  ┌ ─ ─ ─ ┐
                                  │       │
                                  │   ┼   │
                                  │       │
                                  └ ─ ─ ─ ┘


                                 X：224  Y：208

SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```
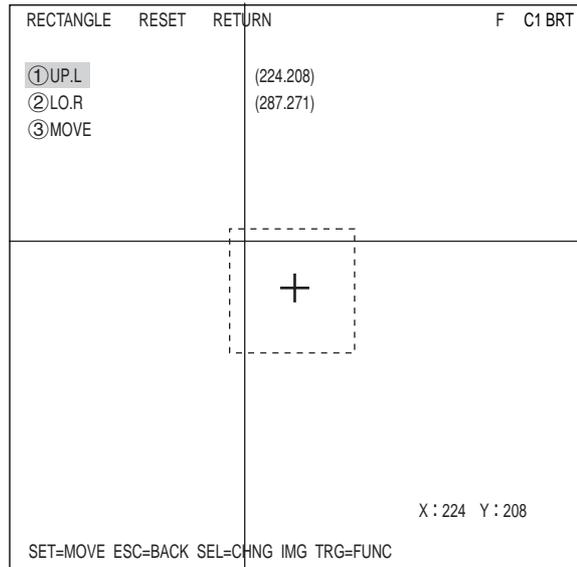
④ **DTECT MODE**
Select an image processing method for the
edges.
CHNG POINT
DRK → BRT
BRT → DRK   ⇨ See page 3-14.
CENT (BRT)
CENT (DRK)

⑤ **SEARCH DIRECT**
Specify a search direction. The direction for searching varies with each detection shape.

● **When "RECTANGLE" is selected**

Horizontal (→)	Scan the reference line from left to right （→）
Horizontal(←)	Scan the reference line from left to right （←）
Vertical (↓)	Scan the reference line from top to bottom （↓）
Vertical (↑)	Scan the reference line from bottom to top （↑）

● **When "LINE" is selected**

| Start point → End point	Scan along a straight line from the starting point to the end point
End point → Start point	Scan along a straight line from the end point to the starting point

● **When "CIRC-L" or "ELIP-L" is selected**

Clockwise direction	Scan around the circumference clockwise
Counter-clockwise direction	Scan around the circumference counter-clockwise

⇨ For details, see page 3-14.

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⑥ **THRESHOLD**

Enter the threshold value for binary conversion. Move the cursor to "⑥THRESHOLD" and press the SET key. Then highlight the "SET" position on this line and press the SET key and the "REG COND" setting screen will appear.
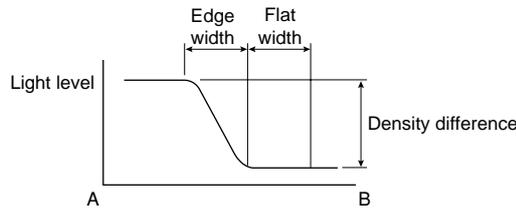
Automatic setting

Select "AUTO-REG" from the upper function menu on the THRESHOLD setting screen. The controller will set the optimum value automatically.

```
THRESHOLD VAL      AUTO-REG   RESET              F  C1  BRT

①GRYS.              050     (0〜255)
②EDGE.W             2       (1〜8)
③FLAT.W             04      (1〜16)

  GRAY




                                                      COORD

SET=CHNG ESC=BACK SEL=CHNG IMG TRG=FUNC
```

● **Example of register**

Shown below is an example detected with "②MEAS SHAPE" set to "LINE," and "④DETECT MODE" set to "CHNG POINT."
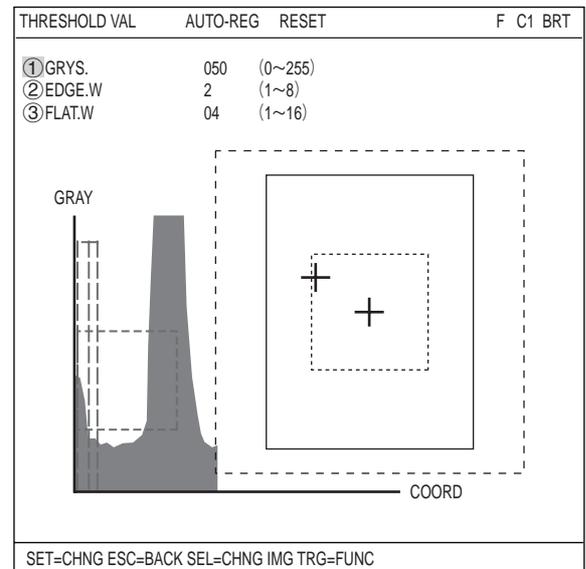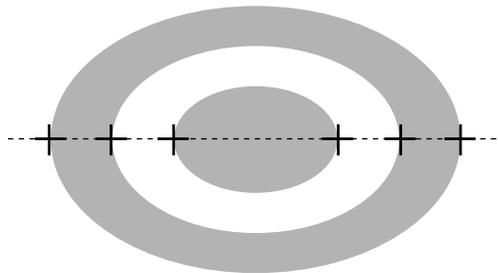
11

■ Set the evaluation conditions

● **How to move to the evaluation condition setting screen**

There are two methods for getting to the evaluation condition setting screen.

1) Select "COND" in the upper function menu on the "MEAS COND (or REG COND)" screen and press the SET key. Select "EVALUATION" on the pop up menu to go to the "EVALUAT COND" screen.

```
MEAS CND        SCREEN  COND  SAVE            F  C1  BRT

①DTECT  PRECISION  STANDARD
②REGISTER NO.      0(0〜3)
③MODE              GRAY-SRC
④DTECT ORDER       SCAN-ORDER

  REGISTER NO.    00010203040506070809101112131415
⑤DTECT OBJECT      S

                                          IMG PRE-PROC
                                          REG-COND(S)
                                          REG-COND(E)
                                          EVALUATION
                                          DST&ANGL
                                          NUM-CALC
                                          OUT

SET=SELECT A MENU  ESC=BACK SEL=CHNG IMG TRG=FUNC
```

2) Move the cursor to the "EVALUATION COND" item on the Menu tree screen and press the SET key.

```
SELECT OBJECT TYPE COND                                    F C1 DRK
OBJECT TYPE COND
  ⊟ ─ TYPE00                                      ①REGISTER NO.
         ──TYPE RUN COND                          ②CONDITION SET
         ──IMAGE-ADJ                              ③NUMBER OF OBJ
         ⊟─MEA-CND(CAMERA1)                       ④DTECT NUMBER
              ── MEASO                             ⑤MATCH LVL
              ── POSI-CORRECT                      ⑥TEST
              ⊟─MEAS01(MULTI-POSI)
                   ──IMG PRE-PROC
                   ⊟─MEAS CND
                        ── REG-COND(S)
                        ── REG-COND(E)
                     EVALUATION COND
                   ⊞─DISTANCE&ANGLE COND
                   ──NUM-CALC
                   └─OUT-COND
              ──MEAS(NEW)
       ⊞─ MEA-CND(CAMERA2)
       ── FINAL NUM. CALC
       ── FINAL OUTPUT COND
       ── OBJ-TYPE I/O
       ── OBJ TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```
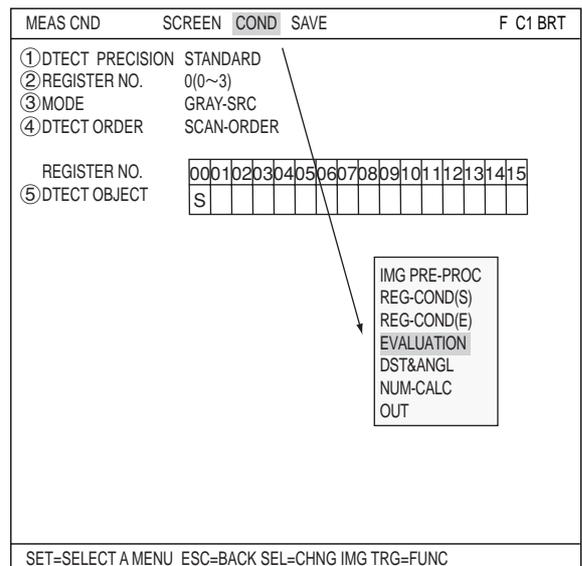
The "EVALUAT COND"(evaluation conditions) screen will appear.
⇨ For details about the evaluation conditions, see page 3-17.

- When "GRAY-SRC" is selected on line "③ MODE."

```
EVALUAT COND  SCREEN COND SAVE EDIT SEL              F C1 BRT

①REGISTER NO.       0(0~3)        [TEST RESULT]  [OUTPUT]
②CONDITION SET      AUTO(–10%)
③NUMBER OF OBJ      000~128        K=            NO
④DTECT NUMBER       000~(0~000)
⑤MATCH LVL          -10000~+1000   M0=           NO
  X COORD.          X0=
  Y COORD.          Y0=
⑥TEST               EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)
```

- When "EDGE DTECT" is selected on line "③ MODE."

```
EVALUAT COND  SCREEN COND SAVE EDIT SEL              F C1 BRT

①REGISTER NO.       0(0~3)        [TEST RESULT]  [OUTPUT]
②CONDITION SET      AUTO(–10%)
③NUMBER OF OBJ      000~128        K=            NO
④DTECT NUMBER       000~(0~000)

  X COORD.          X0=
  Y COORD.          Y0=
⑤TEST               EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)
```

■ **Numeric calculation setting**
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to show the popup menu. Select "NUM-CALC" from the popup menu.
- Select "NUM-CALC" on the menu tree.
⇨ See "Chapter 14: Numerical calculations."

■ **Output condition setting**
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to display the popup menu. Select "OUT" from the popup menu.
- Select "OUT-COND" on the menu tree.
⇨ See "Chapter 16: Setting the Input/Output Conditions.

■ Display the measurement results

Return to the operation screen and press the TRG/BRT key. The measurement results will be displayed on the screen.

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

```
(TYPE00)                              F  C1  BRT
                                           V*.**
OK
MEAS  XXXXms
MEASUREMENT 1  MULTI-POSI

REGISTER NO.0(0~3)
K=004              OK
DETECT NO.000(000~003)
M=+09870           OK
X=236.0
Y=163.0




                        *2



X0~6 □□□□□□□□    Y0~7 □□□□□□□□    READY □
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

Final evaluation result ————→ OK

Measuring time ————→ MEAS XXXXms

Measuring program number ————→ MEASUREMENT 1 MULTI-POSI

Register number ————→ REGISTER NO.0(0~3)

Number of detected images ————→ K=004 OK

Numbered in the order detected (range) ————→ DETECT NO.000(000~003)

*1 ⌈ Degree of match ————→ M=+09870 OK

⌊ Detected point coordinates ————→ X=236.0 / Y=163.0

- 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 LVL" on item "④DETECT ORDER" on the "MEAS CND" screen. ⇨ See page 11-3.
* 2 The inspection number corresponds to the image of the solid line.

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

Register number ————→ REGISTER NO

Number of points detected ————→ K=006 OK

Numbered in the order detected (range)*3 ————→ DTECT NO.000（000~005）

⌈ Detected point coordinate. ⌋ ————→ X=102.0 / Y=257.0

*3 Coordinates of the detected point.

Chapter 12: Multiple Degree of Match Inspection

12-1 Outline

Purpose	Using the gray search function, the IV-S30J 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 level and cannot be converted into binary images.
Example	Reference image Four workpieces detected **[Measurement results]** - Number of images detected - Degree of match, density (average/absolute difference), and detected coordinates

12-2 Setting operation

■ Setting the measurement conditions

● How to enter the measurement conditions setting screen

Select "MAIN-COND" -> "OBJECT TYPE COND"
(menu tree)-> "TYPE00" ->"MEA-CND
(CAMERA1)" -> "MEAS(NEW)," in that order.
Then press the SET key to bring up the "MEAS1"
screen.

```
SELECT OBJECT TYPE COND                        F C1 BRT

OBJECT TYPE COND
 ├─TYPE00                          ①MEAS SELECTION
 │   ├─ TYPE RUN COND
 │   ├─ IMAGE-ADJ
 │   ├─ MEA-CND(CAMERA1)
 │   │    ├─MEAS0
 │   │    ├─POSI-CORRECT
 │   │    └─MEAS(NEW)
 │   ├─ MEA-CND(CAMERA2)
 │   ├─ FINAL NUM. CALC
 │   ├─ FINAL OUTPUT COND
 │   ├─ OBJ-TYPE I/0
 │   └─ OBJ-TYPE SYS.
 └─ TYPE(NEW)




SET=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=POPUP
```
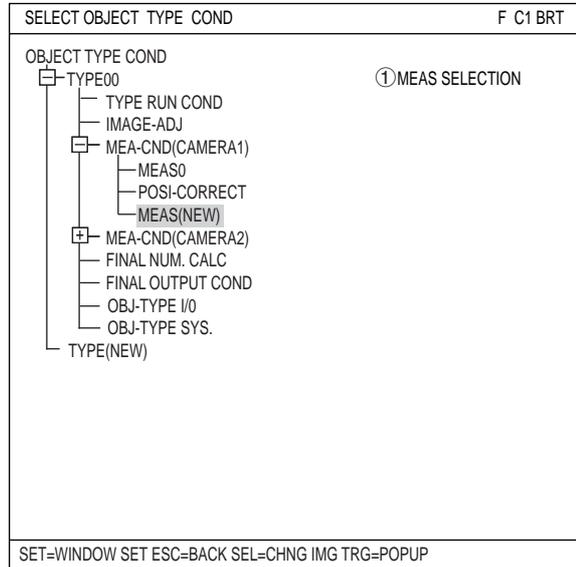
Move to the "①MEAS SELECTION" line on the
"MEASUREMENT1" screen and select "MULTI
MATCHES" from the popup menu.
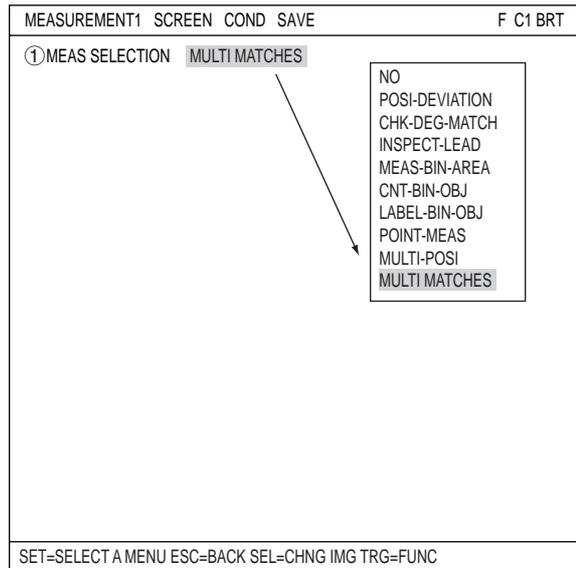
```
MEASUREMENT1  SCREEN  COND  SAVE               F C1 BRT

①MEAS SELECTION  MULTI MATCHES
                              ┌──────────────┐
                              │ NO           │
                              │ POSI-DEVIATION│
                              │ CHK-DEG-MATCH│
                              │ INSPECT-LEAD │
                              │ MEAS-BIN-AREA│
                              │ CNT-BIN-OBJ  │
                              │ LABEL-BIN-OBJ│
                              │ POINT-MEAS   │
                              │ MULTI-POSI   │
                              │ MULTI MATCHES│
                              └──────────────┘




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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Press the ESC key to return to the "OBJECT TYPE COND" (menu tree) screen, and select the "MEAS
CND" item shown under "MEAS01 (MULTI MATCHES)" to go to the "MEAS CND" screen.
⇨ For details, see "Chapter 8: Setting Examples Using the Menu Tree" in the Introduction and
Hardware.

① **DTECT PRECISION**
Select detection precision. You can select one of two levels (standard/high), according to your conditions, the desired precision level for detection results, and the detection speed.
⇨ For details, see page 3-9.

② **REGISTER NO.**
4 registers are available for the multiple degree of match inspection (Registers 0 to 3). If you want to set the measurement conditions for a different register number, press the SET key to highlight the register number currently selected. Then press the up and down arrow keys to select the register number whose measurement conditions you want to set. Press the SET key to confirm your selection.

```
MEAS CND          SCREEN  COND  SAVE              F  C1 DRK

①DTECT PRECISION   STANDARD  ──→   STANDARD
②REGISTER NO.      0(0~3)           HIGH
③MODE             YES
④MATCHING         AVG-GRAYS                    NO
⑤DETECT ORDER     SCAN-ORDER                   YES

  REGISTER NO.    00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑥DTECT OBJECT     S  ×  ×  ×

                              SCAN-ORDER      AVG-GRAYS
                              MATCH LVL       DIFF.ABS

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

③ **MODE**
Select detection precision.

④ **MATCHING**
Select a density for comparison when inspecting the image. The details are as follows.

	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 = $\Sigma (Ni - Nt)$ Ni : Light level of the captured image (contraction 3) Nt : Light level of the reference image (contraction 3)

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⑤ **DETECT ORDER**
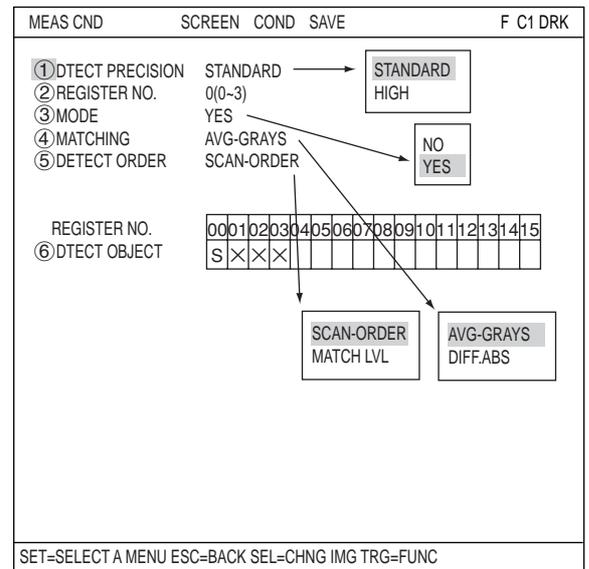Select "SCAN-ORDER" or "MATCH LVL" on the "⑤DETECT ORDER" line.
SCAN-ORDER (in the order scanned): Searches in the order scanned.
MATCH LVL (degree of match):   Searches by comparing levels with the reference image.

⑥ **DTECT OBJECT**
"S" will be displayed for the objects to be detected.

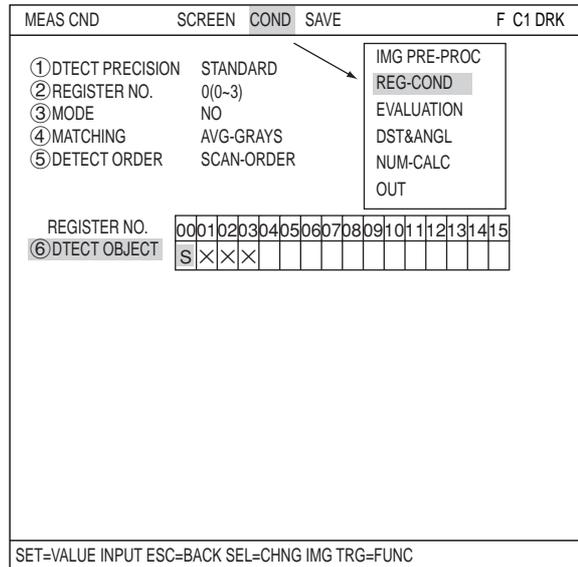| 00	01	02	03
S	×	×	×

■ How to set the register conditions

● How to enter the REG-COND setting screen
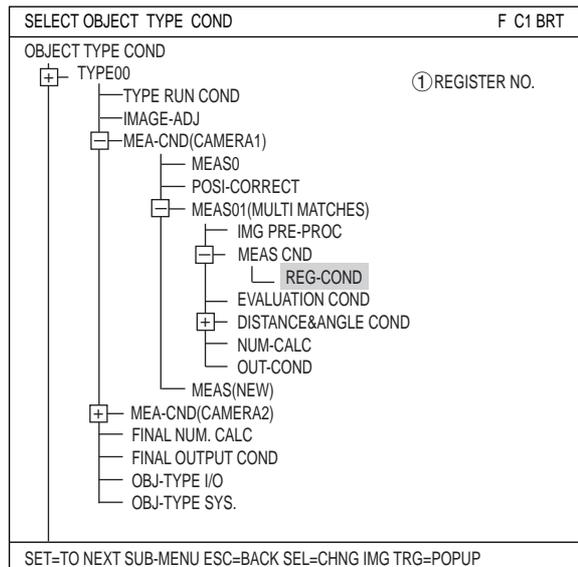There are three methods for getting to the REG-COND setting screen.

1) On the "MEAS CND" setting screen, move the cursor to the "⑥DETECT OBJECT" and press the SET key. The cursor will move into the table. Move the cursor to the "S" column and press the SET key.
   Note: If you press the SET key in the "X" column, the setting will be invalid.

```
MEAS CND          SCREEN COND  SAVE              F C1 DRK

①DTECT PRECISION   STANDARD              IMG PRE-PROC
②REGISTER NO.      0(0~3)                REG-COND
③MODE             NO                    EVALUATION
④MATCHING         AVG-GRAYS             DST&ANGL
⑤DETECT ORDER     SCAN-ORDER            NUM-CALC
                                        OUT

  REGISTER NO.    00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑥DTECT OBJECT    S  ×  ×  ×

SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

2) On the "MEAS CND" setting screen, press the TRG/BRT key to move the cursor to the upper function menu. Select the "COND" item and then select the "REG COND" item and press the SET key.
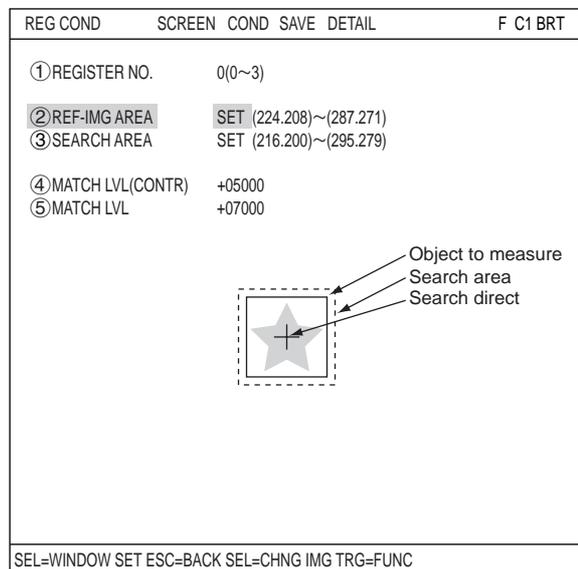
3) On the menu tree, move the cursor to the "MEAS CND" item, and press the right arrow key. The sub menu which contains the "REG COND" item will appear. Move the cursor to this item and press the SET key.

```
SELECT OBJECT TYPE COND                          F C1 BRT
OBJECT TYPE COND
  ⊞─ TYPE00                            ①REGISTER NO.
         ─ TYPE RUN COND
         ─ IMAGE-ADJ
       ⊟─ MEA-CND(CAMERA1)
              ─ MEAS0
              ─ POSI-CORRECT
            ⊟─ MEAS01(MULTI MATCHES)
                   ─ IMG PRE-PROC
                 ⊟─ MEAS CND
                        └ REG-COND
                   ─ EVALUATION COND
                 ⊞─ DISTANCE&ANGLE COND
                   ─ NUM-CALC
                   ─ OUT-COND
              ─ MEAS(NEW)
     ⊞─ MEA-CND(CAMERA2)
       ─ FINAL NUM. CALC
       ─ FINAL OUTPUT COND
       ─ OBJ-TYPE I/O
       ─ OBJ-TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

Register a reference image
After setting the reference image area, store an image in the controller as a reference image.

Select "②REF-IMG AREA" using the up/down arrow keys and select "REG" from the popup menu.

```
REG COND        SCREEN  COND  SAVE  DETAIL         F C1 BRT

①REGISTER NO.        0(0~3)

②REF-IMG AREA       SET  (224.208)~(287.271)
③SEARCH AREA        SET  (216.200)~(295.279)

④MATCH LVL(CONTR)   +05000
⑤MATCH LVL          +07000

                                      Object to measure
                                      Search area
                                      Search direct

SEL=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Set the coordinates for "①UP.L" and "②LO.R." The rectangle inside the solid lines is the reference image.

```
RECTANGLE    RESET    RETURN                    F   C1 BRT

MDL 0
①UP.L          (224.208)
②LO.R          (287.271)
③MOVE
④REFERENCE IMG



                              ┌ ─ ┐
                              │ ★ │
                              └ ─ ┘




                                        X:224  Y:208

SET=MOVE ESC=BACK SEL=CHNG IMG TRG=FUNC
```
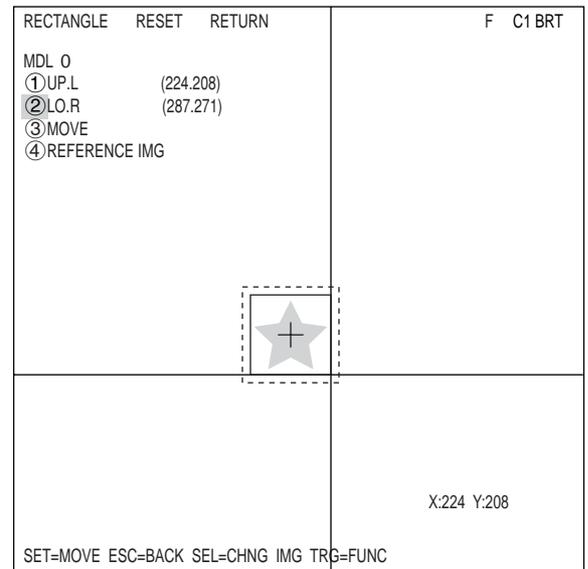
Register a reference image

After setting the reference image area, store an image in the controller as a reference image.
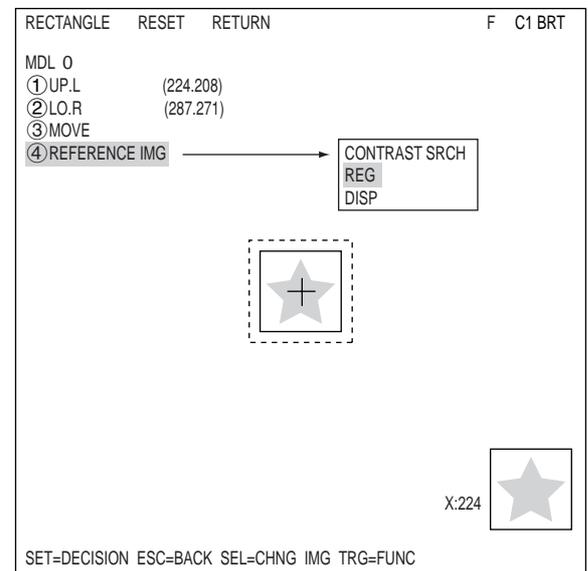Select "④REFERENCE IMG" using the up/down arrow keys and select "REG" from the popup menu.

```
RECTANGLE    RESET    RETURN                    F   C1 BRT

MDL 0
①UP.L          (224.208)
②LO.R          (287.271)
③MOVE                            ┌──────────────┐
④REFERENCE IMG  ───────────────▶ │ CONTRAST SRCH│
                                 │ REG          │
                                 │ DISP         │
                              ┌ ─ ┐ └──────────────┘
                              │ ★ │
                              └ ─ ┘



                                          ┌────┐
                                          │ ★  │
                                    X:224 └────┘

SET=DECISION ESC=BACK SEL=CHNG IMG TRG=FUNC
```
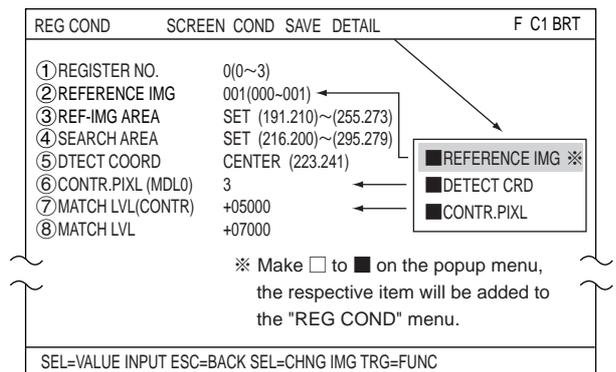
Select a reference image

Move the cursor to the function menu on the "REG COND" screen by pressing the TRG/BRT key. Move the cursor to "DETAIL." Press the SET key on the "REFERENCE IMG" line in the popup menu. The white square on the left will change to a black square. Then, the "②REFERENCE IMG" item will appear on the screen.
On the "②REFERENCE IMG" line, select a reference image from the reference images already registered.
Ex : 015 (000 to 026)
    Select reference image No. 15 from the 26 registered reference images (000 to 026).

```
REG COND      SCREEN COND SAVE DETAIL            F  C1 BRT

①REGISTER NO.        0(0~3)
②REFERENCE IMG       001(000~001) ◀
③REF-IMG AREA        SET (191.210)~(255.273)
④SEARCH AREA         SET (216.200)~(295.279)
⑤DTECT COORD         CENTER (223.241)         ┌──────────────┐
⑥CONTR.PIXL (MDL0)   3                ◀───────│ ■REFERENCE IMG ※│
⑦MATCH LVL(CONTR)    +05000           ◀───────│ ■DETECT CRD   │
⑧MATCH LVL           +07000                   │ ■CONTR.PIXL   │
                                              └──────────────┘
                       ※ Make □ to ■ on the popup menu,
                          the respective item will be added to
                          the "REG COND" menu.

SEL=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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12-5

④ **SEARCH AREA**
Specify the search area (inside the dotted lines) on the "④SEARCH AREA" line, using the same procedures used for setting the reference image area.
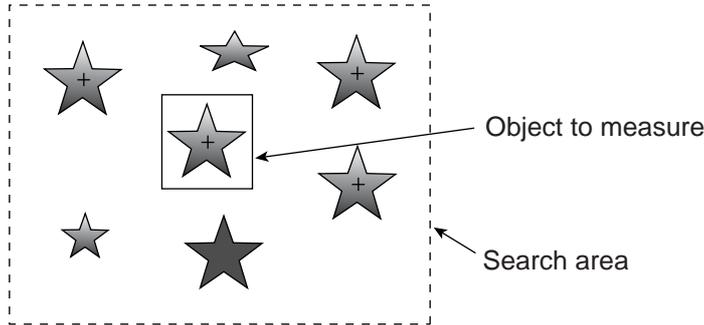
■An example

Object to measure

Search area

⑤ **DTECT COORD (detection coordinates)**
Select whether to use the detection coordinates as the center of the reference area or to allow the point to be set freely.

CENTER: The center of the rectangular area will automatically be used for the detection coordinates.

SET: You can specify any position in the rectangular area to be used for the detection coordinates.

```
REG COND       SCREEN  COND  SAVE  DETAIL          F  C1 BRT

①REGISTER NO.      0(0~3)
②REFERENCE IMG     015(000~026)
③REF-IMG AREA      SET  (224.208)~(287.271)
④SEARCH AREA       SET  (216.200)~(295.279)
⑤DTECT COORD       CENTER (223.241)  ──→    CENTER
⑥CONTR.PIXEL       3                        SET
⑦MATCH LVL(CONTR)  +05000
⑧MATCH LVL         +07000




SEL=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=FUNC
```

Set degree of match
⑦ **MATCH LVL (CONTR)**
Specify the degree of match used for detection in the contracted images (detects contracted shapes in images whose value is larger than the specified reference value).
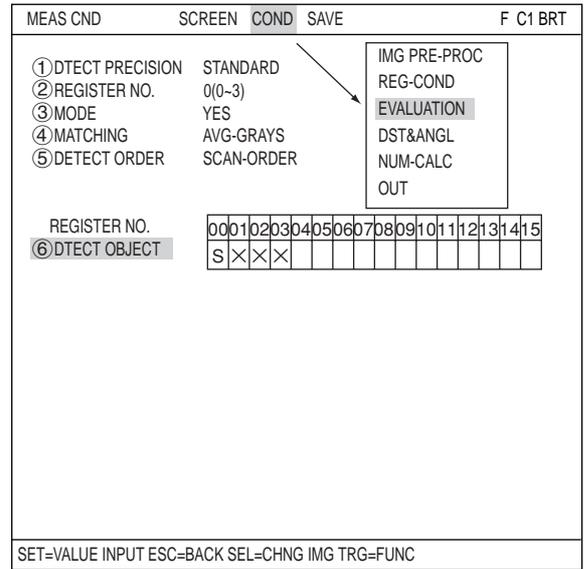
⑧ **MATCH LVL**
Specify a degree of match used for detection in the original images of the contracted images that were detected in the search at line "⑦MATCH LVL" (detects original images which are larger than the specified value).
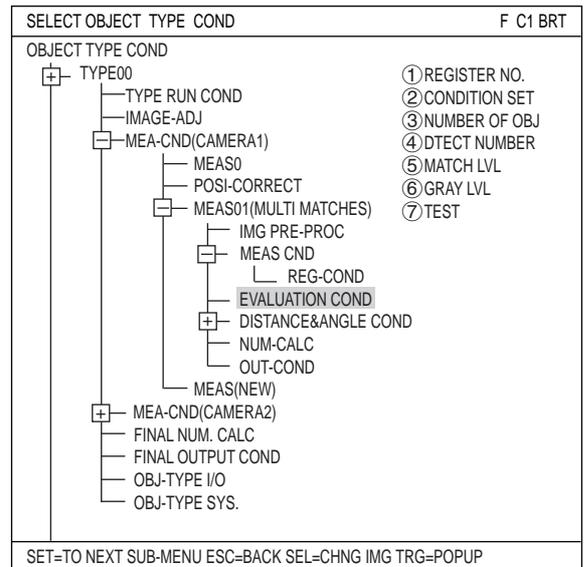
12

12-6

■ Set the evaluation conditions

● **How to move to the evaluation condition setting screen**
There are two methods for getting to the evaluation condition setting screen.

1) Select "COND" in the upper function menu on the "MEAS COND (or REG COND)" screen and press the SET key. Select "EVALUATION" on the pop up menu to go to the "EVALUAT COND" screen.
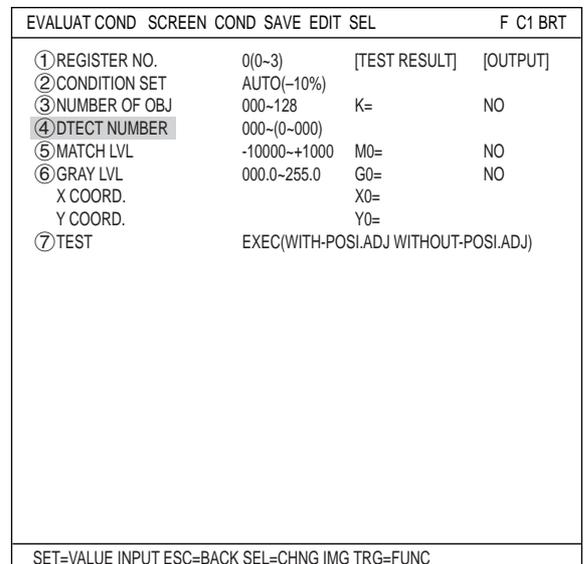
```
MEAS CND          SCREEN COND SAVE              F C1 BRT

①DTECT PRECISION   STANDARD          ┌─────────────┐
②REGISTER NO.      0(0~3)            │ IMG PRE-PROC │
③MODE             YES               │ REG-COND     │
④MATCHING         AVG-GRAYS         │ EVALUATION   │
⑤DETECT ORDER     SCAN-ORDER        │ DST&ANGL     │
                                     │ NUM-CALC     │
                                     │ OUT          │
                                     └─────────────┘
   REGISTER NO.     00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑥DTECT OBJECT       S ✕ ✕ ✕

SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

2) Move the cursor to the "EVALUATION COND" item on the menu tree screen and press the SET key.

```
SELECT OBJECT TYPE COND                        F C1 BRT
OBJECT TYPE COND
 ┼─ TYPE00                          ①REGISTER NO.
     ├─TYPE RUN COND                ②CONDITION SET
     ├─IMAGE-ADJ                    ③NUMBER OF OBJ
     ┼─MEA-CND(CAMERA1)             ④DTECT NUMBER
         ├─ MEAS0                   ⑤MATCH LVL
         ├─ POSI-CORRECT            ⑥GRAY LVL
         ┼─ MEAS01(MULTI MATCHES)   ⑦TEST
             ├─ IMG PRE-PROC
             ┼─ MEAS CND
             │   └─ REG-COND
             ├─ EVALUATION COND
             ┼─ DISTANCE&ANGLE COND
             ├─ NUM-CALC
             └─ OUT-COND
         └─ MEAS(NEW)
     ┼─ MEA-CND(CAMERA2)
     ├─ FINAL NUM. CALC
     ├─ FINAL OUTPUT COND
     ├─ OBJ-TYPE I/O
     └─ OBJ-TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

The "EVALUAT COND"(evaluation conditions) screen will appear.
⇨ For details about the evaluation conditions, see page 3-17.

```
EVALUAT COND  SCREEN COND SAVE EDIT SEL        F C1 BRT

①REGISTER NO.      0(0~3)        [TEST RESULT]   [OUTPUT]
②CONDITION SET     AUTO(–10%)
③NUMBER OF OBJ     000~128        K=              NO
④DTECT NUMBER      000~(0~000)
⑤MATCH LVL         -10000~+1000   M0=             NO
⑥GRAY LVL          000.0~255.0    G0=             NO
   X COORD.                       X0=
   Y COORD.                       Y0=
⑦TEST              EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ)

SET=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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■ **Numeric calculation setting**
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to show the popup menu. Select "NUM-CALC" from the popup menu.
- Select "NUM-CALC" on the menu tree.
⇨ See "Chapter 14: Numerical calculations."

■ **Output condition setting**
- Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to display the popup menu. Select "OUT" from the popup menu.
- Select "OUT-COND" on the menu tree.
⇨ See "Chapter 16: Setting the Input/Output Conditions.

■ **Display the measurement results**
Return to the operation screen and press the TRG/BRT key. The measurement results will be displayed on the screen.

■ Display example

Final evaluation result ⟶
Measuring time ⟶
Measuring program number ⟶
Register number ⟶
Number of detected images ⟶
Numbered in the order detected (range) ⟶
Degree of match ⟶
Light level (average/absolute value) ⟶
Detected coordinate ⟶

```
(TYPE00)                                    F  C1 BRT
                                                 V*.**
OK
MEAS XXXXms
MEASUREMENT 1  MULTI-MATCHES
REG.NO (0~3)
K=004              OK
DTECT NO.000(000~003)
M=+09870           OK
G=228.3
X=236.0
Y=163.0




X0~6 □□□□□□□    Y0~7 □□□□□□□□    READY □
MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```
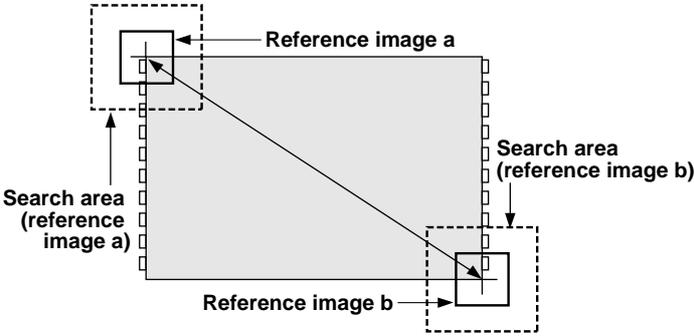
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Chapter 13: Distance and Angle Measurement

13-1 Outline

You can specify the settings for distance and angle measurement 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 measurement), multiple position measurement, and multiple degree of match inspection.
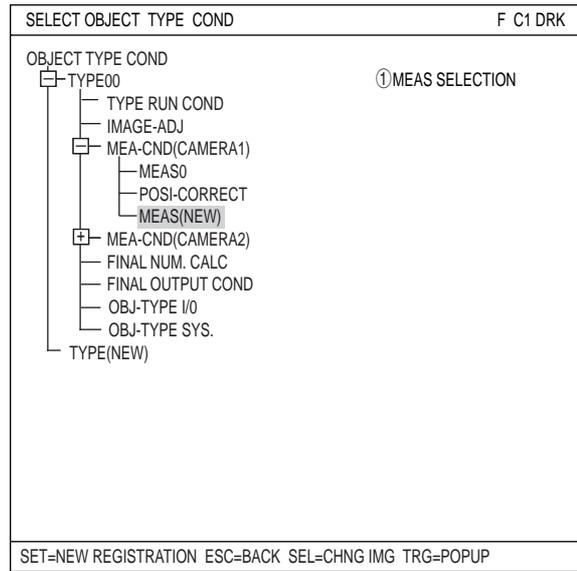
⇨ See page 4-3, 5-4, 9-5, 11-4, and 12-4.

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 gravity 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 image a Search area (reference image b) Search area (reference image a) Reference image b 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.

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- 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 2-13) for the crosshair cursor display.
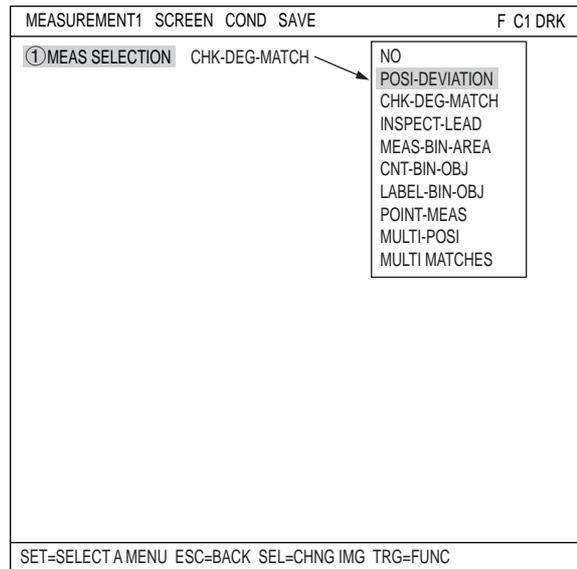
13-1

13-2 Setting operation

■ Setting distance and angle conditions

Select "MAIN-COND" -> "OBJECT TYPE COND"
(menu tree) -> "TYPE00" -> "MEA-CND
(CAMERA1)" -> "MEAS (NEW)," in that order.
Then press the SET key to bring up the "MEAS1"
screen.

```
SELECT OBJECT TYPE COND                          F  C1 DRK

OBJECT TYPE COND
 ├─TYPE00                              ①MEAS SELECTION
 │   ├─ TYPE RUN COND
 │   ├─ IMAGE-ADJ
 │   ├─ MEA-CND(CAMERA1)
 │   │   ├─ MEAS0
 │   │   ├─ POSI-CORRECT
 │   │   └─ MEAS(NEW)
 │   ├─ MEA-CND(CAMERA2)
 │   ├─ FINAL NUM. CALC
 │   ├─ FINAL OUTPUT COND
 │   ├─ OBJ-TYPE I/0
 │   └─ OBJ-TYPE SYS.
 └─ TYPE(NEW)




SET=NEW REGISTRATION ESC=BACK SEL=CHNG IMG TRG=POPUP
```

Move to the "①MEAS SELECTION" line on the
"MEASUREMENT1" screen and select any of
"POSI-DEVIATION," "CHK-DEG-MATCH,"
"LABEL-BIN-OBJ," "MULTI-POSI," or "MULTI
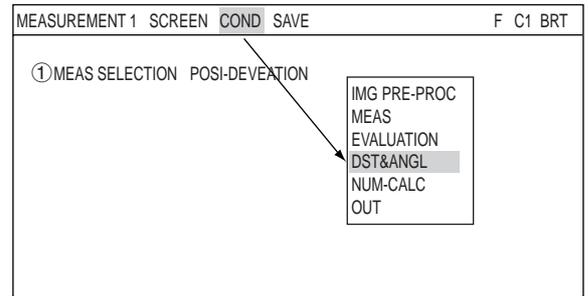MATCHES" from the popup menu.
⇨ For details, see "Chapter 8: Setting Examples
   Using the Menu Tree" in the Introduction and
   Hardware.

```
MEASUREMENT1  SCREEN  COND  SAVE                  F  C1 DRK

①MEAS SELECTION    CHK-DEG-MATCH ─┐ ┌──────────────────┐
                                  └→│ NO               │
                                    │ POSI-DEVIATION   │
                                    │ CHK-DEG-MATCH    │
                                    │ INSPECT-LEAD     │
                                    │ MEAS-BIN-AREA    │
                                    │ CNT-BIN-OBJ      │
                                    │ LABEL-BIN-OBJ    │
                                    │ POINT-MEAS       │
                                    │ MULTI-POSI       │
                                    │ MULTI MATCHES    │
                                    └──────────────────┘






SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```
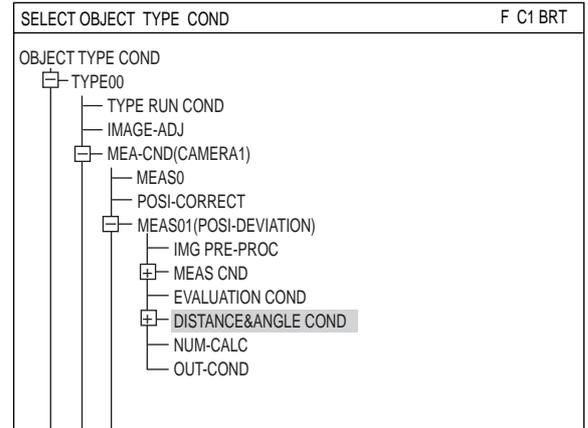
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● **How to display the distance and angle conditions setting screen**
There are two methods for displaying the distance and angle conditions setting screen.

1) On the "MEASUREMENT 1", "MEAS CND", or "REG COND" screen, press the TRG/BRG key to move the cursor to the upper function menu. Select "COND' using the left and right keys and press the SET key. Select "DST&ANGL" from the popup menu.

```
MEASUREMENT 1  SCREEN  COND  SAVE              F  C1  BRT

①MEAS SELECTION   POSI-DEVEATION
                                        IMG PRE-PROC
                                        MEAS
                                        EVALUATION
                                        DST&ANGL
                                        NUM-CALC
                                        OUT
```
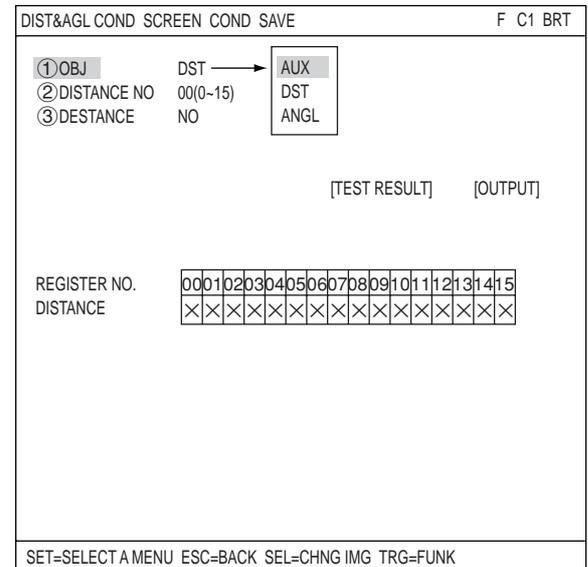
2) On the SELECT OBJECT TYPE COND screen, select "TYPE00" -> "MEA-CND(CAMERA1)" -> "MEAS01(POSI-DEVIATION)" -> "DISTANCE&ANGLE COND," in that order.

```
SELECT OBJECT  TYPE  COND                      F  C1  BRT

OBJECT TYPE COND
  ┣─ TYPE00
  │    ─ TYPE RUN COND
  │    ─ IMAGE-ADJ
  ┣─ MEA-CND(CAMERA1)
  │    ─ MEAS0
  │    ─ POSI-CORRECT
  ┣─ MEAS01(POSI-DEVIATION)
  │    ─ IMG PRE-PROC
  ┣─ MEAS CND
  │  ─ EVALUATION COND
  ┣─ DISTANCE&ANGLE COND
  │  ─ NUM-CALC
  └  ─ OUT-COND
```

● **Setting the distance and angle conditions**

① **OBJ**
Select object type you want to measure. The object types available are: "AUX" (auxiliary), "DST" (distance), and "ANGL" (angle). The setting details are different for each type.
⇨ "AUX": See page 13-4.
"DST": See page 13-6.
"ANGL": See page 13-7.

```
DIST&AGL COND  SCREEN  COND  SAVE              F  C1  BRT

 ①OBJ          DST ──→  AUX
 ②DISTANCE NO  00(0~15)  DST
 ③DESTANCE     NO        ANGL

                          [TEST RESULT]    [OUTPUT]

REGISTER NO.  0001020304050607080910111213141 5
DISTANCE      ×××××××××××××××××

SET=SELECT A MENU  ESC=BACK  SEL=CHNG IMG  TRG=FUNK
```

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(1) When "AUX" is selected.

② **AUXILIARY NO.**
Enter a register number. The register numbers available are 0 to 15.

```
DIST&AGL COND  SCREEN  COND SAVE              F  C1 BRT

①OBJ             AUX              ┌──────────────┐
②AUXILIARY NO.   01(0~15)         │ NO           │
③AUXILIARY       CIRC-C ─────────►│ MID-PNT      │
④COND.1          REG NO MDL 0     │ CIRC-C       │
⑤COND.2          REG NO MDL 0     │ GRAV         │
⑥COND.3          REG NO MDL 0     │ LINE-2P      │
                                  │ INTERSECTN   │
                                  └──────────────┘
                                  [TEST RESULT]   [OUTPUT]
⑦AUX JUDGEMENT1  000.0~511.0       X=              NO
⑧AUX JUDGEMENT2  000.0~479.0       Y=
⑨RUN A TEST      EXEC
```

③ **AUXILIARY**
Select an auxiliary point.

Selection	Description	Measurement position	Display on the screen
NO	Do not select auxiliary point.	————————	————————
MID-PNT	The center point is the coordinate half way between points 1 and 2 that are specified on ④ and ⑤ (COND. 1 and 2).	Point 1 (X1, Y1); Point 2 (X2, Y2); Center point $\left(\dfrac{X1+X2}{2}, \dfrac{Y1+Y2}{2}\right)$	③AUXILIARY MID-PNT ④COND.1 REG NO MDL 0 ⑤COND.2 REG NO MDL 0 [TEST RESULT] [OUTPUT] ⑥AUX JUDGEMENT1 000.0~511.0 X= NO ⑦AUX JUDGEMENT2 000.0~479.0 Y= ⑧RUN A TEST EXEC
CIRC-C	The center of the circle is the central coordinate of three points positioned on the circumference of the circle that are specified between ④ and ⑥ (conditions 1 to 3).	Point 1; Point 2; Point 3; Center of the circle	③AUXILIARY CIRC-C ④COND.1 REG NO MDL 0 ⑤COND.2 REG NO MDL 0 ⑥COND.3 REG NO MDL 0 [TEST RESULT] [OUTPUT] ⑦AUX JUDGEMENT1 000.0~511.0 X= NO ⑧AUX JUDGEMENT2 000.0~479.0 Y= ⑨RUN A TEST EXEC
GRAV	the center of gravity between points 1 to 3 that are specified beween ④ and ⑥ is calculated as the mean of the three coordinates (conditions 1 to 3).	Point 1 (X1, Y1); Point 2 (X2, Y2); Point 3 (X3, Y3); Center of Gravity $\left(\dfrac{X1+X2+X3}{3}, \dfrac{Y1+Y2+Y3}{3}\right)$	③AUXILIARY GRAV ④COND.1 REG NO MDL 0 ⑤COND.2 REG NO MDL 0 ⑥COND.3 REG NO MDL 0 [TEST RESULT] [OUTPUT] ⑦AUX JUDGEMENT1 000.0~511.0 X= NO ⑧AUX JUDGEMENT2 000.0~479.0 Y= ⑨RUN A TEST EXEC
LINE-2P	The line passing through two points is the line that passes through points 1 and 2 specified in items ④ and ⑤ (COND.1/2). In this system, the angle of the slope is referred to as a negative angle if it is W from the horizontal (X axis), and as a positive angle if it is CCW from the horizontal (X axis).	Slice through the Y axis (Y axis coordinate); Zero position (0, 0); 512; X axis; Slope $\left(\dfrac{Y}{X}\right)$; 480; Point 1; Point 2; Image display area; (Units used above: Pixel); Coordinates (511, 479); Y axis; Line passing through two points	③AUXILIARY LINE-2P ④COND.1 REG NO MDL 0 ⑤COND.2 REG NO MDL 0 [TEST RESULT] [OUTPUT] AUX.1:SLOPE ANGL 000.0~511.0 d1= AUX.2:Y INDENT 000.0~479.0 Y= ⑥RUN A TEST EXEC
INTERS-ECTN	The intersection of two lines is the point where lines 1 and 2, specified in items ④ and ⑤ (COND.1/2),cross.	Line 1; Line 2; Intersection	③AUXILIARY INTERSECTN ④COND.1 AUX NO ⑤COND.2 AUX NO [TEST RESULT] [OUTPUT] ⑥AUX JUDGEMENT1 000.0~511.0 X= NO ⑦AUX JUDGEMENT2 000.0~479.0 Y= ⑧RUN A TEST EXEC

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④ **COND. 1,** ⑤**COND. 2, (**⑥ **COND.3)**
Specify conditions for the auxiliary points that were selected in the "③AUXILIARY" item.

■ How to enter COND.1 and COND.2.

```
④COND.1      REG NO MDL 0
⑤COND.2      REG NO MDL 0
                  ↑      ↑
                  A      B
```

A: Enter a register number from one of the measurement programs already registered.
B: Select a model: 0 or 1.

⑦ **AUX JUDGEMENT1,** ⑧ **AUX JUDGEMENT2**
Specify judgment conditions for X and Y.
[TEST RESULT]: When executing a test from the "⑨RUN A TEST" line the result will be displayed here.
[OUTPUT]: Specify a destination for the output of test results: "NO," "Y," or "C."

⑨ **RUN A TEST**
Press the SET key to execute a test.

13

(2) When "DST" is selected.

② **DISTANCE NO.**
Enter a register number. The register numbers
available are 0 to 15.

```
DIST&AGL COND  SCREEN  COND  SAVE              F  C1  BRT

①OBJ            DST
②DISTANCE NO.   01(0~15)                        NO
③DISTANCE       DIST-BETW-2PT ─────────────→   DIST-BETW-2PT
④COND.1         REG NO MDL 0                    DIST-BETW-X
⑤COND.2         REG NO MDL 0                    DIST-BETW-Y
                          [TEST RESULT]         [OUTPUT]
⑥DISTANCE EVALUAT 000.0~702.0                   NO

⑦RUN A TEST     EXEC

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




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

③ **DISTANCE**
Select an distance.

NO	Do not select distance.
The distance between 2 points	The distance between 2 points $\left(\sqrt{(X2-X1)^2+(Y2-Y1)^2} \right)$ Point 1 (X1, Y1) Point 2 (X2, Y2)
The distance between X coordinates	The distance between X coordinates ($|X2-X1|$) Point 1 (X1, Y1) Point 2 (X2, Y2)
The distance between Y coordinates	Point 1 (X1, Y1) The distance between Y coordinates ($|Y2-Y1|$) Point 2 (X2, Y2)

④ **COND. 1** ⑤**COND. 2**
Specify conditions for the distance that were selected in the "③DISTANCE" item.

⑥ **DISTANCE EVALUAT**
Specify judgment conditions for distance.
[TEST RESULT]:   When executing a test from the "⑦RUN A TEST" line the result will be
                  displayed here.
[OUTPUT]:   Specify a destination for the output of test results: "NO," "Y," or "C."

⑦ **RUN A TEST**
Press the SET key to execute a test.

13

(3) When "ANGL" is selected.

② **ANGL NO.**
Enter a register number. The register numbers available are 0 to 15.

```
DIST&AGL COND  SCREEN  COND  SAVE              F  C1  BRT

①OBJ              ANGL
②ANGL NO.         00(0~15)               ┌─────────────┐
③ANGL             3PT-ANGL ─────────────▶│ NO          │
④COND.1           REG NO  MDL 0          │ 3PT-ANGL    │
⑤COND.2           REG NO  MDL 0          │ 2PT-H-ANGL  │
⑥COND.3           REG NO  MDL0           │ 2PT-V-ANGL  │
                              [TEST RESULT]    [OUTPUT]
⑦ANGL EVALUATION  -180.0~+180.0¡  B=    ¡     NO

⑧RUN A TEST       EXEC

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

③ **ANGL**
Select the angle specifying method.

NO	Do not select angle.	
3PT-A-NGL	Point 1 is the point of inter section 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.	
2PT-H-ANGL	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.	
2PT-V-ANGL	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.	

④ **COND. 1,** ⑤**COND. 2,** ⑥**COND.3**
Specify conditions for the angle that were selected in the "③ANGL" item.

⑦ **ANGL EVALUATION**
Specify judgment conditions for angle.
[TEST RESULT]:   When executing a test from the "⑦RUN A TEST" line the result will be displayed here.
[OUTPUT]:   Specify a destination for the output of test results: "NO," "Y," or "C."

⑧ **RUN A TEST**
Press the SET key to execute a test.

13

■ **Numeric calculation setting**
   - Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to show the popup menu. Select "NUM-CALC" from the popup menu.
   - Select "NUM-CALC" on the menu tree.
   ⇨ See "Chapter 14: Numerical calculation."

■ **Output condition setting**
   - Press the TRG/BRT key to move the cursor to the upper function menu, and highlight "COND" using the left and right arrow keys. Press the SET key to display the popup menu. Select "OUT" from the popup menu.
   - Select "OUT-COND" on the menu tree.
   ⇨ See "Chapter 16: Setting the Input/Output Conditions."

■ **Display the measurement results**
   Return to the operation screen and press the TRG/BRT key. The measurement results will be displayed on the screen.
   To display the measurement results, select "COND-CHG" or "DIST&ANG COND…" on the lower menu bar and press the right arrow key. On the popup menu, select which item you want to display: "AUX," "DST," or "ANGL." Then press the SET key. On the "CHNG-REG" item, press the up and down arrow keys and the display will change.

● **Example of the results displayed for a distance measurement**

Final evaluation result
Measuring time
Measurement program number

Measurement object
Distance of distance number 00
" 01
" 02
" 03
" 04
" 05
" 06
" 07
(Number of pixels)

*Areas will not be displayed for unspecified registration numbers.

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```
(TYPE00)                                    F  C1  DRK
                                               V*.**
OK
MEAS  XXXXms
MEASURE 0 CAM1   POSI-DEVIATION

MXR
00:100.0          OK
01:100.0          OK
02:050.0          OK
03:360.0          OK
04:250.0          OK
05:
06:
07:




                              MEA-CND          AUX
                              DST&ANG COND···   DST
X0~6 □□□□□□□   Y0~7 □□□□□□    NUMERIC CALC      ANGL

MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

● **Example of the displayed of angle results**

Measurement object ──────────► ANGL
Angle of angle number   00 ──► 00:+080.0˚ OK
  "   01 ──► 01:+070.0˚ OK
  "   02 ──► 02:+050.0˚ OK
  "   03 ──► 03:+088.2˚ OK
  "   04 ──► 04:+00 6.5˚ OK
  "   05 ──► 05:
  "   06 ──► 06:
  "   07 ──► 07:

● **Example of the displayed of auxiliary results**

Measurement object ──────────► AUX
Angle of auxiliary number 00 ──► 00: (259.0, 178.0) OK
  "   01 ──► 01: (466.0, 178.0) OK
  "   02 ──► 02: (361.0, 228.0) OK
  "   03 ──► 03: (132.0, 298.0) OK
  "   04 ──► 04: (362.5, 178.0) OK
  "   05 ──► 05:
  "   06 ──► 06:
  "   07 ──► 07:
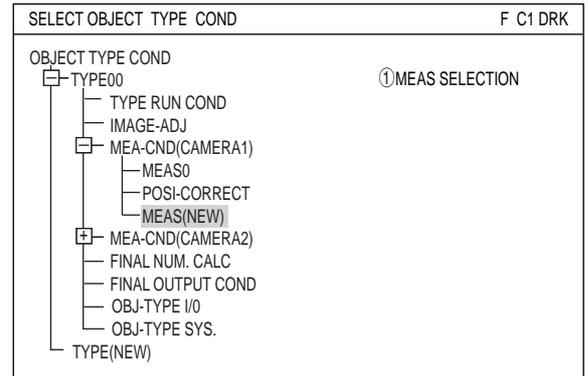
Chapter 14 Numerical Calculations

14-1 Outline

Numeric calculation function of the IV-S30J consists 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 "TYPE" and "FORMULA" settings of the final numerical calculation.

14-2 The individual numerical calculations for each measuring program

● **How to display the numerical calculation conditions setting screen**

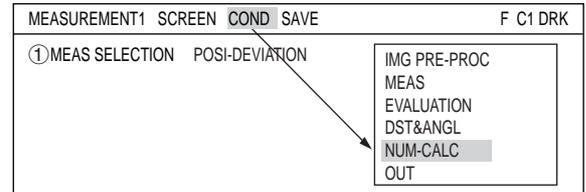There are two methods for displaying the numerical calculation conditions setting screen.

1) Select "MAIN COND" -> "OBJECT TYPE COND" (menu tree) -> "TYPE00" -> "MEA-CND (CAMERA1)" -> "MEAS(NEW)," in that order. On the "①MEAS SELECTION" line, select any of the measurement programs.

Note: When "①MEAS SELECTION" is left set to "NO," you cannot specify a numerical calculation function.

```
SELECT OBJECT TYPE COND                    F C1 DRK

OBJECT TYPE COND
 �E─TYPE00                              ①MEAS SELECTION
 │   ├─ TYPE RUN COND
 │   ├─ IMAGE-ADJ
 │   �E─ MEA-CND(CAMERA1)
 │   │    ├─ MEAS0
 │   │    ├─ POSI-CORRECT
 │   │    └─ MEAS(NEW)
 │   ┼─ MEA-CND(CAMERA2)
 │   ├─ FINAL NUM. CALC
 │   ├─ FINAL OUTPUT COND
 │   ├─ OBJ-TYPE I/0
 │   └─ OBJ-TYPE SYS.
 └─ TYPE(NEW)
```
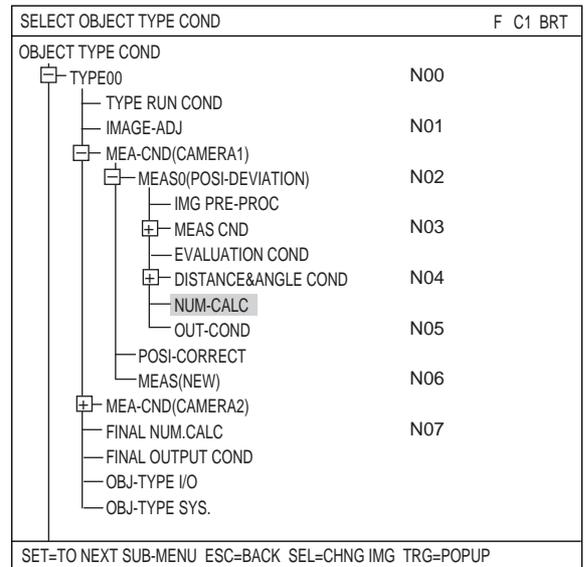
On either the MEAS CND, or REG-COND screen, press the TRG/BRT key to move the cursor to the upper function menu. Select "COND" and then from the popup menu, select the "NUM-CALC" item.

Note: The items shown in the popup menu will vary with the measurement program selected.

• When the position deviation measurement is selected

```
MEASUREMENT1  SCREEN  COND  SAVE          F C1 DRK

①MEAS SELECTION   POSI-DEVIATION    ┌──────────────┐
                                    │ IMG PRE-PROC │
                                    │ MEAS         │
                                    │ EVALUATION   │
                                    │ DST&ANGL     │
                                    │ NUM-CALC     │
                                    │ OUT          │
                                    └──────────────┘
```

2) Open the sub menu for "MEAS0" or "MEAS1" on the menu tree, and select "NUM-CALC." Then press the SET key.

```
SELECT OBJECT TYPE COND                    F C1 BRT

OBJECT TYPE COND
 �E─TYPE00                              N00
 │   ├─ TYPE RUN COND
 │   ├─ IMAGE-ADJ                      N01
 │   �─ MEA-CND(CAMERA1)
 │   │    �E─ MEAS0(POSI-DEVIATION)    N02
 │   │    │    ├─ IMG PRE-PROC
 │   │    │    ┼─ MEAS CND             N03
 │   │    │    ├─ EVALUATION COND
 │   │    │    ┼─ DISTANCE&ANGLE COND  N04
 │   │    │    ├─ NUM-CALC
 │   │    │    └─ OUT-COND             N05
 │   │    ├─ POSI-CORRECT
 │   │    └─ MEAS(NEW)                 N06
 │   ┼─ MEA-CND(CAMERA2)
 │   ├─ FINAL NUM.CALC                 N07
 │   ├─ FINAL OUTPUT COND
 │   ├─ OBJ-TYPE I/O
 │   └─ OBJ-TYPE SYS.

SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

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┌──────────┐
│ **Note** │
└──────────┘

┌───┐
│ **- Numeric calculation errors (deviation from the exact value) after digitizing the image**
│ Since the IV-S30J` uses 64-bit, floating-point arithmetic operations in its calculations, small quantization errors may occur when converting the images into numbers. │
└───┘

● **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.
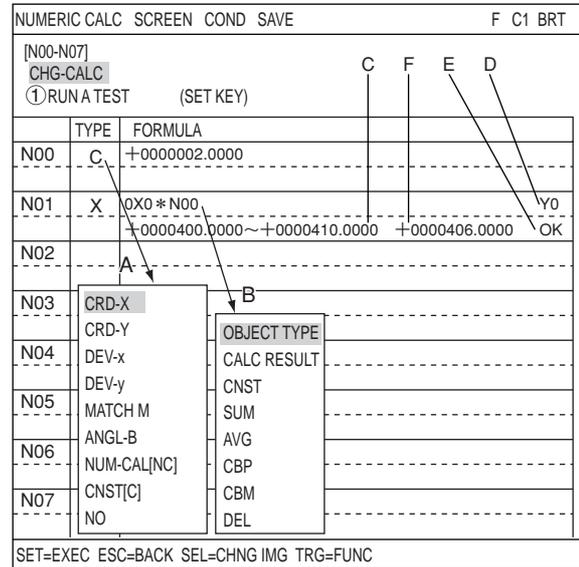
"CHG-CALC"

Move the cursor to the "CHG-CALC" item. Each time you press the SET key the display in the left most column will alternate between "AN00 to AN07" and "AN08 to AN15."

① **RUN A TEST**

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 [F] and the OK or NG judgment will be displayed at position [E].

A: TYPE

Select the type of data being calculated.
The details displayed for each measuring program.
⇨ See page 14-5 to 14-8.

- [NUMERIC CALC] screen on positional deviation measurement

```
NUMERIC CALC  SCREEN  COND  SAVE                      F  C1  BRT

 [N00-N07]
  CHG-CALC                             C    F    E    D
  ①RUN A TEST      (SET KEY)

         TYPE │ FORMULA
 N00 │   C.   │ +0000002.0000

 N01 │   X    │ 0X0 * N00                                    Y0
         │ +0000400.0000~+0000410.0000   +0000406.0000   OK
 N02 │        A

 N03 │  CRD-X        B
         CRD-Y     OBJECT TYPE
 N04 │  DEV-x      CALC RESULT
         DEV-y     CNST
 N05 │  MATCH M    SUM
         ANGL-B    AVG
 N06 │  NUM-CAL[NC] CBP
         CNST[C]   CBM
 N07 │  NO         DEL

 SET=EXEC  ESC=BACK  SEL=CHNG  IMG  TRG=FUNC
```

B: FORMULA

Select the formula to apply. Select formula using the left and right arrow keys and enter numerical values using the up and down arrow keys.
The details displayed for "FORMULA" will depend on the "TYPE" selected.

Item selections	Selection on line
CRD-X, CRD-Y, DEV-x, DEV-y, MATCH M, ANGL B	OBJECT TYPE, CALC RESULT, CNST, SUM, AVG, CBP, CBM, DEL
NUM-CAL [NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST [C]	+0000000.0000 (second line is not displayed)

⇨ For details about the items that can be selected with other measurement programs, see pages 14-5 to 14-8.

C: UPR&LOW LIMIT

Enter the upper and lower limits for making a judgment.

D: OUTPUT

Setting the output of the calculation results. Select an output target: "NO," "Y," or "C."
The output can be set to Y0 to Y7 or C000 to C107.
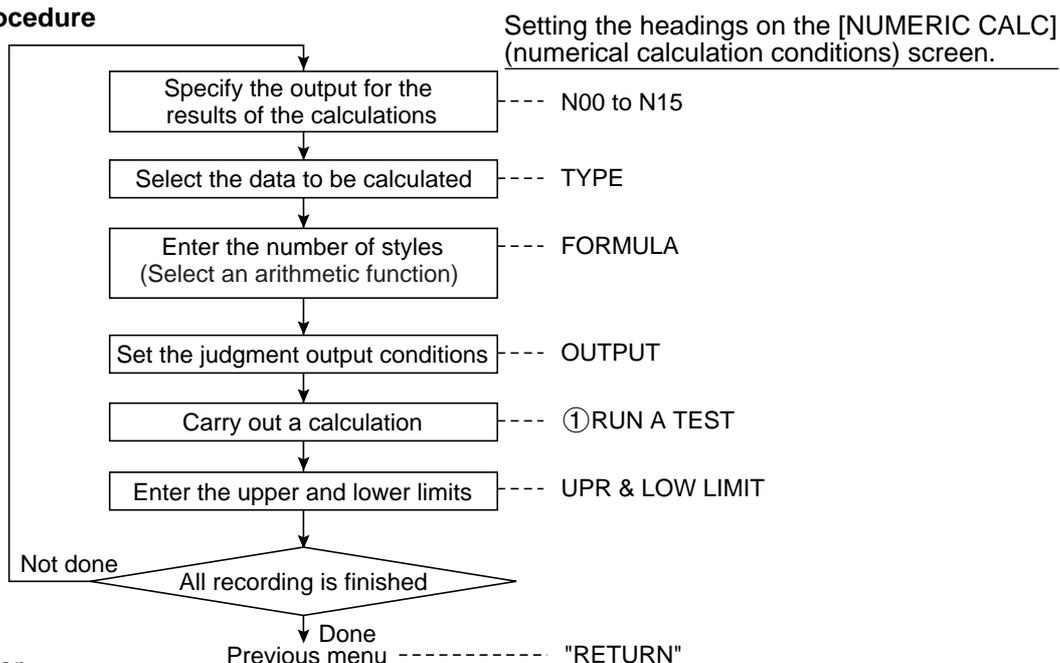- The number of styles may be set as follows, depending on the selections made in items A and B.

OBJECT TYPE	Model 0	Model 1
CRD [X Y]	00X0 to 07X0 / 00Y0 to 07Y0	00X1 to 07X1 / 00Y1 to 07Y1
DEV [x y]	0x0 to 7x0 / 0y0 to 7y0	0x1 to 7x1 / 0y1 to 7y1
MATCH [M]	00M0 to 07M0	00M1 to 07M1
ANGL [B]	0B to 7B	
NUM-CAL [NC]	ABS / SQRT / TAN / ATAN (00 to 14) MAX/MIN (00 to 14)	
CNST [C]	-9999999.9999 to +9999999.9999	

Corresponds to page 14-4.

These are the same as for the other measurement programs.

The numbers from 00 to 07 in front of the characters are registration

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● **Setting procedure**

Setting the headings on the [NUMERIC CALC] (numerical calculation conditions) screen.

Specify the output for the results of the calculations	---- N00 to N15
Select the data to be calculated	---- TYPE
Enter the number of styles (Select an arithmetic function)	---- FORMULA
Set the judgment output conditions	---- OUTPUT
Carry out a calculation	---- ①RUN A TEST
Enter the upper and lower limits	---- UPR & LOW LIMIT

Not done ← ◇ All recording is finished ◇ → Done

Previous menu ---------- "RETURN"

● **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)

● **Types and number of styles of entered for each measurement program**
The table shown below contains the numeric formulas that can be assigned in "TYPE" and "FORMULA" on the "NUMERIC CALC" screen, 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

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Numerical Calculations

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 MIN: MNR	0MXR to 3MXR 0MNR to 3MNR		
Distance between gravity centers X	MAX: XDX MIN: NDX	0XDX to 3XDX 0NDX to 3NDX		
Distance between gravity centers Y	MAX: XDY MIN: NDY	0XDY to 3XDY 0NDY to 3NDY		
Fellet diameter X	MAX: XFX MIN: NFX	0XFX to 3XFX 0NFX to 3NFX		
Fellet diameter Y	MAX: XFY MIN: NFY	0XFY to 3XFY 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
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	
Center point X	CX	0CX000 to 0CX127···3CX000 to 3CX127	
Center point Y	CY	0CY000 to 0CR127···3CY000 to 3CY127	
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)
Numerical calculation results	N	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

[1] Display lists on the "NUMERIC CALC" screen

This section displays the "NUMERIC CALC" screen for each measuring program.
The details displayed for "FORMULA" will depend on the "TYPE" selected.

(1) Positional deviation measurement

See page 14-2.

(2) Degree of match inspection

```
NUMERIC CALC  SCREEN  COND  SAVE          F  C1 BRT
[N00-N07]
CHG-CALC
①RUN A TEST      (SET KEY)

      TYPE   FORMULA
N00    ←   ┌─────────────┐
           │ MATCH M     │
N01        │ CRD-X       │
           │ CRD-Y       │
N02        │ LVL G       │
           │ NUM-CAL[NC] │
N03        │ CNST[C]     │
           │ NO          │
N04        └─────────────┘
```

The details displayed for "FORMULA" will depend on the "TYPE" selected.

Selection of type	Selection of formula
MATCH M CRD-X CRD-Y LVL G	OBJECT TYPE, CALC RESULT, CNST, SUM, AVG, CBP, CBM, DEL
NUM-CAL[NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST[C]	+0000000,000

(3) Lead inspection

```
NUMERIEC CALC  SCREEN  COND  SAVE         F  C1 BRT
[N00-N07]
CHG-CALC
①RUN A TEST      (SET KEY)

      TYPE   FORMULA
N00    ←   ┌──────────────────────┐
           │ OBJ-K                │
N01        │ DISTANCE MAX MXD     │
           │ DISTANCE MIN MND     │
N02        │ LEAD WIDTH MAX MXW   │
           │ LEAD-WIDTH MIN MNW   │
N03        │ LEAD-LENGTH MAX MXL  │
           │ LEAD-LENGTH MIN MNL  │
N04        │ NUM-CAL[NC]          │
           │ CNST[C]              │
N05        │ NO                   │
           └──────────────────────┘
N06
```

The details displayed for "FORMULA" will depend on the "TYPE" selected.

Selection of type	Selection of formula
OBJ-K DISTANCE MAX MXD/MIN MND LEAD WIDTH MAX MXW/MIN MNW LEAD-LENGTH MAX MXL/MIN MNL	OBJECT TYPE, CALC RESULT, CNST, SUM, AVG, CBP, CBM, DEL
NUM-CAL[NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST[C]	+0000000,000

(4) Area measurement by binary conversion

```
NUMERIC CALC  SCREEN  COND  SAVE          F  C1 BRT
[N00-N07]
CHG-CALC
①RUN A TEST      (SET KEY)

      TYPE   FORMULA
N00    ←   ┌──────────────┐
           │ TOTAL-AREA-A │
N01        │ NUM-CAL[NC]  │
           │ CNST[C]      │
N02        │ NO           │
           └──────────────┘
N03
```

The details displayed for "FORMULA" will depend on the "TYPE" selected.

Selection of type	Selection of formula
TOTAL-AREA-A	OBJECT TYPE, CALC RESULT, CNST, SUM, AVG, CBP, CBM, DEL
NUM-CAL[NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST[C]	+0000000,000

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(5) Object counting by binary conversion

```
NUMERIC CALC  SCREEN  COND  SAVE              F  C1  BRT

[N00-N07]
CHG-CALC
①RUN A TEST      (SET KEY)

       TYPE │ FORMULA
N00      ◄────┌ TOTAL-AREA-A ┐- - - - - - - - - - - - - - -
             │ OBJ-K         │
N01 - - - - -│ NUM-CAL[NC]   │- - - - - - - - - - - - - - -
             │ CNST[C]       │
N02          └───────────────┘

N03

N04

N05

N06

N07

SET=EXEC ESC=BACK SEL=CHNG IMG TRG=FUNC
```

The details displayed for "FORMULA" will depend on the "TYPE" selected.

Selection of type	Selection of formula
TOTAL-AREA-A OBJ-K	OBJECT TYPE, CALC RESULT, CNST, SUM, AVG, CBP, CBM, DEL
NUM-CAL[NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST[C]	+0000000,000

(6) Object identification of binary conversion

```
NUMERIC CALC  SCREEN  COND  SAVE              F  C1  BRT

[N00-N07]
CHG-CALC
①RUN A TEST      (SET KEY)

       TYPE │ FORMULA
N00      ◄──┌ TOTAL-AREA-A ┐- - - - - - - - - - - - - -
            │ OBJ-K        │
N01 - - - - │ OBJECT-AREA-R│- - - - - - - - - - - - - -
            │ C-GRAVS X GX │
N02         │ C-GRAVS Y GY │- - - - - - - - - - - - - -
            │ X FILLET-W FX│
N03         │ Y FILLET-W FY│- - - - - - - - - - - - - -
            │ AX.ANGL[B]   │
N04         │ LB-CIRCUM[CR]│- - - - - - - - - - - - - -
            │ MID-PNT X CX │
N05         │ MID-PNT Y CY │- - - - - - - - - - - - - -
            │ NUM-CAL[NC]  │
N06         │ CNST[C]      │- - - - - - - - - - - - - -
            │ NO           │
N07         └──────────────┘- - - - - - - - - - - - - -

SET=EXEC ESC=BACK SEL=CHNG IMG TRG=FUNC
```

The details displayed for "FORMULA" will depend on the "TYPE" selected.

Selection of type	Selection of formula
TOTAL-AREA-A OBJ-K OBJCT-AREA-R C-GRAVS GX/GY X FILLET-W FX/FY AX.ANGL[B] LB-CIRCUM[CR] MID-PNT CX/CY	OBJECT TYPE, CALC RESULT, CNST, SUM, AVG, CBP, CBM, DEL
NUM-CAL[NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST[C]	+0000000,000

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14-6

(7) Point measurement

● When "BINARY" is selected on the "①MODE"

```
NUMERIC CALC  SCREEN  COND  SAVE              F  C1  BRT

[N00-N07]
 CHG-CALC
 ①RUN A TEST        (SET KEY)

       TYPE  FORMULA
 N00    ◄──      WHT.CNT/REG.NO[WRC]
                 NUM-CAL[NC]
 N01             CNST[C]
                 NO
 N02
```

● When "AVG-GRAYS" is selected on the "①MODE"

```
NUMERIC CALC  SCREEN  COND  SAVE              F  C1  BRT

[N00-N07]
 CHG-CALC
 ①RUN A TEST        (SET KEY)

       TYPE  FORMULA
 N00    ◄──      AVG-GRAYS[G]
                 OBJ TYPES REG.LIST
 N01             NUM-CAL[NC]
                 CNST[C]
 N02             NO

 N03
```

The details displayed for "FORMULA" will depend on the "TYPE" selected.

Selection of type	Selection of formula
WHT.CNT/REG.NO[WRC]	WHT.CNT[WC], REG.NO[WRC], NUM-CAL, CNST,DEL
NUM-CAL[NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST[C]	+0000000,000

Selection of type	Selection of formula
AVG-GRAYS[G]	OBJECT TYPE, CALC RESULT, CNST, SUM, AVG, CBP, CBM, DEL
WHT.CNT/REG.NO[WRC]	WHT.CNT[WC], REG.NO[WRC], NUM-CAL, CNST,DEL
NUM-CAL[NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST[C]	+0000000,000

(8) Multiple positional measurement

```
NUMERIC CALC  SCREEN  COND  SAVE              F  C1  BRT

[N00-N07]
 CHG-CALC
 ①RUN A TEST        (SET KEY)

       TYPE  FORMULA
 N00    ◄──      OBJ-K
                 MATCH M
 N01             CRD-X
                 CRD-Y
 N02             NUM-CAL[NC]
                 CNST[C]
 N03             NO

 N04
```

The details displayed for "FORMULA" will depend on the "TYPE" selected.

Selection of type	Selection of formula
OBJ-K MATCH M CRD X/Y	OBJECT TYPE, CALC RESULT, CNST, SUM, AVG, CBP, CBM, DEL
NUM-CAL[NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST[C]	+0000000,000

(9) Multiple degree of match inspection

```
NUMERIC CALC  SCREEN  COND  SAVE              F  C1  BRT

[N00-N07]
 CHG-CALC
 ①RUN A TEST        (SET KEY)

       TYPE  FORMULA
 N00    ◄──      OBJ-K
                 MATCH M
 N01             LVL G
                 CRD-X
 N02             CRD-Y
                 NUM-CAL[NC]
 N03             CNST[C]
                 NO
 N04

 N05
```

The details displayed for "FORMULA" will depend on the "TYPE" selected.

Selection of type	Selection of formula
OBJ-K MATCH M LVL G CRD X/Y	OBJECT TYPE, CALC RESULT, CNST, SUM, AVG, CBP, CBM, DEL
NUM-CAL[NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST[C]	+0000000,000

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(10) Distance and angle measurement

```
NUMERIC CALC  SCREEN  COND  SAVE              F  C1  BRT
 [N00-N07]
 CHG-CALC
 ①RUN A TEST        (SET KEY)

       TYPE  FORMULA
 N00    ◄─────  DST[D]      ─────────────────────
                ANGL[B]
 N01    ────    AUX H1      ─────────────────────
                AUX H2
 N02    ────    NUM-CAL[NC] ─────────────────────
                CNST[C]
 N03    ────    NO          ─────────────────────

 N04    ──────────────────────────────────────────

 N05    ──────────────────────────────────────────

 N06    ──────────────────────────────────────────

 N07    ──────────────────────────────────────────

 SET=EXEC  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

The details displayed for "FORMULA" will depend on the "TYPE" selected.

Selection of type	Selection of formula
DST[D] ANGL[B] AUX[H1/H2]	OBJECT TYPE, CALC RESULT, CNST, SUM, AVG, CBP, CBM, DEL
NUM-CAL[NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST[C]	+0000000,000

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14-3 Final numerical calculations

Final numerical calculations can be set at item "FINAL NUM-CALC" on the menu tree.
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 "14-2 The individual numerical calculations for each measuring program."

● **How to display the final numerical calculation screen.**

Open the sub menu for "TYPExx" on the menu tree and select "FINAL NUM. CALC." Then press the SET key.

```
SELECT OBJECT TYPE COND                              F  C2  BRT

OBJECT TYPE COND                        AN00
 └─TYPE00
      ├─ TYPE RUN COND                  AN01
      ├─ IMAGE-ADJ
      ├─ MEA-CND(CAMERA1)               AN02
      ├─ MEA-CND(CAMERA2)
      ├─ FINAL NUM.CALC                 AN03
      ├─ FINAL OUTPUT COND
      ├─ OBJ-TYPE I/O                   AN04
      └─ OBJ-TYPE SYS.
   └─TYPE(NEW)                          AN05

                                        AN06

                                        AN07



SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

● **Settings on the final numerical calculation screen.**

The display positions of each item selected are the same as in section "14-2 The individual numerical calculation for each measurement program."
⇨ See the next page for the display details.

```
NUMERIC CALC  SCREEN  COND  SAVE                     F  C1  BRT

[N00-N07]
CHG-CALC                              C    D    F    E
①RUN A TEST        (SET KEY)

        TYPE  FORMULA
AN00 │  N  │ +0000002.0000
     │     │
AN01 │ AN  │ 0X0 ＊ N00                                    Y0
     │     │ +0000400.0000～+0000410.0000  +0000406.0000  OK
AN02 │     │         A              B
     │     │
AN03 │     │ MEAS-CAL-RESULT[N]
     │     │ A-CAL-RESULT[AN]    OBJECT TYPE
AN04 │     │ NUM-CAL[NC]         CNST
     │     │ CNST[C]             SUM
AN05 │     │ NO                  AVG
     │     │                     CBP
AN06 │     │                     CBM
     │     │                     DEL
AN07 │     │

SET=EXEC ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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"CHG-CALC"

Move the cursor to the "CHG-CALC" item. Each time you press the SET key the display in the left most column will alternate between "AN00 to AN07" and "AN08 to AN15."

① **RUN A TEST**

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 [F] and the OK or NG judgment will be displayed at position [E].

A: TYPE

Select the type of data being calculated.

B: FORMULA

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 details displayed for "FORMULA" will depend on the "TYPE" selected.

Selected of type	Formula
MEAS-CAL-RESULT[N] A-CAL-RESULT[AN]	OBJECT TYPE, CNST, SUM, AVG, CBP, CBM, DEL
NUM-CAL[NC]	ABS, SQRT, TAN, ATAN, MAX, MIN, DEL
CNST[C]	+0000000,000 (second line is not displayed)

Note: When "SUM" (total) or "AVG" (average) is selected for calculating the results, specify the range from 0 to 15.

C: UPR&LOW LIMIT

Enter the upper and lower limits for making a judgment

D: OUTPUT

Setting the output of the calculation results.
Based on the settings at items "TYPE" and "FORMULA," the number of styles may be entered as follows.

OBJECT 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) 10N00 to 10N15 (Calculation result for measurement 1: N00 to 15) 20N00 to 20N15 (Calculation result for measurement 2: N00 to 15) 30N00 to 30N15 (Calculation result for measurement 3: N00 to 15) 40N00 to 40N15 (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

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14-4 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 15: PC Function.)

Image 0   X coordinate difference

Object to be measured

Point detected in image 1
(register number 01, model 0)

Point detected in image 0
(register number 00, model 0)

Image 1

Y coordinate difference
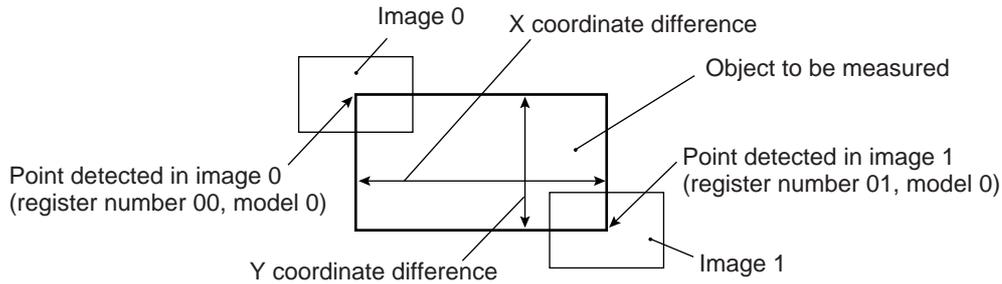
(1) Image setting

After specifying the images, return to the "MEA CND" screen for the degree of match inspection.

(2) Operations on the "MEA CND" screen

Press the TRG/BRT key to move the cursor to the upper function menu. Select "COND" and press the SET key. Select "NUM-CALC" from the popup menu and then press the SET key.

```
MEA CND    SCREEN  COND  SAVE                    F  C1  BRT

①DTECT PRECISION  STANDARD              IMG PRE-PROC
②REGISTER NO.     00(0~15)              REG COND
③MODE            1P-SCH                 EVALUATION
④SEARCH          YES                    DST&ANGL
⑤MATCHING        AVG-GRAYS              NUM-CALC
                                        OUT

REGISTER  NO.    00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
⑥MDL 0           S  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×
⑦MDL 1           ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```
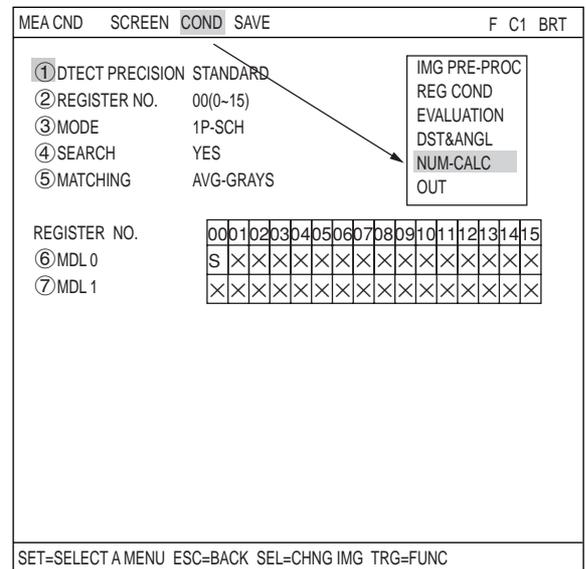
(3) Operations on the "NUMERIC CALC" screen

1. Select position "A" (2nd cell in the "TYPE" column) on the "N00" line using the up and down arrow keys. Select "CRD-X" from the popup menu and then press the SET key.
2. Move the cursor to position "B" (2nd cell in the "FORMULA" column) and press the SET key. "00X0" will be displayed in the "FORMULA" column. Select a digit using the left and right arrow keys. Press the SET key. Then change the selected digit "01X0" by using the up and down keys.

N00	X	01X0
		+0000000.00~+0000000.00

"01X0" is referring to the X coordinate of register number 01 (image 1) and model 0.

```
NUMERIC CALC  SCREEN  COND  SAVE                 F  C1  BRT

[N00-N07]
CHG-CALC
①RUN A TEST        (SET KEY)

        TYPE │ FORMULA
N00                                    OBJECT TYPE
                           B           CALC RESULT
N01            A                       CNST
                                       SUM
                      MATCH M          AVG
N02                   CRD-X            CBP
                      CRD-Y            CBM
N03                   LVL G            DEL
                      NUM-CAL[NC]
N04                   CNST[C]
                      NO
N05

N06

N07

SET=EXEC ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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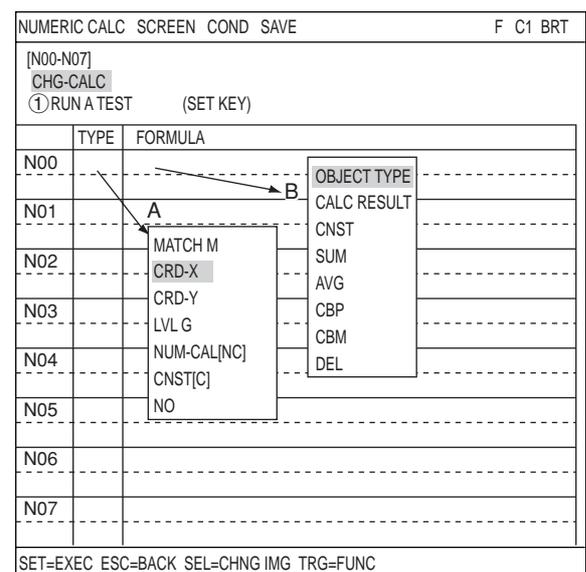
Press the SET key, the cursor will move to the right. Press the SET key again and a popup menu will appear. Select the "-" and press the SET key.
- The cursor will appear to the right of the "-." Press the SET key and a popup menu will appear. Select a "TYPE" and press the SET key.
⇨ 00X0 will be displayed 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).

3. Move the cursor to the 2nd line using the up and down arrow keys and set the upper limit value using the left and right arrow keys. Then press the SET key. Then select a digit to change using the left and right arrow keys. Repeat this procedure to set the value to +160.0000 and then press the SET key.

+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.

+0000140.0000~+0000160.0000

    Lower limit

⇨ +0000140.0000 to +0000160.0000 will be displayed in the lower and upper limit fields.

4. Move the cursor to the "N01" line and the "TYPE" column using the up/down keys.
- As described in steps 2 to 3, enter 01Y0 to 00Y0 in the formula field, and inter +0000090.0000 to +0000095.0000 in the upper and lower limit fields.

N00	X	01X0−00X0
		+0000140.00～+0000160.00
N01	Y	01Y0−00Y0
		+0000090.00～+0000095.00

5. Move the cursor to the "①RUN 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

6. Press the ESC key to return to the "MEA-CND" setting screen.

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(4) Operation on the "OUTPUT COND" screen

1. On the "MEA CND" setting screen, press the TRG/BRT key to move the cursor to the upper function menu. Select the "COND" item and then select the "OUT" item and press the SET key.

```
MEA CND    SCREEN   COND   SAVE                    F  C1  DRK

①DTECT PRECISION STANDARD
②REGISTER NO.    00(0~15)                        ┌─────────────┐
③MODE            1P-SCH                          │IMG PRE-PROC │
④SEARCH          YES                             │REG COND     │
⑤MATCHING        AVG-GRAYS                       │EVALUATION   │
                                                 │DST&ANGL     │
                                                 │NUM-CALC     │
REGISTER NO.    00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15│OUT│
⑥MDL 0          S × × × × × × × × × × × × × × ×  └─────────────┘
⑦MDL 1          × × × × × × × × × × × × × × × ×
```
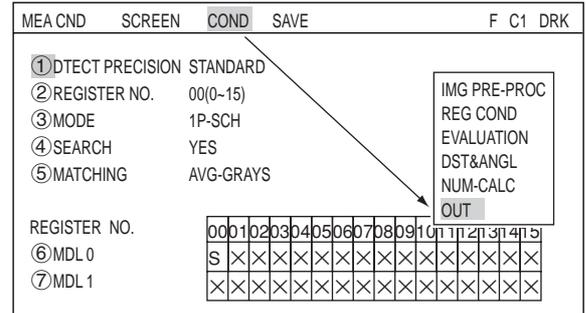
2. Select the "INPUT00" line and row 0. Then press the SET key. Select "NUM-CAL[NC]" from the popup menu and press the SET key.

```
OUTPUT COND  SCREEN  SAVE                          F  C1  BRT

                                        Column No.

          0    1    2    3    4    5    6    7   OUT

INPUT00                                          ┤├
LOGIC                                            ╫╀
INPUT01                      ┌──────────┐
LOGIC                        │MATCH M   │        ─
INPUT02                      │CRD-X     │
LOGIC                        │CRD-Y     │         ┐ L
INPUT03                      │LVL G     │        DEL
LOGIC                        │NUM-CAL[NC]│
INPUT04                      │AUX.RLY-C │
LOGIC                        └──────────┘
INPUT05
```
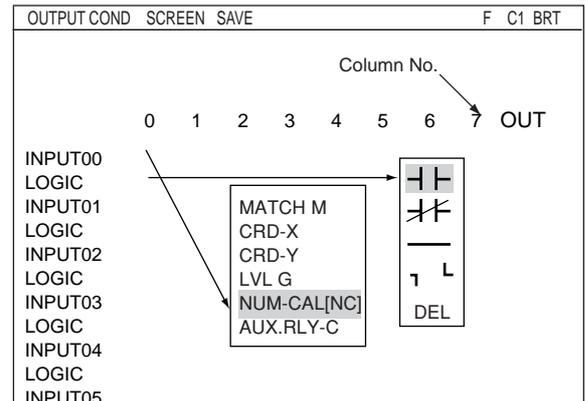
3. Move the cursor to the "LOGIC" line on the same row and press the SET key. Select "┤├" from the popup menu and press the SET key.

The logical condition will be displayed in the left most 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" screen.

4. Select the "INPUT00" line and row 1. Then press the SET key. Set "NUM-CAL[NC]" using the same procedures as in Steps 2 and 3 above. Since "N00" will appear first, press the SET key and change "N00" to "N01," using the up/down/left/right arrow keys.

```
[PAGE0]    0    1    2    3    4    5    6    7   OUTPUT
INPUT0 N00  N01
LOGIC   ┤├   ┤├   ──   ──   ──   ──   ──   ──
```

5. Move the cursor to the "OUT" row using the left and right arrow keys, and press the SET key. Select "AUX-RLY" from the popup menu and press the SET key.

6. A list of auxiliary relays will be displayed. Select "C000" using the up and down arrow 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   ┤├   ┤├   ──   ──   ──   ──   ──   ──   ◇
```

AUX-RLY	Use place
C000	MEAS1/OUTPUT COND
C001	NO
C002	NO
C003	NO
C004	NO
C005	NO
C006	NO
C007	NO

7. Press the ESC key to move to the "MEA-CND" setting screen.

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(5) Operations on the "FINAL OUTPUT COND" screen

1. Select "FINAL OUTPUT COND" on the "SELECT OBJECT TYPE COND" screen, to display the final output conditions screen.

```
SELECT OBJECT TYPE COND

 OBJECT TYPE COND
   ⊟─ TYPE00
        ├── TYPE RUN COND
        ├── IMAGE-ADJ
        ⊟── MEA-CND(CAMERA1)
             ⊞── MEAS0
             ├── POSI-CORRECT
             └── MEAS (NEW)
        ⊞── MEA-CND(CAMERA2)
        ├── FINAL NUM.CALC
        ├── FINAL OUTPUT COND
        ├── OBJ-TYPE I/O
        └── OBJ-TYPE SYS.
   └── TYPE(NEW)
```
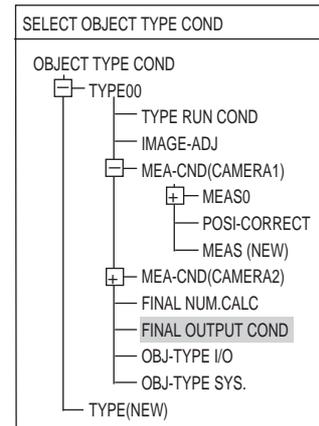
2. Move the cursor to "INPUT00" and row 0, and press the SET key. Select "AUX. RLY-C." from the popup menu and press the SET key.

```
OUTPUT COND   SCREEN  SAVE                    F  C1  BRT

                    0   1   2   3   4   5   6   7  OUT
INPUT00
LOGIC
INPUT01                    AUX.RLY-C           OUTPUT Y
LOGIC                      EXT-INP X           AUX.RLY-C
INPUT02                    TMR TM              TMR TM
LOGIC                      CNTR CN             CNTR CN
INPUT03                    AN                  DEL
LOGIC                      OUTPUT Y
INPUT04
LOGIC
INPUT05
LOGIC
INPUT06
LOGIC
INPUT07
LOGIC

SET=SELECT TYPE SEC=BACK SEL=CHNG IMG  TRG=FUNC
```
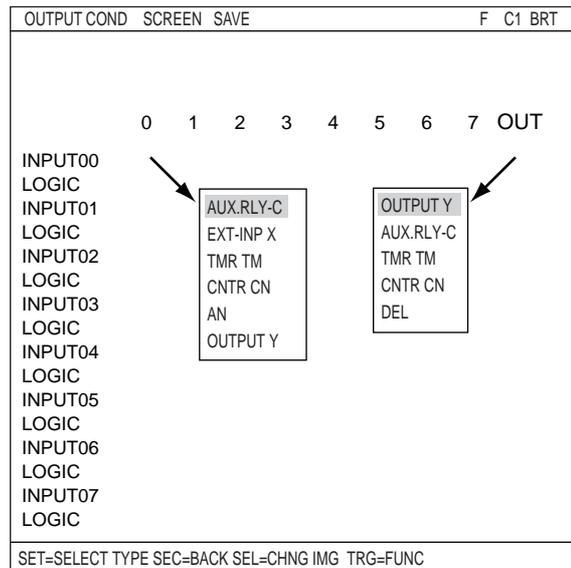
⇨ The following logical symbol will be displayed in the left most column of INPUT 0.
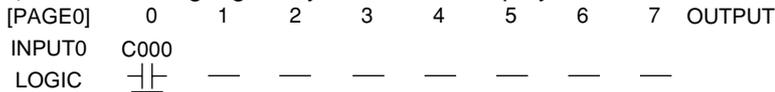
```
[PAGE0]    0    1    2    3    4    5    6    7   OUTPUT
INPUT0   C000
LOGIC    ─┤├─  ──   ──   ──   ──   ──   ──   ──
```

3. Move the cursor to the "OUT" row using the left and right arrow keys, and press the SET key. Select "OUTPUT Y" from the popup menu and press the SET key.

4. Now, a list of the Y outputs will be displayed. Select "Y0" using the up and down arrow 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   C000                                      Y00
LOGIC    ─┤├─  ──   ──   ──   ──   ──   ──   ──   ◇
```
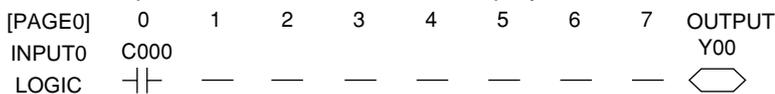
Y OUTPUT	Use place
Y0	FINAL OUTPUT COND
Y1	NO
Y2	NO
Y3	NO
Y4	NO
Y5	NO
Y6	NO
Y7	NO

5. Press the TRG/BRT key to move the cursor to the upper function menu. Then select "SCREEN" and press the SET key. Select "OPS-MENU" from the popup menu and press the SET key.
   ⇨ Select the operation screen.

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14-14

(6) Degree of match inspection

Press the TRG/BRT key, and the will calculate the X-Y coordinates of the detection points in images 0 and 1, and then evaluate and output the results.

```
(TYPE00)                              F  C1  BRT
                                           V*.**
OK
MEAS  XXXXms
MEASUREMENT 1  CHK-DEG-MATCH


REGISTER  N00(0~15)
M0=+09735      OK
X0=  090.0     OK
Y0=  092.0     OK
G0=  018.0     OK




X0~6 □□□□□□□   Y0~7 ■□□□□□□   READY □

MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE
```

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.

Output conditions

N00 N01   C000
─┤├─ ─┤├─ ─ ─ ─ ─ ─ ─ ─ ─ ─◇─

Final output conditions

C000   Y00
─┤├─ ─ ─ ─ ─ ─ ─ ─ ─ ─◇─

- 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.

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14-15

Chapter 15: PC Function

15-1 Outline

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-S30J. Then it outputs the results of the calculations performed by the circuit.

Use of the PC function enables the IV-S30J to output measurement results to an external equipment such as a lamp by itself, without the need for an external PC.

15-2 Operation cycle

The operation cycle of the IV-S30J is outlined below. This flowchart contains only the operations related to the PC function, and does not show communications with external devices.
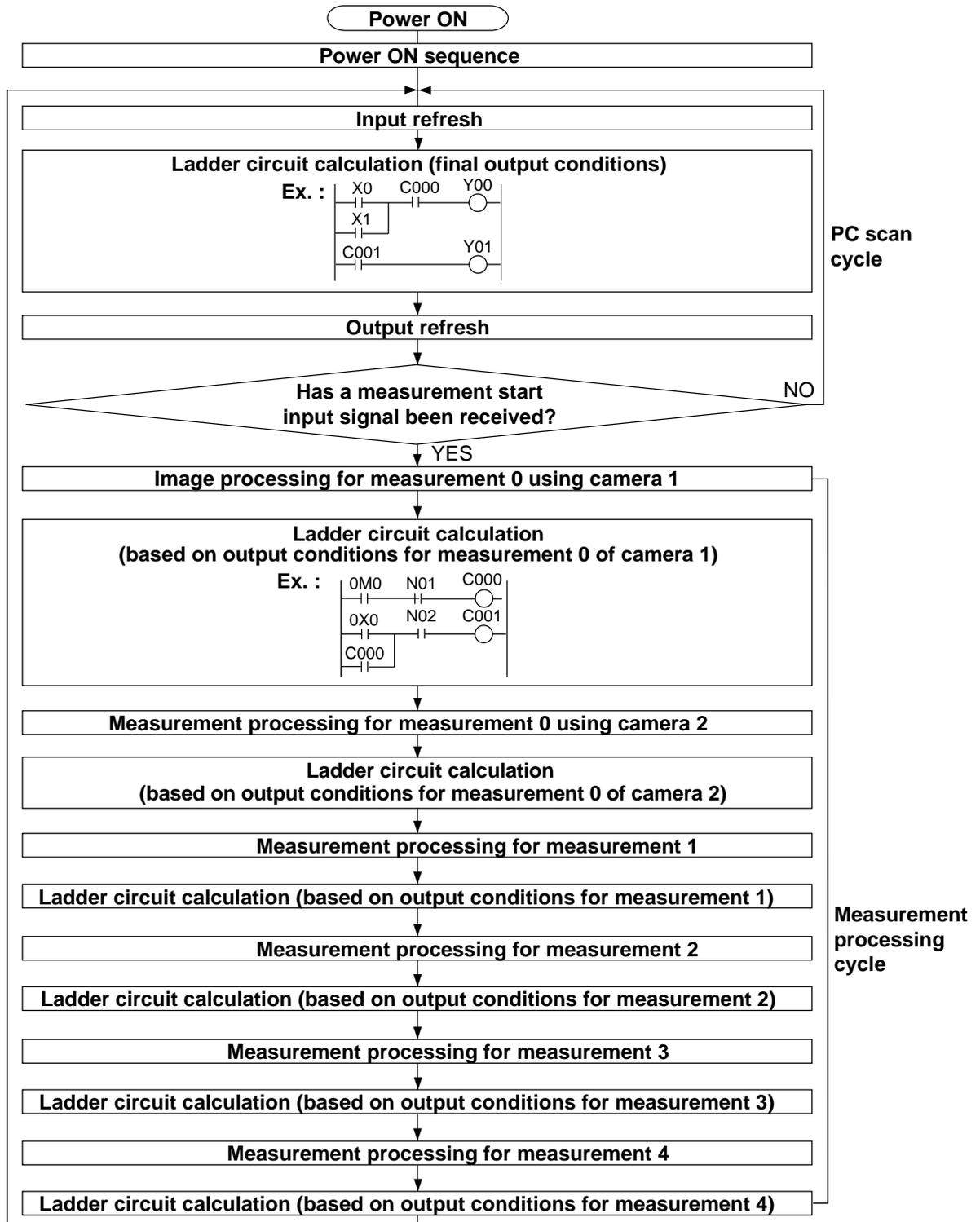
[1] Power ON sequence

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

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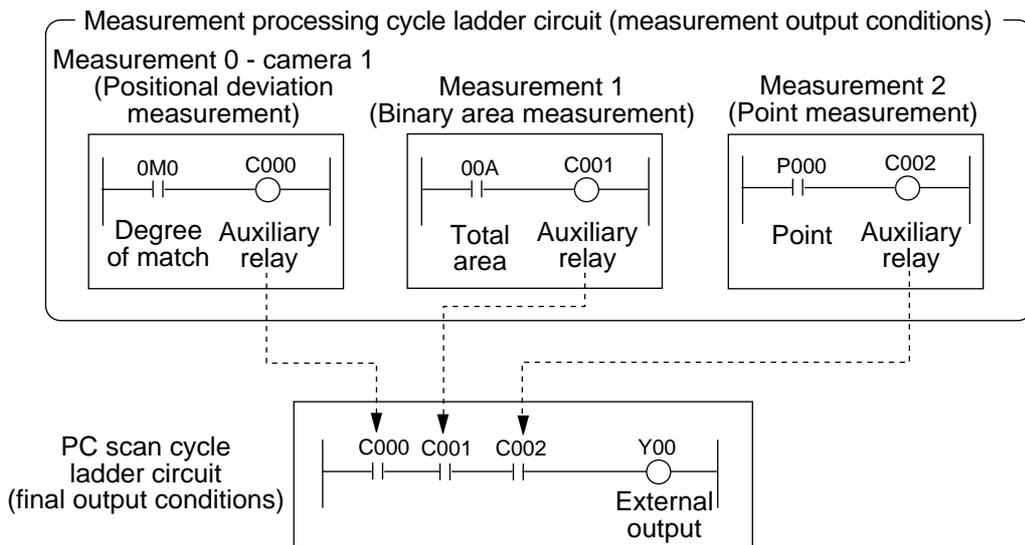
Notes

- 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.

15-3 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, 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) How to display the output conditions setting screen.

There are two methods for displaying the output conditions setting screen, as follows.

1. On the menu tree, open the sub menu at "MEAS01(POSI-DEVIATION)." Press the SET key on the "OUT-COND" line.

```
SELECT OBJECT TYPE COND                           F  C1  BRT
OBJECT TYPE COND
  ⊟─ TYPE00                              INPUT0
     ├── TYPE RUN COND                   LOGIC
     ├── IMAGE-ADJ                       INPUT1
     ⊟── MEA-CND(CAMERA1)                LOGIC
        ├── MEAS0                        INPUT2
        ├── POSI-CORRECT                 LOGIC
        ├── MEAS0(POSI-DEVIATION)        INPUT3
           ├── IMG PRE-PROC              LOGIC
           ⊟── MEAS CND                  INPUT4
              ├── REG-COND(S)            LOGIC
              └── REG-COND(S)            INPUT5
           ├── EVALUATION COND           LOGIC
           ⊞── DISTANCE&ANGLE COND       INPUT6
           ├── NUM-CALC                  LOGIC
           └── OUT-COND                  INPUT7
        └── MEAS(NEW)                    LOGIC
     ⊞── MEA-CND(CAMERA2)
     ├── FINAL NUM.CALC
     ├── FINAL OUTPUT COND
SET=TO NEXT SUB-MENU  ESC=BACK  SEL=CHNG IMG  TRG=POPUP
```

2. On the screen used for selecting the measurement program, or on the screens used for setting the measurement conditions or the register conditions, press the TRG/BRT key to move the cursor to the upper function menu. Then, move the cursor to the "COND" and press the SET key. Select "OUT" from the popup menu.
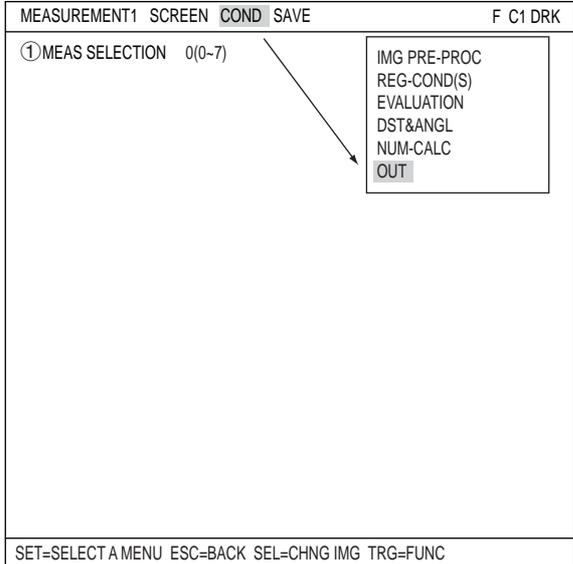
```
MEASUREMENT1  SCREEN  COND  SAVE                   F  C1  DRK
①MEAS SELECTION    0(0~7)              IMG PRE-PROC
                                       REG-COND(S)
                                       EVALUATION
                                       DST&ANGL
                                       NUM-CALC
                                       OUT




SET=SELECT A MENU  ESC=BACK  SEL=CHNG IMG  TRG=FUNC
```

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(2) How to specify the input conditions for ladder circuit diagrams

1. While "CHANGE INPUT" is selected, each press of the SET key will change the display in the left most row. The display will cycle through the following choices: "INPUT00 to INPUT07," "INPUT08 to INPUT15," and "INPUT16 to INPUT19." When the input group you want is displayed, press the down arrow key to move the cursor to the ladder circuit display section.

2. Move the cursor to a line number (INPUTxx) and a row using the up/down/left/right arrow keys, and press the SET key. Select a type to input from the popup menu.
   ⇨ The input types for each measurement program are shown on pages 16-6 to 16-7.

Note: "00M0" means the following:

```
OUTPUT COND    SCREEN SAVE                          F  C1  BRT
INPUT00-07
  CHANGE INPUT              Column No. 0 to 7
                  0    1    2    3    4    5    6    7   OUT
INPUT00          00M0
LOGIC             ┤├  ─── ─── ─── ─── ─── ─── ───
INPUT01
LOGIC
INPUT02      Row No.         ┌─────────────┐
LOGIC                        │  MATCH M    │
INPUT03                      │  CRD-X      │
LOGIC                        │  CRD-Y      │
INPUT04                      │  DEV-x      │
LOGIC                        │  DEV-y      │
INPUT05                      │  ANGL-B     │
LOGIC                        │  NUM-CAL[NC]│
INPUT06                      │  AUX.RLY-C  │
LOGIC                        └─────────────┘
INPUT07
LOGIC               This display varies with each
                    measurement program.
                    ⇨ Page 16-9 to 16-10.

SET=SELECT TYPE SEC=BACK SEL=CHNG IMG TRG=FUNC
```

Ladder circuit display area

```
            ┌─ MATCH M0         (0~1)
            │  - CRD-X          (0~1)
            │  - CRD-Y          (0~1)
00M0 ───────┤  - DEV-x0         (0~1)
            │  - DEV-y0         (0~1)
            │  - ANGL-B0        (0~1)
            │  - NUM-CAL[NC]00  (0~15)
            └─ - AUX.RLY-C000   (0~127)

            ┌─ - 0 to 3:    BGA/CSP inspection, object counting by binary conversion, object
            │               identification by binary conversion, multiple position measurement,
            │               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 selecting an input type, press the SET key and move the cursor to a logic line.

```
OUTPUT COND    SCREEN SAVE                          F  C1  BRT
INPUT00-07
  CHANGE INPUT
                  0    1    2    3    4    5    6    7   OUT
INPUT00          00M0
LOGIC             ┤├  ─── ─── ─── ─── ─── ─── ───
INPUT01
LOGIC
INPUT02
LOGIC                            ┌──────┐
INPUT03                          │ ┤├   │
LOGIC                            │ ┤╱├  │
INPUT04                          │ ──── │
LOGIC                            │   ┐L │
INPUT05                          │      │
LOGIC                            │ DEL  │
INPUT06                          └──────┘
LOGIC
INPUT07
LOGIC

SET=SELECT LOGIC SYMBOL SEC=BACK SEL=CHNG IMG TRG=FUNC
```

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4. Press the SET key and select a logic symbol from the popup menu.

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.

(3) How to specify the output conditions for ladder circuit diagrams

Move the cursor to the "OUT" row for the desired line number and press the SET key. Press the SET key while the cursor is on "AUX-RLY" and select the auxiliary relays you want to use from the table that is displayed.

Note: Only the lines which have a specified input signal can be selected for output.

Creation example:

```
        0   1   2   3   4   5   6   7   OUT
INPUT00 00M0                            C000
LOGIC  ─┤├─ ── ── ── ── ── ── ──       ⬡
```

```
OUTPUT COND    SCREEN  SAVE                    F  C1  BRT

INPUT00-07
   CHANGE INPUT
                 0   1   2   3   4   5   6   7   OUT
INPUT00        00M0
LOGIC         ─┤├── ── ── ── ── ── ── ──      [AUX-RLY]
INPUT01       ------------------------------------
LOGIC          AUX-RLY          Use place
INPUT02       ------------------------------------
LOGIC          C000             NO
INPUT03        C001             NO
LOGIC          C002             NO
INPUT04        C003             NO
LOGIC          C004             NO
INPUT05        C005             NO
LOGIC          C006             NO
INPUT06        C007             NO
LOGIC
INPUT07       ------------------------------------
```

(4) Creating a ladder circuit is complete

Create a ladder circuit for the page numbers registered in step (1), repeating the operations in steps (2) and (3).

Creation example:
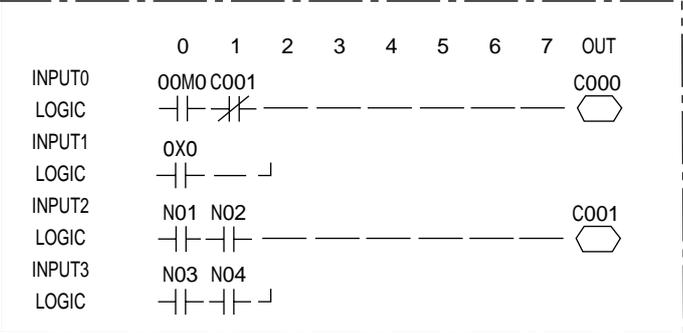
```
            0    1    2    3    4    5    6    7   OUT
INPUT0    00M0 C001                              C000
LOGIC     ─┤├─ ─/├─ ── ── ── ── ── ──           ⬡
INPUT1    0X0
LOGIC     ─┤├─ ── ┘
INPUT2    N01  N02                               C001
LOGIC     ─┤├─ ─┤├─ ── ── ── ── ── ──           ⬡
INPUT3    N03  N04
LOGIC     ─┤├─ ─┤├─ ┘
```

Note: Output relays cannot be used in series on a ladder circuit. Change circuit a to circuit b.

Circuit a ✕   Circuit b ◯

```
   C001      C010              C001        C010
  ─┤├─        ◯               ─┤├─          ◯
             C011              C001        C011
              ◯               ─┤├─          ◯
```

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15-5
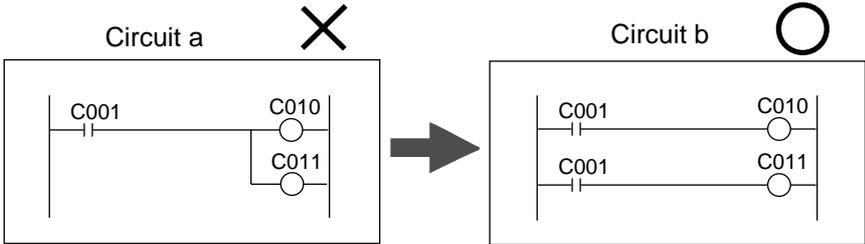
■ Kinds of input signals in each measurement program

Kind of input	Symbol	Measurement program		Lead inspection	Point measurement
		Positional deviation measurement	Degree of match inspection		
Degree of match	M	Model 0: 00M0 to 07M0 Model 1: 00M1 to 07M1	Model 0 : 00M0 to 15M0 Model 1 : 00M1 to 15M1		
Coordinate	X	Model 0: 00X0 to 07X0 Model 1: 00X1 to 07X1	Model 0 : 00X0 to 15X0 Model 1 : 00X1 to 15X1		
Coordinate	Y	Model 0: 00Y0 to 07Y0 Model 1: 00Y1 to 07Y1	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	0B to 7B			
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 2	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	Object counting by binary conversion	Object identification by binary conversion
		Area measurement by binary conversion		
Total area	A	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
Area of each label	R			0R000 to 0R127 ⋯3R000 to 3R127
Fillet diameter X	FX			
Fillet diameter Y	FY			
Distance between gravity centers X	DX			
Distance between gravity centers Y	DY			
Numerical calculation results	N	N0 to N15	N0 to N15	N0 to N15
Auxiliary relay	C	C000 to C127		

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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.

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■ 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 operation screen which correspond 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.
		    X0 C113
		    —| |——————◯—

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 operation screen will depend on the ON/OFF state of C116.
		  Ex.: "OK" is displayed on the operation screen when C000 is ON, and "NG" when the C000 is OFF.
		    C000 C116
		    —| |——————◯—
		- 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 16-14.)

* OK/NG displayed on the operation screen ⇨ See page 1-10.

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[2] A list of the "OUTPUT COND" screen displays
Shown below are the "OUTPUT COND" screen displays for each program.

(1) Positional deviation measurement
⇨ See page 15-4.

(2) Degree of match inspection

```
OUTPUT COND    SCREEN  SAVE              F  C1  BRT

INPUT00-07
  CHANGE INPUT

               0   1   2   3   4   5   6   7   OUT
INPUT00      ←
LOGIC              MATCH M
INPUT01            CRD-X
LOGIC              CRD-Y
INPUT02            LVL G
LOGIC              NUM-CAL[NC]
INPUT03            AUX.RLY-C
LOGIC
INPUT04
LOGIC
INPUT05
LOGIC
INPUT06
LOGIC
INPUT07
LOGIC

SET=SELECT TYPE SEC=BACK SEL=CHNG IMG TRG=FUNC
```

(3) Lead inspection

```
OUTPUT COND    SCREEN  SAVE              F  C1  BRT

INPUT00-07
  CHANGE INPUT

               0   1   2   3   4   5   6   7   OUT
INPUT00      ←
LOGIC              OBJ-K
INPUT01            DST-D
LOGIC              LEAD WIDTH W
INPUT02            LEAD LENGTH L
LOGIC              NUM-CAL[NC]
INPUT03            AUX.RLY-C
LOGIC
INPUT04
LOGIC
INPUT05
LOGIC
INPUT06
LOGIC
INPUT07
LOGIC

SET=SELECT TYPE SEC=BACK SEL=CHNG IMG TRG=FUNC
```

(4) Area measurement by binary conversion

```
OUTPUT COND    SCREEN  SAVE              F  C1  BRT

INPUT00-07
  CHANGE INPUT

               0   1   2   3   4   5   6   7   OUT
INPUT00      ←
LOGIC              TOTAL-AREA-A
INPUT01            NUM-CAL[NC]
LOGIC              AUX.RLY-C
INPUT02
LOGIC
INPUT03
LOGIC
INPUT04
LOGIC
INPUT05
LOGIC
INPUT06
LOGIC
INPUT07
LOGIC

SET=SELECT TYPE SEC=BACK SEL=CHNG IMG TRG=FUNC
```

15

15-9

(5) Object counting by binary conversion

```
OUTPUT COND    SCREEN  SAVE              F  C1  BRT

INPUT00-07
   CHANGE INPUT

            0    1    2    3    4    5    6    7   OUT
INPUT00          ←
LOGIC                   TOTAL-AREA-A
INPUT01                 OBJ-K
LOGIC                   NUM-CAL[NC]
INPUT02                 AUX.RLY-C
LOGIC
INPUT03
LOGIC
INPUT04
LOGIC
INPUT05
LOGIC
INPUT06
LOGIC
INPUT07
LOGIC

SET=SELECT TYPE SEC=BACK SEL=CHNG IMG TRG=FUNC
```

(6) Object identification by binary conversion

```
OUTPUT COND    SCREEN  SAVE              F  C1  BRT

INPUT00-07
   CHANGE INPUT

            0    1    2    3    4    5    6    7   OUT
INPUT00          ←
LOGIC                   TOTAL-AREA-A
INPUT01                 OBJ-K
LOGIC                   OBJECT-AREA-R
INPUT02                 NUM-CAL[NC]
LOGIC                   AUX.RLY-C
INPUT03
LOGIC
INPUT04
LOGIC
INPUT05
LOGIC
INPUT06
LOGIC
INPUT07
LOGIC

SET=SELECT TYPE SEC=BACK SEL=CHNG IMG TRG=FUNC
```

(7) Point measurement

● When "BINARY" is selected in "MODE" line.

```
OUTPUT COND    SCREEN  SAVE              F  C1  BRT

INPUT00-07
   CHANGE INPUT

            0    1    2    3    4    5    6    7   OUT
INPUT00          ←
LOGIC                   BIN-PNT-P
INPUT01                 NUM-CAL[NC]
LOGIC                   AUX.RLY-C
INPUT02
LOGIC
INPUT03
LOGIC
INPUT04
```

● When "AVG-GRAY" is selected in "MODE" line.

```
OUTPUT COND    SCREEN  SAVE              F  C1  BRT

INPUT00-07
   CHANGE INPUT

            0    1    2    3    4    5    6    7   OUT
INPUT00          ←
LOGIC                   AVG-GRAY G
INPUT01                 NUM-CAL[NC]
LOGIC                   AUX.RLY-C
INPUT02
LOGIC
INPUT03
LOGIC
INPUT04
```

(8) Multiple positional measurement

```
OUTPUT COND    SCREEN  SAVE              F  C1  BRT

INPUT00-07
   CHANGE INPUT

            0    1    2    3    4    5    6    7   OUT
INPUT00          ←
LOGIC                   OBJ-K
INPUT01                 NUM-CAL[NC]
LOGIC                   AUX.RLY-C
INPUT02
LOGIC
INPUT03
LOGIC
```

(9) Multiple degree of match inspections

```
OUTPUT COND    SCREEN  SAVE              F  C1  BRT

INPUT00-07
   CHANGE INPUT

            0    1    2    3    4    5    6    7   OUT
INPUT00          ←
LOGIC                   OBJ-K
INPUT01                 NUM-CAL[NC]
LOGIC                   AUX.RLY-C
INPUT02
LOGIC
INPUT03
LOGIC
```

15

(10) Distance and angle measurement

```
OUTPUT COND    SCREEN  SAVE              F  C1  BRT

INPUT00-07
   CHANGE INPUT

            0    1    2    3    4    5    6    7   OUT
INPUT00          ←
LOGIC                   AUX-H
INPUT01                 DST-D
LOGIC                   ANGL-B
INPUT02                 NUM-CAL[NC]
LOGIC                   AUX.RLY-C
INPUT03
LOGIC
INPUT04
LOGIC
INPUT05
LOGIC
```

[3] Procedure for creating the final output conditions in a ladder circuit

This section describes the ladder circuit creation procedures for each object type number.

(1) How to display the final output conditions setting screen

1. Select an object type from 00 to 15 on the menu tree and then move the cursor to "FINAL OUTPUT COND." Press the SET key.

```
SELECT OBJECT TYPE COND                          F  C1  BRT

OBJECT TYPE COND
  ⊟TYPE00                            INPUT0
    ─ TYPE RUN COND                  LOGIC
    ─ IMAGE-ADJ                      INPUT1
    ⊞─ MEA-CND(CAMERA1)              LOGIC
    ⊞─ MEA-CND(CAMERA2)              INPUT2
    ─ FINAL NUM.CALC                 LOGIC
    ─ FINAL OUTPUT COND              INPUT3
    ─ OBJ-TYPE I/O                   LOGIC
    └ OBJ-TYPE SYS.                  INPUT4
  └TYPE(NEW)                         LOGIC
                                     INPUT5
                                     LOGIC
                                     INPUT6
                                     LOGIC
                                     INPUT7
                                     LOGIC



SET=TO NEXT SUB-MENU  ESC=BACK  SEL=CHNG IMG  TRG=POPUP
```
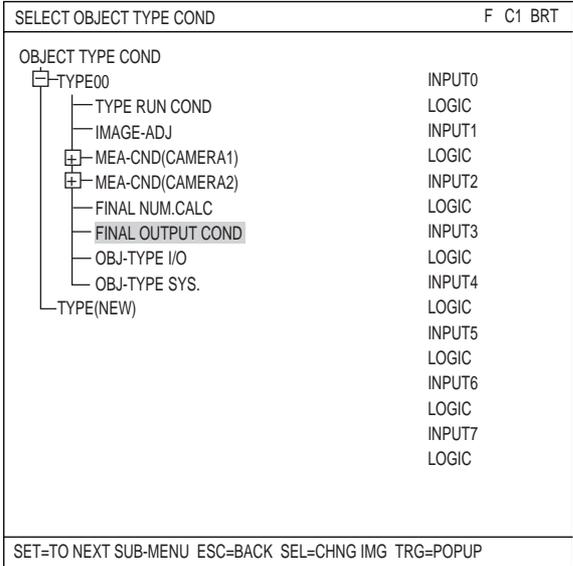
2. The "OUTPUT COND" screen will appear.
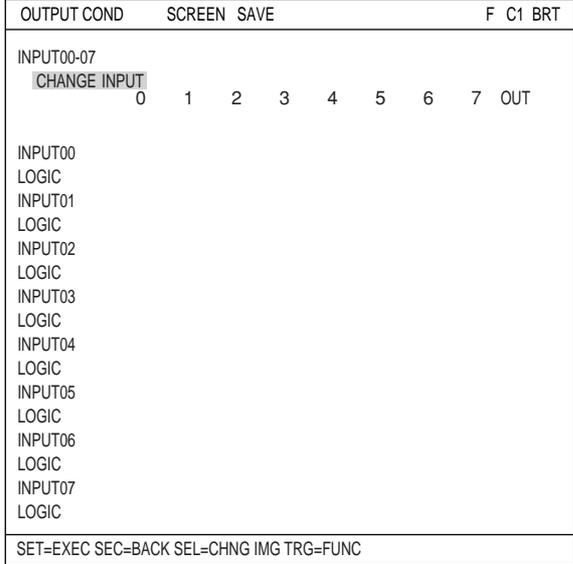
```
OUTPUT COND      SCREEN  SAVE                    F  C1  BRT

INPUT00-07
  CHANGE INPUT
           0    1    2    3    4    5    6    7   OUT

INPUT00
LOGIC
INPUT01
LOGIC
INPUT02
LOGIC
INPUT03
LOGIC
INPUT04
LOGIC
INPUT05
LOGIC
INPUT06
LOGIC
INPUT07
LOGIC

SET=EXEC SEC=BACK SEL=CHNG IMG TRG=FUNC
```

15

15-11

(2) How to specify the input conditions for ladder circuit diagrams

1. While "CHANGE INPUT" is selected, each press of the SET key will change the display in the left most row. The display will cycle through the following choices: "INPUT00 to INPUT07," "INPUT08 to INPUT15," "INPUT16 to INPUT23," and "INPUT24 to INPUT31." When the input group you want is displayed, press the down arrow key to move the cursor to the ladder circuit display section.

2. Move the cursor to a line number (INPUTxx) and a row using the up/down/left/right arrow keys, and press the SET key. Select a type to input from the popup menu.
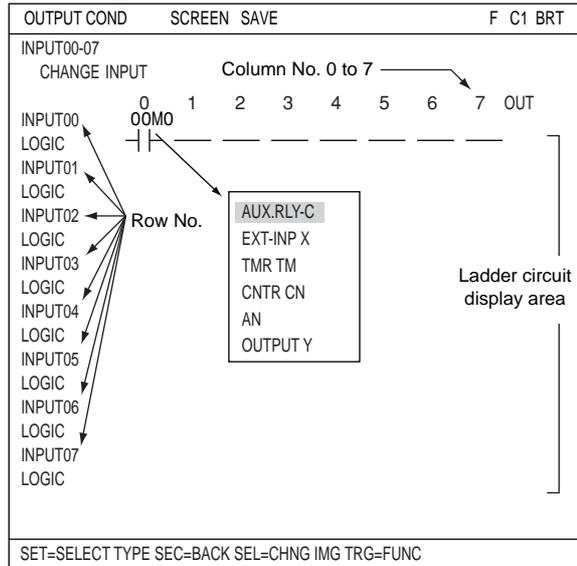
3. After selecting an input type, press the SET key and move the cursor to a logic line.

4. Press the SET key and select a logic symbol from the popup menu.

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.

15

(3) How to specify the output conditions for ladder circuit diagrams

Move the cursor to "OUT" and press the SET key. Select a target for the output signals from the popup menu. Detail of the registration table that will appear varies, depending on the target selected for output.

When "OUTPUT Y" is selected

```
OUTPUT COND    SCREEN  SAVE                      F  C1  BRT

INPUT00-07
   CHANGE INPUT
                   0   1   2   3   4   5   6   7   OUT
INPUT00        00M0
LOGIC          ┤├── ── ── ── ── ── ──       ┌─────────┐
INPUT01     ------------------------------  │ OUTPUT Y │
LOGIC                                        │ AUX-RLY-C│
INPUT02      AUX-RLY        Use place        │ TMR TM   │
LOGIC     --------------------------------   │ CNTR CN  │
INPUT03       Y0             NO              │ DEL      │
LOGIC         Y1             NO              └─────────┘
INPUT04       Y2             NO
LOGIC         Y3             NO
INPUT05       Y4             NO
LOGIC         Y5             NO
INPUT06       Y6             NO
LOGIC         Y7             NO
INPUT07     --------------------------------
LOGIC


SET=SELECT OUTPUT RELAY SEC=BACK SEL=CHNG IMG TRG=FUNC
```

When "AUX.RLY-C" is selected

```
OUTPUT COND    SCREEN  SAVE                      F  C1  BRT

INPUT00-07
   CHANGE INPUT
                   0   1   2   3   4   5   6   7   OUT
INPUT00        00M0                                  ┌──┐
LOGIC          ┤├── ── ── ── ── ── ──       ┌────────┤
INPUT01     ------------------------------  │ OUTPUT Y │
LOGIC                                        │ AUX-RLY-C│
INPUT02      Y OUTPUT        Use place       │ TMR TM   │
LOGIC     --------------------------------   │ CNTR CN  │
INPUT03       C000           NO              │ DEL      │
LOGIC         C001           NO              └─────────┘
INPUT04       C002           NO
LOGIC         C003           NO
INPUT05       C004           NO
LOGIC         C005           NO
INPUT06       C006           NO
LOGIC         C007           NO
INPUT07     --------------------------------
LOGIC


SET=SELECT OUTPUT RELAY SEC=BACK SEL=CHNG IMG TRG=FUNC
```

When "TMR TM" is selected

```
OUTPUT COND    SCREEN  SAVE                      F  C1  BRT

INPUT00-07
   CHANGE INPUT
                   0   1   2   3   4   5   6   7   OUT
INPUT00        00M0                                  ┌──┐
LOGIC          ┤├── ── ── ── ── ── ──       ┌────────┤
INPUT01     ------------------------------  │ OUTPUT Y │
LOGIC                                        │ AUX-RLY-C│
INPUT02      TM TIME REG     Use place       │ TMR TM   │
LOGIC     --------------------------------   │ CNTR CN  │
INPUT03       TM0            NO              │ DEL      │
LOGIC         TM1            NO              └─────────┘
INPUT04       TM2            NO
LOGIC         TM3            NO
INPUT05       TM4            NO
LOGIC         TM5            NO
INPUT06       TM6            NO
LOGIC         TM7            NO
INPUT07     --------------------------------
LOGIC


SET=SELECT OUTPUT RELAY SEC=BACK SEL=CHNG IMG TRG=FUNC
```

When "CNTR CN" is selected

```
OUTPUT COND    SCREEN  SAVE                      F  C1  BRT

INPUT00-07
   CHANGE INPUT
                   0   1   2   3   4   5   6   7   OUT
INPUT00        00M0                                  ┌──┐
LOGIC          ┤├── ── ── ── ── ── ──       ┌────────┤
INPUT01     ------------------------------  │ OUTPUT Y │
LOGIC                                        │ AUX-RLY-C│
INPUT02      TM TIME REG     Use place       │ TMR TM   │
LOGIC     --------------------------------   │ CNTR CN  │
INPUT03       CN0            NO              │ DEL      │
LOGIC         CN1            NO              └─────────┘
INPUT04       CN2            NO
LOGIC         CN3            NO
INPUT05       CN4            NO
LOGIC         CN5            NO
INPUT06       CN6            NO
LOGIC         CN7            NO
INPUT07     --------------------------------
LOGIC


SET=SELECT OUTPUT RELAY SEC=BACK SEL=CHNG IMG TRG=FUNC
```

15

Creation example:

```
              0   1   2   3   4   5   6   7   OUT
INPUT00     00M0                               C000
LOGIC       ┤├── ── ── ── ── ── ── ──         <>
```

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.]** C001 —][— ——— TM0 ← Timer instruction / 0250 ← Timer set value (2.5 sec.) TM0 —][— ——— Y00 ← Output instruction (external output) └ Timer terminal C001 ⎓ 2.5 sec. ⎓ 2.5 sec. TM0 [Y00]
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.]** C002 —][— ——— CN0 ← Counter instruction / 0003 ← Counter set value X5 —][— ——— C120 ← Resetting the CN0 CN0 —][— ——— Y01 ← Output instruction (external output) └ Counter terminal X5 [C120] C002 _⎮‾⎮_1_2_3_4_5 CN0 [Y01]
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.

15

(4) Creating a ladder circuit is complete

Create a ladder circuit for the page numbers registered in step (1), repeating the operations in steps (2) and (3).

```
                0   1   2   3   4   5   6   7   OUT
INPUT0       C000 C001                          Y00
LOGIC         ─┤├─ ─┤╱├─ ── ── ── ── ── ──      �ç◊
INPUT1         X0
LOGIC         ─┤├─ ┘
INPUT2       C001  X1                           TM0
LOGIC         ─┤├─ ─┤├─ ── ── ── ── ── ──       0150
INPUT3       TM0                                Y01
LOGIC         ─┤├─ ── ── ── ── ── ── ──         �ç◊
```

Note: Output relays cannot be used in series on a ladder circuit. Change circuit a to circuit b.

Circuit a   ✕

```
   C001              C010
   ─┤├─────────────── ─◯─
                     C011
                      ─◯─
```

Circuit b   ◯

```
   C001              C010
   ─┤├─────────────── ─◯─
   C001              C011
   ─┤├─────────────── ─◯─
```

15
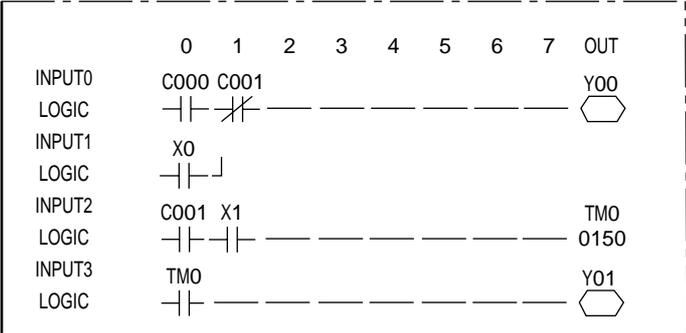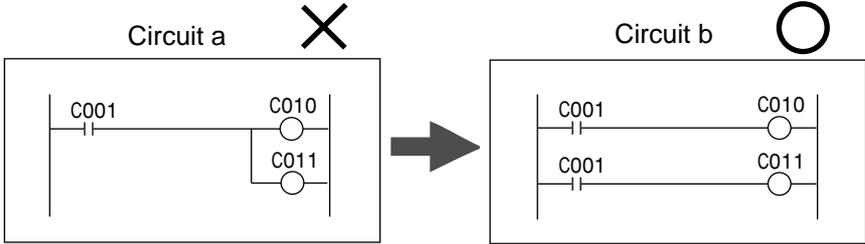
15-4 Program examples (shape and positional deviation inspection)

(1) 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)

Object to be measured

Reference image registration window

Search area

Shape NG
(degree of match NG)

Positional deviation NG
(X coordinate, Y coordinate NG)

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
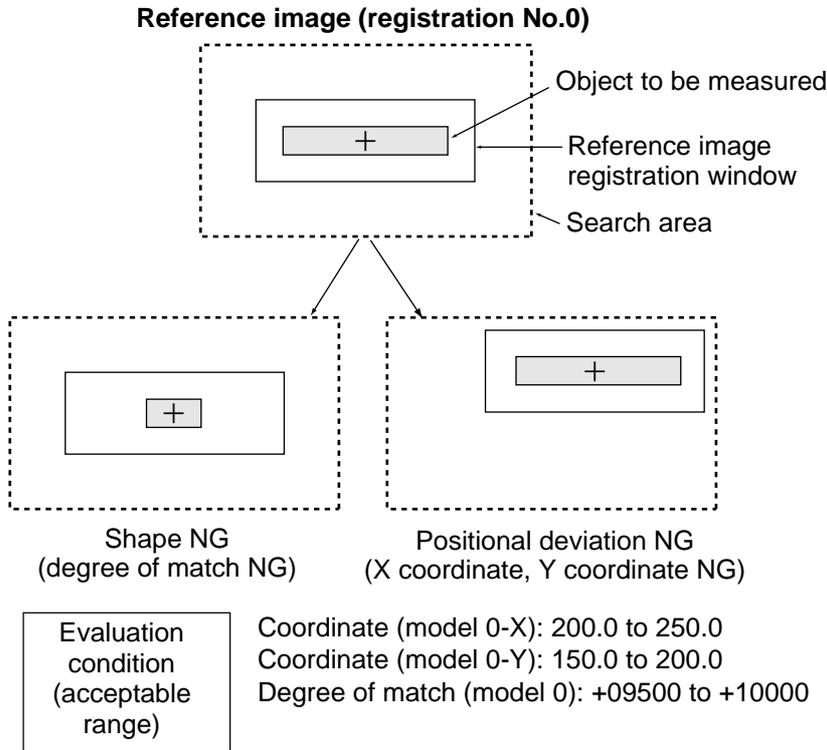
(2) Output conditions and ladder circuit for measurement 0 using camera 1

When the X coordinate, Y coordinate and degree of match are within acceptable ranges, the auxiliary relay C000 is turned ON.
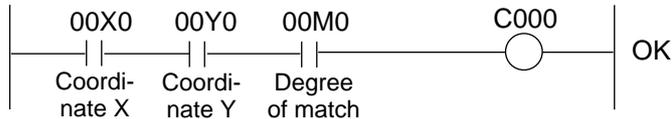
(3) Final output conditions and ladder circuit
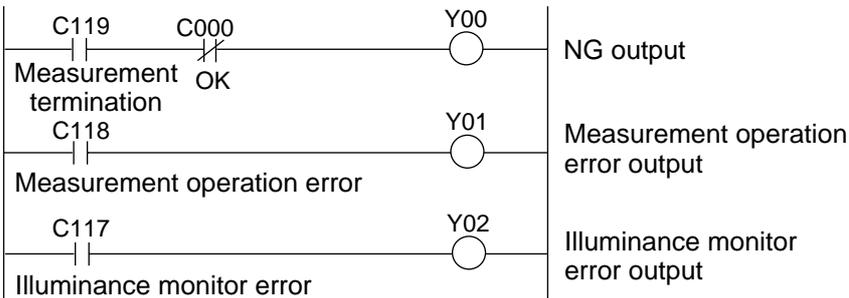
15-5 Examples of a final output conditions ladder circuit

(1) Circuit for keeping the external output ON until the next external trigger is received

```
        C119            C000              Y00
     ───┤ ├───────────┤/├──────────────( )──────   NG output
     Measurement        OK
     termination
```

```
External trigger input ____▨▨_____▨▨_____

READY               _____▨▨▨▨▨▨▨▨▨_____▨▨▨▨▨

External output                      ▨▨▨▨▨▨
  (Y00)             _____▨▨▨▨▨▨_____
```
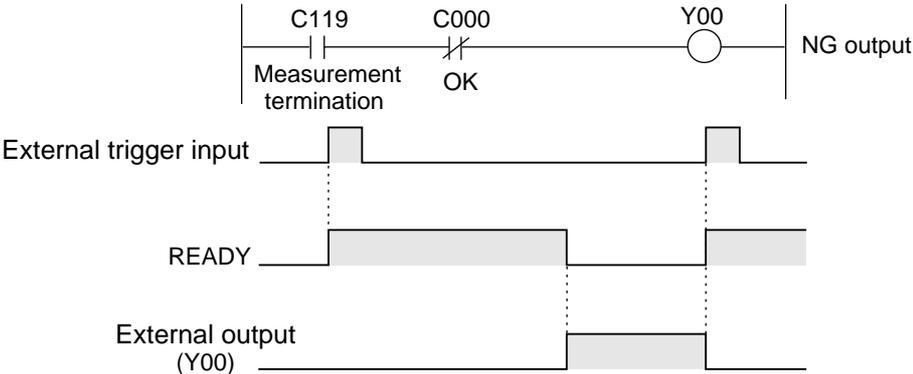
(2) Circuit for controlling the ON time of the external output using the timer

```
        C119                          TM0
     ───┤ ├────────────────────────── 0010 ──────   10ms×10＝100ms
     Measurement
     termination
        C119   C000      TM0           Y00
     ───┤ ├───┤/├───────┤/├──────────( )──────   NG output
               OK
```

```
External trigger input ____▨▨_____▨▨_____

READY               _____▨▨▨▨▨▨▨▨▨_____▨▨▨▨▨

                                   |─ 100ms ─|
External output                      ▨▨▨▨▨
  (Y00)             _____▨▨▨▨▨_____
```
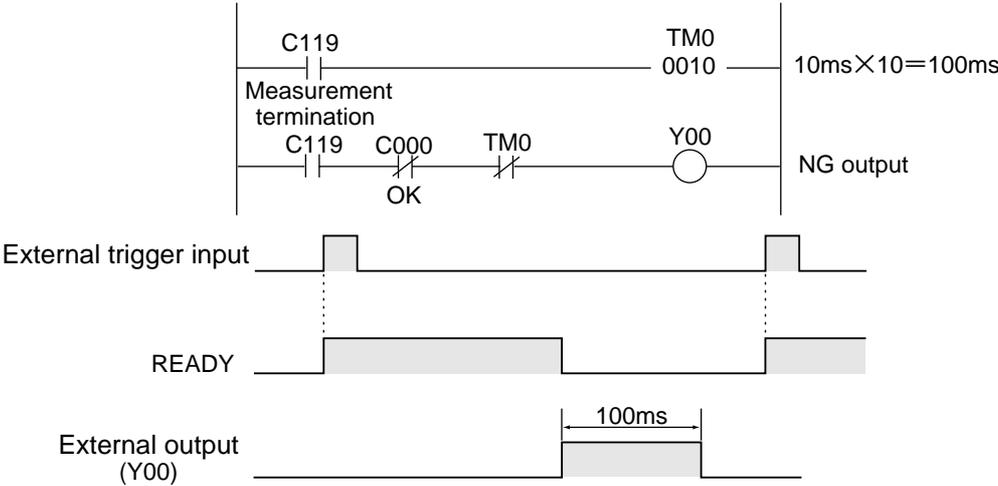
(3) An example of a circuit that can output a signal when the IV-S30 is operating normally.

```
        C110                          Y00
     ───┤/├──────────────────────────( )──────   Output while operation is normal
     Normally OFF
```

```
    Start the system      System error      Restart the system

Y00 _____▨▨▨▨▨▨▨▨▨▨▨_____▨▨▨▨▨▨▨

          The system will restart automatically
               if it detects a system error.
```

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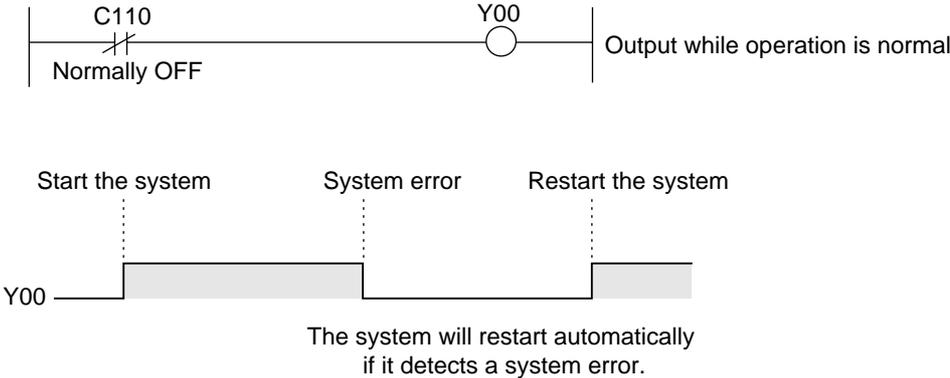
15-6 PC monitor screen

Move the cursor to "SCREEN-CHG" on the operation screen and press the SET key. A popup menu will appear and you can select "PC-MNTR" or "PC-MNTR 2", and press the SET key. Then the PC monitor screen will be displayed.
However, before you can display this screen, you have to set "YES" on the "⑨PC-MNTR" on the "TYPE RUN COND" menu.
⇨ See page 2-11.

```
(TYPE00)                                      F  C1  DRK
OK
MEAS  XXXXms
①→  X00～ 06 ☐☐☐☐☐☐☐
②→  Y000～007 ☐☐☐☐☐☐☐☐    READY▮
③→  C000～007 ☐☐☐☐☐☐☐☐

④→  [NUMERIC CALC]        [TMR]        [CNTR]
⑤    AN00=NOT SET         TM0:NOT SET  CN0:NOT SET
⑥    AN01=NOT SET         TM1:NOT SET  CN1:NOT SET
     AN02=NOT SET         TM2:NOT SET  CN2:NOT SET
     AN03=NOT SET         TM3:NOT SET  CN3:NOT SET
     AN04=NOT SET         TM4:NOT SET  CN4:NOT SET
     AN05=NOT SET         TM5:NOT SET  CN5:NOT SET
     AN06=NOT SET         TM6:NOT SET  CN6:NOT SET
     AN07=NOT SET         TM7:NOT SET  CN7:NOT SET

                                        OPS-MAIN
                                        PC-MNTR 2
⑦
MNU-CHG MAIN-COND SEL-OUT SEL-AUX SEL-NUM SCREEN-CHG CHG-TYPE
```

Change the output relay address   Change the auxiliary relay address   Change the final numerical calculation address

① The ON (▮) or OFF (☐) status of the input relays (X00 to X07) is displayed.

②The 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.
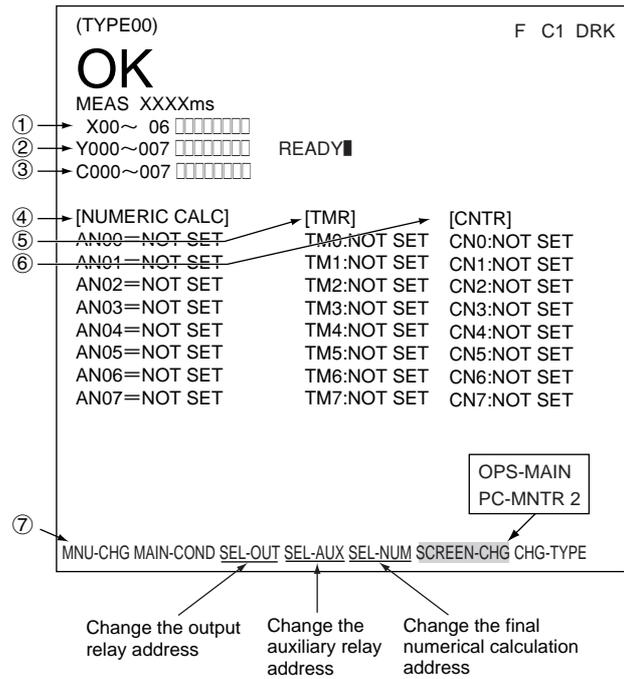
⑦ Menu bar

Menu bar	Description
SEL-OUT	Change the output relay address (Y00 to Y15) with the up and down keys (in units of 8 points).
SEL-AUX	Change the auxiliary relay address (C000 to C127) with the up and down keys (in units of 8 points).
SEL-NUM	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 operation screen. ⇨ See page 1-10.

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Chapter 16: Setting the Input/Output Conditions

16-1 Outline

This section describes the input and output settings on the IV-S30J when connecting it for communication with other equipment (a personal computer or a programmable controller).

■ How to display the "I/O CONDITIONS" setting screen

To display the "I/O CONDITIONS" screen, select "MAIN COND" -> "SYS-CND" -> "I/O CONDITIONS," in that order.

```
SELECT SYSTEM COND                          F  C1 BRT

SYS-CND
    ─I/O CONDITIONS                    ①MEAS INP I/F
    ─COMM.SET                          ②OUT I/F(PARAL.)
    ─COMPUTER LINK                     ③MANL TYPE CHNG
    ─GAIN-OFFSET                       ④PARALLEL INP X5
                                       ⑤PARALLEL INP X6
                                       ⑥STROBE OUT
                                       ⑦'READY'ON
```

■ How to set the input and output conditions

The items you will need to set depend on whether you selected "PARALLEL+SERIAL" or "TRIG CCD START" on the "①MEAS INP I/F" line.

```
I/O CONDITION      SCREEN  COND  SAVE          F  C1 BRT

①MEAS INP I/F         PARALLEL+SERIAL

②OUT I/F(PARAL.)      NO                      ┌─────────────────┐
③MANL TYPE CHNG       NO                      │ PARALLEL+SERIAL │
④PARALLEL INP X6      EXT-INP                 │ TRIG CCD START  │
                                              └─────────────────┘
⑤PARALLEL INP X7      EXT-INP
⑥STROBE OUT           NO
⑦'READY'ON            CAPTURE COMPLETE
```

● When you want to select the " PARALLEL +SERIAL" on the "MEAS INP I/F" line.

① MEAS INP I/F

Select "PARALLEL+SERIAL" for the interface, in order to allow an external device to provide trigger signals for the IV-S30J.

```
I/O CONDITION      SCREEN  COND  SAVE          F  C1 BRT

①MEAS INP I/F         PARALLEL+SERIAL              ┌──────┐
                                                   │ NO   │
②OUT I/F(PARAL.)      NO                 ┌────┐    │ PC-LINK │
③MANL TYPE CHNG       NO                 │ NO │    │ SERIAL │
④PARALLEL INP X5      EXT-INP            │ YES│    └──────┘
                                         └────┘  ┌──────────────┐
⑤PARALLEL INP X6      EXT-INP                    │ EXT-INP      │
⑥STROBE OUT           NO                         │ REG REF      │
⑦'READY'ON            CAPTURE COMPLETE           │ COMRARE-IMGS │
                                                 │ AREA EVAL CORECT │
          ┌──────┐                               └──────────────┘
          │ NO   │                               ┌──────────────┐
          │ Y0   │                               │ EXT-INP      │
          │ Y1   │        ┌──────────────┐       │ CHNG-IMG-OUT-CAM │
          │ Y2   │        │ CAPTURE COMPLETE │   │ CAM-MEAS     │
          │ Y3   │        │ MEAS-COMPLETE │       │ 2 IMAGES     │
          │ Y4   │        └──────────────┘       └──────────────┘
          │ Y5   │
          │ Y6   │
          │ Y7   │
          └──────┘

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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16-1

② **OUT I/F(PARAL.)**
Select a signal output interface, in order to output the measured results externally. The choices are: "NO," "PC-LINK" or "SERIAL."

NO	No connection. (No output.)
PC-LINK	Connect to the parallel input on a programmable controller.
SERIAL	Connect to a standard serial port.

③ **MANL TYPE CHNG**
The object type can be changed manually using the remote keypad on the operation screen.

NO	Means that you cannot change the object type manually on the operation screen.
YES	Means that you will be allowed to change the object type manually on the operation screen. Move the cursor to the "CHG-TYPE" item on the operation screen, and select the object type No., displayed on the upper part of the screen, using the up and down keys. ⇨ See page 1-10.

④ **PARALLEL INP X5**
Select the type of input terminal (INPUT) X5.

EXT-INP	External input: The PC function uses the terminal as an external input signal. ⇨See Chapter 15.
REG REF	When X5 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" (X5 reference image register error (code3E)) will occur.
COMPARE-IMGS	On the operation screen, when parallel input X5 is turned ON, the controller will transfer a previously registered reference image into its flash memory for use in performing calculations that compare images.
AREA EVAL CORECT	Total area evaluation correction - When X5 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

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⑤ **PARALLEL INP X6**

Select the type of input terminal (INPUT) X6.

Input/output condition	Setting details
EXT-INP	The PC function uses the terminal as an external input signal. ⇨ See Chapter 15.
CHNG-IMG-OUT-CAM	- Every time X6 is switched from OFF to ON, the selected camera will change. ⇨ page 2-4. - When the object type measurement condition is "CAMERA 1" only. "CAMERA 2" only, you are not allowed to change the camera used for output.
CAM-MEAS	- On starting a measurement, if X6 is OFF "CAMERA 1" will execute the measurement, and if X6 is ON Camera 2 will execute the measurement.
2 IMAGES	- 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. Camera 1 — Through image Camera 2 — Through image / Freeze image Overlap input X6 Monitor output — Camera 2 × Overlapped image

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

Note: When you want to use the strobe output, specify a shutter speed between 1/30 and 1/250 seconds.

■ **Strobe output timing**

Shutter

Minimum 4 ms (1/250 sec.)

Strobe output (Y*)

Maximum 2 ms
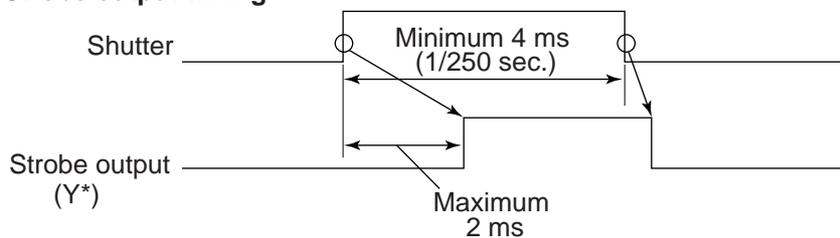
⑦ **'READY'ON**

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.)

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.

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● **When you want to select the "TRIG CCD START" on the "MEAS INP I/F" line.**
The display details and items offered for selection on line ③ will depend on the selections made on the "②START CCD SAMPL" line.

● **When "AUTO(EDGE or LEVEL)" is selected**

```
I/O CONDITION        SCREEN  COND  SAVE                F  C1  BRT

①MEAS INP I/F        TRIG CCD START                    AUTO(EDGE)
②START CCD SAMPL     AUTO(EDGE)                         AUTO(LEVEL)
③OUTPUT OBJ TYPE     PARALLEL  ──►      PARALLEL        PARALLEL
④MANL TYPE CHNG      NO                 SERIAL          SERIAL
⑤PARALLEL INP X5     EXT-INP
                                        NO
                                        YES
⑥PARALLEL INP X6     EXT-INP
⑦'READY'ON           NO

         NO                EXT-INP            EXT-INP
         Y0                CHNG-IMG-OUT-CAM   REG REF
         Y1                CAM-MEAS           COMRARE-IMGS
         Y2                2 IMAGES           AREA EVAL CORECT
         Y3
         Y4
         Y5
         Y6
         Y7

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

● **When "PARALLEL" is selected**

```
I/O CONDITION        SCREEN  COND  SAVE                F  C1  BRT

①MEAS INP I/F        TRIG CCD START                    AUTO(EDGE)
②START CCD SAMPL     PARALLEL                           AUTO(LEVEL)
③OUTPUT OBJ TYPE     PC-LINK                            PARALLEL
④MANL TYPE CHNG      NO                                 SERIAL
⑤PARALLEL INP X5     EXT-INP
                                        NO              NO
                                        YES             PC-LINK
⑥PARALLEL INP X6     EXT-INP                            SERIAL
⑦'READY'ON           NO

         NO                EXT-INP            EXT-INP
         Y0                CHNG-IMG-OUT-CAM   REG REF
         Y1                CAM-MEAS           COMRARE-IMGS
         Y2                2 IMAGES           AREA EVAL CORECT
         Y3
         Y4
         Y5
         Y6
         Y7

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

● **When "SERIAL" is selected**

```
I/O CONDITION        SCREEN  COND  SAVE                F  C1  BRT

①MEAS INP I/F        TRIG CCD START                    AUTO(EDGE)
②START CCD SAMPL     SERIAL                             AUTO(LEVEL)
                                                        PARALLEL
③MANL TYPE CHNG      NO                                 SERIAL
④PARALLEL INP X5     EXT-INP
                                        NO
                                        YES
⑤PARALLEL INP X6     EXT-INP
⑥'READY'ON           NO

         NO                EXT-INP            EXT-INP
         Y0                CHNG-IMG-OUT-CAM   REG REF
         Y1                CAM-MEAS           COMRARE-IMGS
         Y2                2 IMAGES           AREA EVAL CORECT
         Y3
         Y4
         Y5
         Y6
         Y7

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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The details of the individual items on the "I/O CONDITION" menu are the same as described on pages 16-1 to 16-3.

16-2 Measurement start input and result output settings

The combinations of various settings for item "①MEAS INP I/F," item "②START CCD SAMPL," and item "②(③)OUT I/F (PARAL.)" on the "I/O CONDITIONS" screen (page 16-1 to 4) are explained below.

Measurement start input interface   **Result output**

- Parallel ──────┬── Parallel → (1)
　　　　　　　　　├── Computer link/parallel → (2)
　　　　　　　　　└── General purpose serial/parallel → (3)

- General purpose serial ──── General purpose serial/parallel → (4)

- CCD trigger ──┬

Start sampling　　　**Object type change**　　　**Result output**

Parallel ──────── (Parallel) ──┬── Parallel → (5)
　　　　　　　　　　　　　　　├── Computer link/parallel → (6)
　　　　　　　　　　　　　　　└── General purpose serial/parallel → (7)

General purpose serial ── (General purpose serial) ── General purpose serial/parallel → (8)

Auto ──┬── Parallel ──── Parallel → (9)
　　　　└── General purpose serial ── General purpose serial/parallel → (10)

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

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(1) Measurement start input = parallel, object type change = parallel, result output = parallel

■ **Setting order** ① (→ ②)

[I/O CONDITIONS]
① MEAS INP I/F → PARALLEL+SERIAL
TRIG CCD START

② OUT I/F(PARAL.) → NO
PC-LINK
SERIAL

■ **Configuration example**

Camera 1 (image capturing)

Camera 2 (image capturing)

Remote keypad

Monitor

Controller

Power supply
(24 V DC)

Warning lamp

External output
(Y0 to Y7)

External trigger X0
(photo sensor or
proximity sensor)

Type selection switch
⇨ See page 16-5.
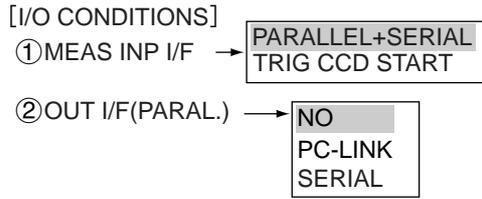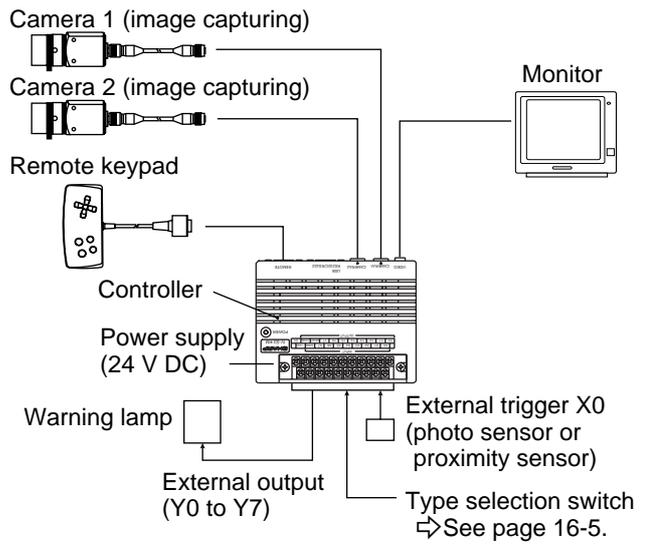
- The conditions for outputting the results to the output signals Y0 to Y7 are set by the PC function. (See "Chapter 15 PC Function.")

■ **Time chart**

10 ms
or more

Measurement
start input
(X0)

10 ms
or more

10 ms
or more

Type selection
input

Specified object type number   Specified object type number

READY output
When you set the READY
ON signal to "CAPTURE
COMPLETE."
⇨ See page 16-3.

Image capture | Image disposition | End of the measurement

When you set the
READY ON signal to
"MEAS COMPLETE."
⇨ See page 16-3.

Image capture | Image disposition

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PC calculation condition

| P C | P C | P C | P C | Halt PC operation during measurement | P C | P C | P C | P C | P C | P C | P C | P C | Halt PC operation during measurement | P C | P C | P C | P C | P C |

When the object type is
changed, all Y output and
auxiliary relays turn OFF.

Parallel output is valid for PC control
after the measurement result is
determined.

Parallel output
(Y0 to Y7)

Result output   Result output

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
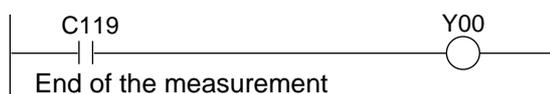
C119   Y00

End of the measurement

16-6

(2) Measurement start input = parallel, object type change = parallel, result output = computer link/parallel

■ **Setting order** ① (→ ②)

[I/O CONDITIONS]
①MEAS INP I/F →
PARALLEL+SERIAL
TRIG CCD START

②OUT I/F(PARAL.) →
NO
PC-LINK
SERIAL

■ **Configuration example**

Camera 1 (image capturing)

Camera 2 (image capturing)

Monitor

Remote keypad

Data
(Computer link)

Controller

Power supply
(24 VDC)

Programmable
controller

Object type change
(parallel IF)

⇨See page 16-5.

External trigger X0
(photo sensor or
proximity sensor)
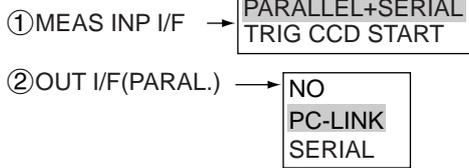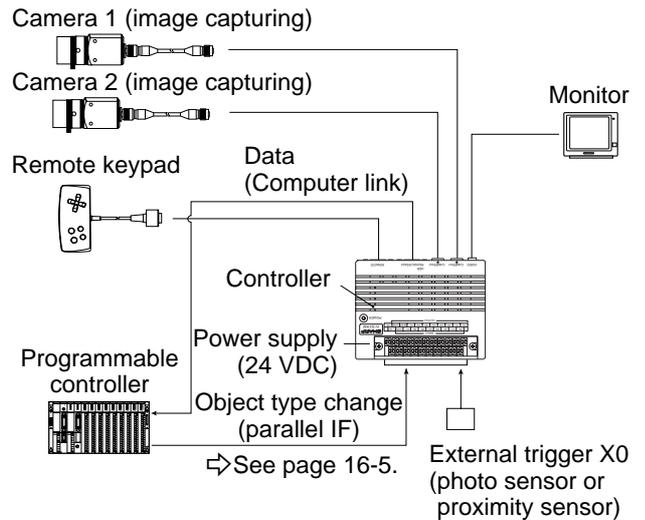
- The data in a specified block No., set in item "⑤SET SERIAL BLOCK" on the "OBJ-TYPE I/O" screen, will be output through the computer link. ⇨ See page 16-23.

■ **Time chart**

10 ms
or more

Measurement
start input
(X0)

10 ms
or more

10 ms
or more

Type selection
input
⇨ See page
16-5.

Specified object type number

Specified object type number

READY output
(While measuring or setting = L)

ⓐ READY signal is turned ON at the conclusion of the result output.

Terminate
measurement
(C119)

Measurement result is valid at the end of a measurement

PC calculation
condition

P|P|P|P| Halt PC operation during measurement

P|P|P|P|P|P|P|P| Halt PC operation during measurement

P|P|P|P|P|P

When the object type is changed, all Y output and auxiliary relays turn OFF.

Parallel output is valid for PC control after the measurement result is determined.

Parallel output
(Y0 to Y7)

Result output

Result output

ⓐ

Computer link output

Result
output

Result
output

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When a Sharp PC is used, a write enable command (EWR) is transmitted from the IV-S30J to the PC in the following cases.
- When the power is applied to the IV-S30J.
- 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 "OUT I/F (PARAL.)" to the "COMPUTER LINK."

(3) Measurement start input = parallel, object type change = parallel, result output = general purpose serial/parallel

■ **Setting order** ① (→ ②)

[I/O CONDITIONS]
①MEAS INP I/F →

| PARALLEL+SERIAL |
| TRIG CCD START |

②OUT I/F(PARAL.) →

| NO |
| PC-LINK |
| SERIAL |

■ **Configuration example**

Camera 1 (image capturing)

Camera 2 (image capturing)

Monitor

Personal computer

Data

Controller

Power supply (24 VDC)

Type selection switch
⇨ See page 16-4

External trigger X0
(photo sensor or
proximity sensor)
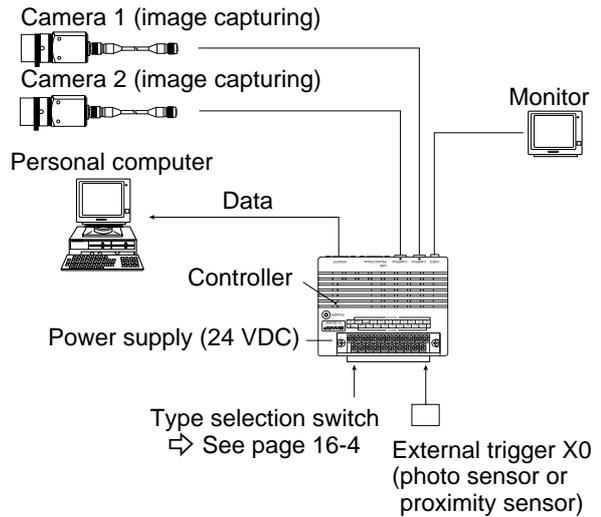
- The data in a block No., set in item "⑤SET SERIAL BLOCK" on the "OBJ-TYPE I/O" screen, will be output from the IV-S30J to the personal computer. ⇨ See page 16-23.

■ **Time chart**

10 ms
or more

Measurement
start input
(X0)

10 ms
or more

10 ms
or more

Type selection
input
⇨ See page
16-5.

Specified object type number

Specified object type number

READY output
(While measuring or setting = L)

ⓐ READY signal is turned ON at the conclusion of the result output.

Terminate
measurement
(C119)

Measurement result is valid at the end of a measurement

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PC calculation
condition

| P | P | P | P | Halt PC operation during | P | P | P | P | P | P | P | P | Halt PC operation during | P | P | P | P | P | P |
| C | C | C | C | measurement | C | C | C | C | C | C | C | C | measurement | C | C | C | C | C | C |

When the object type is changed, all Y output and auxiliary relays turn OFF.

Parallel output is valid for PC control after the measurement result is determined.

Parallel output
(Y0 to Y7)

Result output

Result output

ⓐ

Serial output

Result
output

Result
output

Note - Result output: The data to be sent to the personal computer will be response of general-purpose serial command (code 11(H)).

(4) Measurement start input = general-purpose serial, object type change = general-purpose serial, result output = general-purpose serial/parallel

■ Setting order ① (→ ②)

[I/O CONDITIONS]

①MEAS INP I/F → PARALLEL+SERIAL
TRIG CCD START

■ Configuration example

Camera 1 (image capturing)

Camera 2 (image capturing)

Personal computer

Command, response

Monitor

Remote key pad

Controller

Power supply (24 VDC)
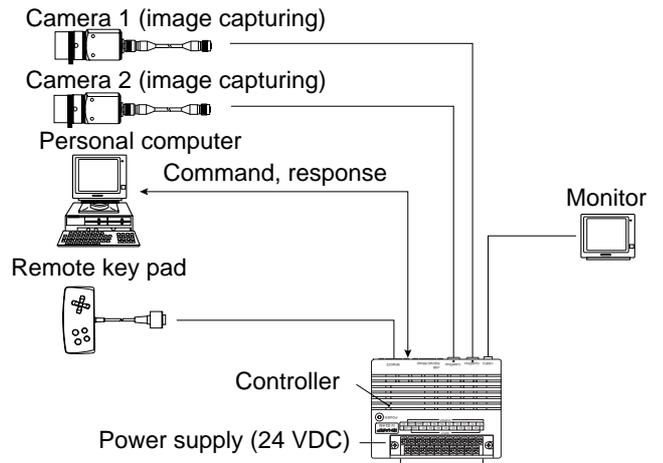
- See Chapter 17: Communications (General Purpose Serial Interface for details about the measurement execution commands (codes 10,11,12 and 14(H)).

■ Time chart

(5) Measurement start input = CCD trigger, start sampling = parallel, object type change = parallel, result output = parallel

■ **Setting order** ① → ② (→ ③)

①MEAS INP I/F →
PARALLEL+SERIAL
TRIG CCD START

②START CCD SAMPL →
AUTO(EDGE)
AUTO(LEVEL)
PARALLEL
SERIAL

③OUT I/F(PARAL.) →
NO
PC-LINK
SERIAL

■ **Configuration example**

Camera 1 (image capturing + CCD trigger)

Camera 2 (image capturing)

Monitor

Remote keypad

Controller

Power supply (24 VDC)

Warning lamp

External output (Y0 to Y7)

Start sampling input X0 (photo sensor or proximity sensor)

Type selection switch ⇨See page 16-5.

Note 1: When the settings listed in section "16-3 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 operation screen.
2. After the measurement is terminated, the sampling will be restarted when the X0 terminal is changed from OFF to ON.

■ **Time chart**

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16-10

(6) Measurement start input = CCD trigger, start sampling = parallel, object type change = parallel, result output = computer link/parallel

When the start sampling input (X0) is turned ON, the CCD trigger is enabled. (Sampling starts)

■ **Setting order** ① → ② (→ ③)

① MEAS INP I/F →
```
PARALLEL+SERIAL
TRIG CCD START
```

② START CCD SAMPL →
```
AUTO(EDGE)
AUTO(LEVEL)
PARALLEL
SERIAL
```

③ OUT I/F(PARAL.) →
```
NO
PC-LINK
SERIAL
```
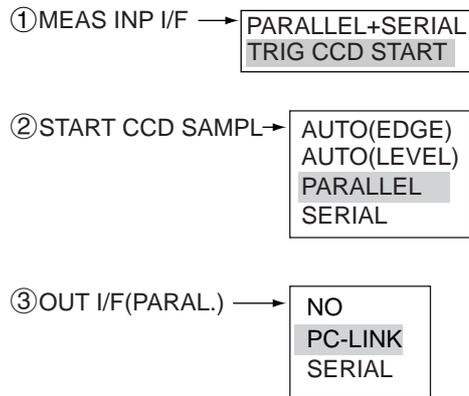
■ **Configuration example**

Note 1: When the settings listed in section "16-3 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 operation screen.
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-S30J to the PC in the following cases.
- When the power is applied to the IV-S30J.
- 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 "OUT I/F (PARAL.)" to the "COMPUTER LINK."

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(7) Measurement start input = CCD trigger, start sampling = parallel, object type change = parallel, result output = general purpose serial/parallel
When the start sampling input (X0) is turned ON, the CCD trigger is enabled. (Sampling starts)

■ **Setting order** ① → ② (→ ③)

① MEAS INP I/F →
| PARALLEL+SERIAL |
| TRIG CCD START |

② START CCD SAMPL →
| AUTO(EDGE) |
| AUTO(LEVEL) |
| PARALLEL |
| SERIAL |

③ OUT I/F(PARAL.) →
| NO |
| PC-LINK |
| SERIAL |

■ **Configuration example**

Camera 1 (image capturing + CCD trigger)

Camera 2 (image capturing)

Personal computer

Monitor

Object type change, data

Controller

Power supply (24 VDC)

External trigger (photo sensor or proximity sensor)
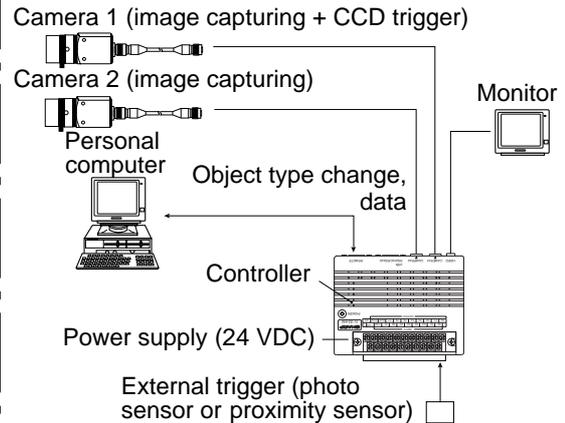
Note 1: When the settings listed in section "16-3 CCD trigger" have not been made, a "CCD TRIG NOT SET. (error 34)" will occur.

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 operation screen.
2. After the measurement is terminated, sampling will be restarted when the X0 terminal is changed from OFF to ON.
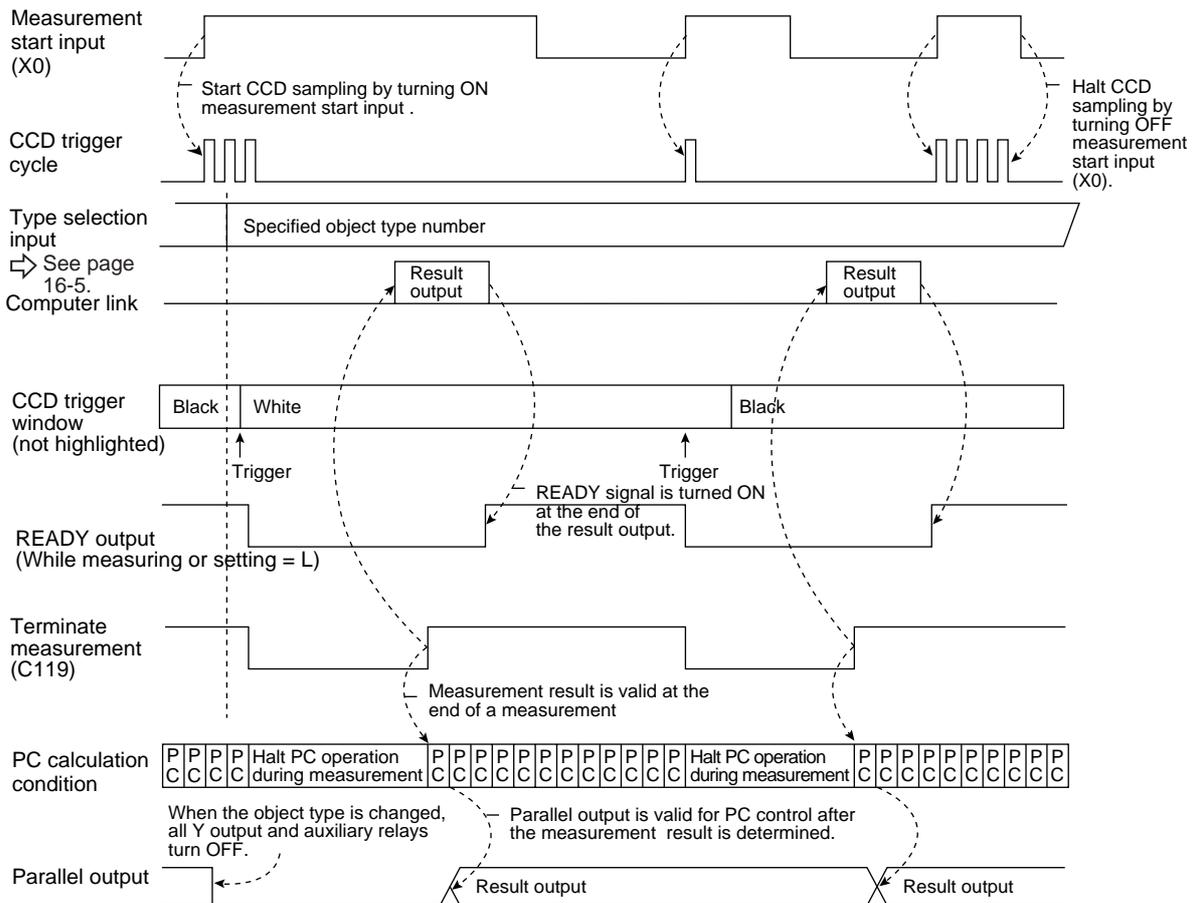
■ **Time chart**

Note: Result output: The data in the block No., set in item "⑤SET SERIAL BLOCK" on the "OBJ-TYPE I/O" screen, will be transmitted to the personal computer. ⇨ See page 16-23.

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(8) Measurement start input = CCD trigger, start sampling, object type change = general purpose serial, result output = general purpose serial/parallel

The CCD trigger is enabled after a measurement execution command is entered.

■ **Setting order** ① → ②

① MEAS INP I/F → PARALLEL+SERIAL
 TRIG CCD START

② START CCD SAMPL → AUTO(EDGE)
 AUTO(LEVEL)
 PARALLEL
 SERIAL

■ **Configuration example**

Camera 1 (image capturing + CCD trigger)

Camera 2 (image capturing)

Personal computer

Sampling start, object type change

Data

Remote key pad

Controller

Power supply (24 VDC)
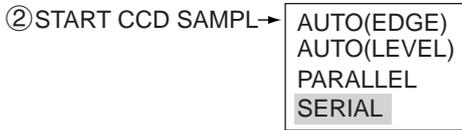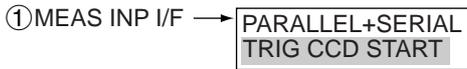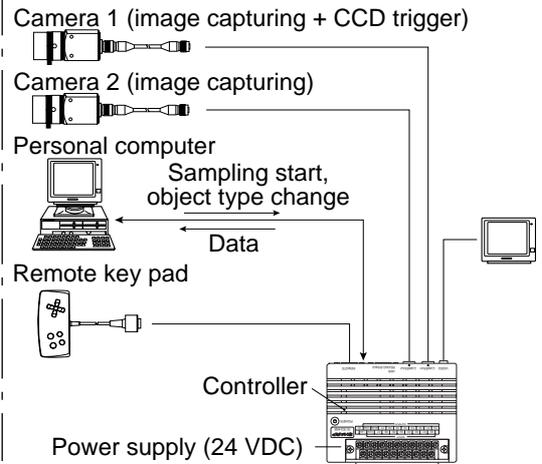
- See Chapter 17 for details about the measurement execution commands (codes 10, 11, 12 and 14(H)).
- When one of the measurement execution commands (codes 10, 11, 12 and 14(H)) is normally received during sampling, the sampling will stop.

    Note: When the settings listed in section "16-3 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 "OBJ-TYPE I/O" screen, will be transmitted to the personal computer. ⇨ See page 16-23.

(9) Measurement start input = CCD trigger, start sampling = auto, object type change, result output = parallel

■ **Setting order** ① → ② (→ ③)

①MEAS INP I/F →
| PARALLEL+SERIAL |
| TRIG CCD START |

②START CCD SAMPL →
| AUTO(EDGE) |
| AUTO(LEVEL) |
| PARALLEL |
| SERIAL |

Select one of these.

③OUTPUT OBJ TYPE →
| PARALLEL |
| SERIAL |

■ **Configuration example**

Camera 1 (image capturing + CCD trigger)

Camera 2 (image capturing)

Monitor

Remote key pad

Controller

Power supply (24 VDC)

Warning lamp

External output (Y0 to Y7)

Start sampling input X0 (photo sensor or proximity sensor)

Type selection switch

→ Measurement is started when the CCD trigger level is ON.

→ Measurement is started when a CCD trigger signal is received.

Work — Black | White

CCD trigger

Measurement — Edge

Level

■ **Time chart (when auto mode (edge) is selected for as the CCD sampling start)**

Restarts CCD sampling automatically after measurement is completed.

CCD trigger cycle

Type selection input ⇨ See page 16-5.

Specified object type number

CCD trigger window (not highlighted)

Black | White | Black | White | Black

Trigger | Trigger

READY output (While measuring or setting = L)

Measurement result is valid at the end of a measurement

PC calculation condition

P P P P | Halt PC operation during measurement | P P P P P P P P | Halt PC operation during measurement | P P P P P
C C C C | | C C C C C C C C | | C C C C C

When the object type is changed, all Y output and auxiliary relays turn OFF.

Parallel output is valid for PC control after the measurement result is determined.

Parallel output (Y0 to Y7)

Result output | Result output

16

■ **Time chart (when auto mode (level) is selected for as the CCD sampling start)**

Restarts CCD sampling automatically after measurement is completed.

CCD trigger cycle

Type selection input
⇨ See page 16-5.

Specified object type number

CCD trigger window (not highlighted)

| Black | White | | Black | White | Black |

Trigger   Trigger   Trigger

READY output (While measuring or setting = L)

Measurement result is valid at the end of a measurement

PC calculation condition

| P C | P C | P C | P C | Halt PC operation during measurement | P C | Halt PC operation during measurement | P C | P C | P C | P C | Halt PC operation during measurement | P C | P C | P C | P C | P C |

When the object type is changed, all Y output and auxiliary relays turn OFF.

Parallel output is valid for PC control after the measurement result is determined.

Parallel output (Y0 to Y7)

Result output   Result output   Result output

16

16-15

(10) Measurement start input = CCD trigger, start sampling = auto, object type change = general purpose serial, result output = general purpose serial/parallel

The general purpose serial command (code 55(H)) is used to change the object type.

■ **Setting order** ① → ② (→ ③)

① MEAS INP I/F →
PARALLEL+SERIAL
TRIG CCD START

② START CCD SAMPL →
AUTO(EDGE)
AUTO(LEVEL)
PARALLEL
SERIAL

Select one of these.

③ OUTPUT OBJ TYPE →
PARALLEL
SERIAL

■ **Configuration example**

Camera 1 (image capturing + CCD trigger)

Camera 2 (image capturing)

Personal computer

Data

Monitor

Remote key pad

Controller

Power supply (24 VDC)

→ Measurement is started when the CCD trigger level is ON.

→ Measurement is started when a CCD trigger signal is received.

Work — Black | White

CCD trigger

Measurement

Edge

Level

16

16-16

■ Time chart (when auto mode (edge) is selected for as the CCD sampling start)

Restarts CCD sampling automatically after measurement is completed.

When a trigger signal is input during sending object type change command, this command will be invalid.

CCD trigger cycle

Serial
Type | Result output | Type | Result output

CCD trigger window (not highlighted)
Black | White | Black | White | Black

Turn ON READY signal by termination of result output.

Trigger | Trigger

READY output (While measuring or setting = L)

Terminate measurement (C119)

Measurement result is valid at the end of a measurement

PC calculation condition
P C | P C | P C | P C | Halt PC operation during measurement | P C | P C | P C | P C | P C | P C | Halt PC operation during measurement | P C | P C | P C | P C | P C

When the object type is changed, all Y output and auxiliary relays turn OFF.

Parallel output is valid for PC control after the measurement result is determined.

Parallel output (Y0 to Y7)
Result output | Result output

Note: Result output; The data in the block No., set in item "⑤SET SERIAL BLOCK" on the "OBJ-TYPE I/O" screen, will be transmitted to the personal computer. ⇨ See page 16-23.

■ Time chart (**when auto mode (level) is selected for as the CCD sampling start**)

Restarts CCD sampling automatically after measurement is completed.

When a trigger signal is input during sending object type change command, this command will be invalid.

CCD trigger cycle

Serial
Type | Result output | Type | Result output

CCD trigger window (not highlighted)
Black | White | Black | White te

Trigger | Trigger | Trigger

READY output (While measuring or setting = L)

Terminate measurement (C119)

Measurement result is valid at the end of a measurement

PC calculation condition
P C | P C | P C | P C | Halt PC operation during measurement | P C | P C | P C | P C | P C | Halt PC operation during measurement | P C | P C | P C | P C | P C | P C | P C | P C | P C | P C | P C | P C

When the object type is changed, all Y output and auxiliary relays turn OFF.

Parallel output is valid for PC control after the measurement result is determined.

Parallel output (Y0 to Y7)
Result output | Result output

16

16-3 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 16-1 to 16-17), and set item "①TRIG CCD START" and item "②CCD TRIG COND" on the "OBJ-TYPE I/O" screen.

- There are four methods for starting the measurement when there is a change in a sampled image, i.e. a "BIN" (binary method), an "AVG-GRAYS" (average light level method), "GRAY-SRC" (gray search) and "EDGE DTECT" (edge detection).

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.
Edge detection	Detects edge with gray search function, and the measurement is started.

- The trigger window can be set in any position for each object type.
  In the past, the position of an external sensor had to be adjusted every time the object type was changed. However, since this function eliminates the necessity of physical position adjustments, the changeover time can be reduced.

Object type 1   Object type 2

⇐ Feeding direction   ⇐ Feeding direction
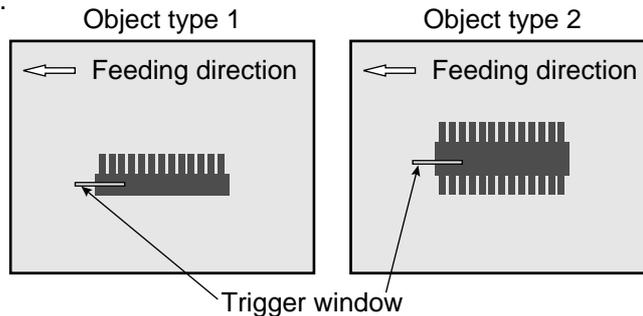
Trigger window

- 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
● **How to display the setting screen**

On the menu tree, select "TYPE00" and then "OBJ-TYPE I/O," to display the OBJ-TYPE I/O screen.

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```
SELECT OBJECT TYPE COND                          F  C1 BRT

OBJECT TYPE COND
 ⊟TYPE00
        ├── TYPE RUN COND
        ├── IMAGE-ADJ
        ⊞── MEA-CND(CAMERA1)
        ⊞── MEA-CND(CAMERA2)
        ├── FINAL NUM.CALC
        ├── FINAL OUTPUT COND
        ├── OBJ-TYPE I/O
        └── OBJ-TYPE SYS.
 └─TYPE(NEW)
```
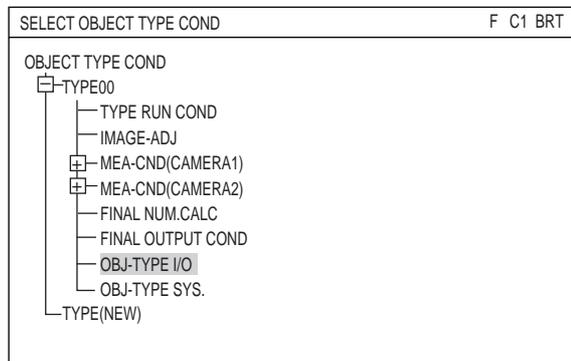
● **Setting methods**

① **TRIG CCD START**

Select a triggering method for the CCD camera used to capture images. The choices are: "BIN," "AVG-GRAYS," "GRAY-SRC," and "EDGE DTECT."

⇨ For details, see page 16-18.
Then the "②CCD TRIG COND" line will appear.

② **CCD TRIG COND**

Select the trigger conditions from the sub menu on this line.
The items in the sub menu will depend on the selection made on the "①TRIG CCD START" line.
Note: When "NO" was selected on the "①TRIG CCD START" line, the "②CCD TRIG COND" line will not appear and the following line numbers will each be one less.

```
OBJ-TYPE I/O  SCREEN  SAVE                F C1 BRT

①TRIG CCD START ─────────────┐      NO
②CCD TRIG COND (TO NEXT SUB-MENU)    BIN
③SHUTTER SPEED                       AVG-GRAYS
④SERIAL OUTPUT                       GRAY-SRC
                                     EDGE DTECT
⑤CAM NO
⑥CALIBRATION




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```
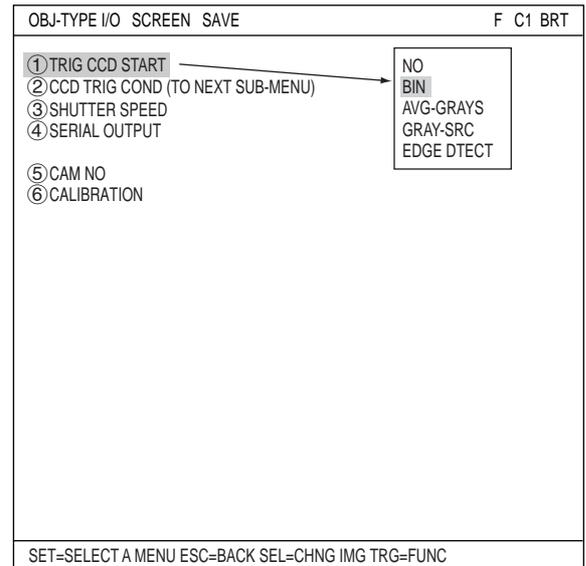
(1) When "BIN" or "AVG-GRAYS" is selected on the "①TRIG CCD START" line

Capture an image
Press the SEL key to move the cursor to the "F" position on the upper function menu. Then press the up or down arrow key to change the image mode from "T" to "F", to capture an image.

① **SIZE**

Specify the size of the window used for the CCD trigger.
While "①SIZE" is selected, press the SET key. The three digits for the X-axis will be highlighted. Change the X-axis value using the up and down arrow keys.
To change value for an individual digit, press the SET key again. The cursor will move to the left most digit. Adjust each digit using the up/down/left/right arrow keys.
When the value is correct, press the SET key. Now all three digits will be highlighted again.
Next, press the left or right arrow key to move the cursor to the next three digits for the Y-axis. Adjust this value the same way you adjusted the X-axis value.

When "BIN" is selected
```
CCD TRIG COND  SCREEN  SAVE              F C1 BRT

①SIZE            Y008(4~480)×X008(4~512)
②EVALUATION      MAJORITY ──────────┐   MAJORITY
③EVAL-SPEC(RATIO %) 050                  AND
④UP.L COORD      MOVE(248.232)           OR
⑤THRESHOLD VAL   SET [U.LM255 L.LM100(0~255)]
⑥INVERT B/W      NO
```

When "AVG-GRAYS" is selected
```
CCD TRIG COND  SCREEN  SAVE              F C1 BRT

①SIZE             Y008(4~480)×X008(4~512)
②UP.L COORD       MOVE(248.232)
③THRESHOLD VALUE  [U.LM255 L.LM100(0~255)]
                  MEAS.AVG.GRA=000.0
```
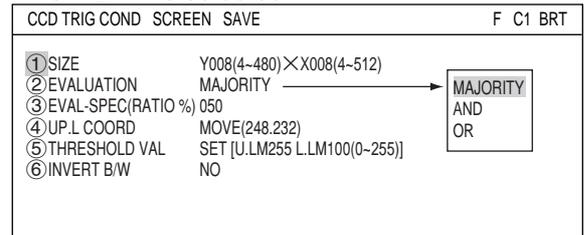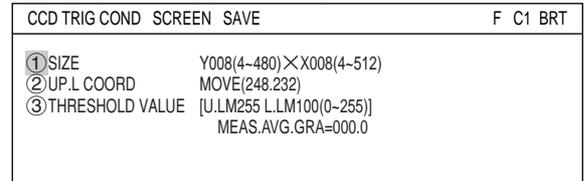
② **EVALUATION**

Select an evaluation condition, "MAJORITY", "AND," or "OR," from the popup menu.

②EVALUATION	Description
MAJORITY	Based on the number of pixels in an area, the controller will decide that the whole area is white if the specified percentage of pixels in that area is white. If the percentage of white pixels is less than this amount, the area will be treated as black. Specify the percentage (%), from 0 to 100% (in units of one percent) in the "③EVAL-SPEC (RATIO%)" item.
AND	Treat as white only when all of the pixels in an area are white.
OR	Treat as white if one or more of the pixels in an area is white.

③ **EVAL-SPEC(RATIO %)**

when "MAJORITY" is selected on the "②EVALUATION" line, enter the ratio % used to determine the color of an area.

④ **UP.L COORD**

Specify the upper left corner coordinates of the CCD trigger window. By changing these values, the position of the CCD trigger window will be moved.

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16-19

⑤ **THRESHOLD VAL**

Specify the threshold value for binary conversion.
Select this line and press the SET key. The
"THRESHOLD VAL" setting screen will appear.
➪ For details, see pages 3-10.

⑥ **INVERT B/W**

NO	Do not reverse black and white areas.
YES	The area detected by binary conversion will be displayed as white.

```
┌─────────────────────────────────────────────┐
│ THRESHOLD VAL   AUTO-REG   RESET      F C1 BRT│
├─────────────────────────────────────────────┤
│ ①U.LM          050      (0~255)              │
│ ②L.LM          100      (1~255)              │
│                                               │
│                                               │
│                    ┌- - - -┐                  │
│                    ┆       ┆                  │
│                    ┆       ┆                  │
│                    └- - - -┘                  │
│                                               │
│              │                                │
│              │                                │
│              │                                │
│              └──────────                      │
├─────────────────────────────────────────────┤
│ SET=CHNG ESC=BACK SEL=CHNG IMG TRG=FUNC       │
└─────────────────────────────────────────────┘
```
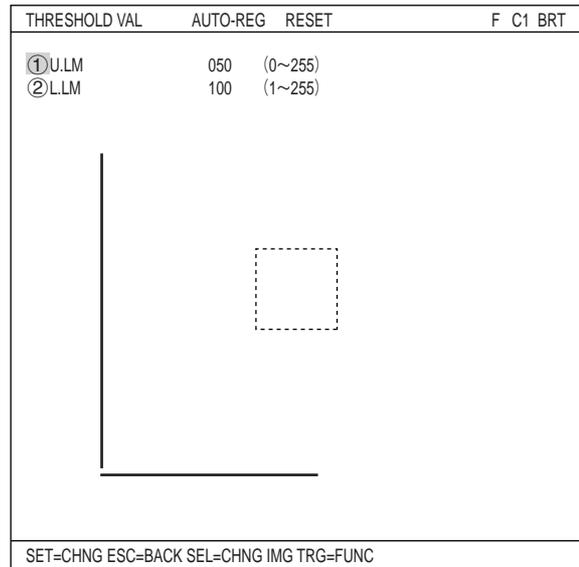
**(2) When "GRAY-SRC" is selected on the "①TRIG
CCD START" line.**
 ① **REF-IMG AREA**
 ② **SEARCH AREA**
 ③ **DETECT CRD**   ➪ For details, see
 ④ **CONTR. PIXEL**   pages 5-5 to 5-7.

⑤ **MATCH LEVEL**

Specify the range for the degree of match
While "⑤MATCH LEVEL" is selected, press the
SET key. The five digits for the lower limit will be
highlighted. Change the number using the up and
down arrow keys.
To change the value of individual digits, press the
SET key again. The cursor will move to the left
most digit. Adjust the value of each digit using the
up/down/left/right arrow keys.
When the value is correct, press the SET key. All
five digits will be highlighted again.
Then, press the left or right arrow key to move the cursor to the next five digits, which are the upper
limit. Adjust this number the same way.

```
┌─────────────────────────────────────────────┐
│ CCD TRIG COND  SCREEN  SAVE          F C1 BRT │
├─────────────────────────────────────────────┤
│ ①REF-IMG AREA   SET (224.208)~(287.271)      │
│ ②SEARCH AREA    SET (216.200)~(295.279)      │
│ ③DIRECT CRD     CENTER (255.239)             │
│ ④CONTR.PIXEL    3                             │
│ ⑤MATCH LEVEL    +07000~+10000                │
│                                               │
│                ┌- - - - - - -┐               │
│                ┆  ┌───────┐  ┆               │
│                ┆  │   +   │  ┆               │
│                ┆  └───────┘  ┆               │
│                └- - - - - - -┘               │
│                                               │
├─────────────────────────────────────────────┤
│ SEL=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=FUNC │
└─────────────────────────────────────────────┘
```
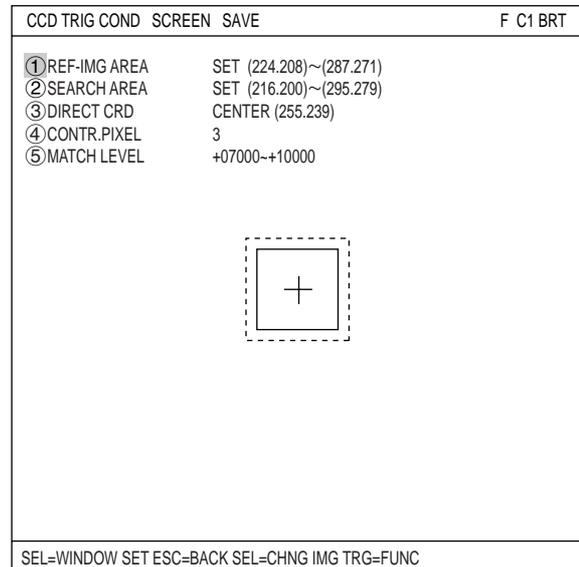
**(3) When "EDGE DTECT" is selected on the "①TRIG
CCD START" line.**
 ① **SEARCH AREA**
 ② **DTECT MODE**
 ③ **SEARCH DIRECT**   ➪ For details, see
 ④ **THRESHOLD VAL**   pages 11-7 to 11-9.

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```
┌─────────────────────────────────────────────┐
│ CCD TRIG COND    SCREEN  SAVE        F C1 BRT │
├─────────────────────────────────────────────┤
│ ①SEARCH AREA    SET (224.208)~(287.271)      │
│ ②DTECT MODE     CHNG POINT                    │
│ ③SEARCH DIRECT  HORIZ (→)                     │
│ ④THRESHOLD VAL  SET (D:050 E:2 F:04)          │
│                                               │
│                                               │
│                    ┌- - - -┐                  │
│                    ┆       ┆                  │
│                    ┆       ┆                  │
│                    └- - - -┘                  │
│                                               │
│                                               │
│                                               │
├─────────────────────────────────────────────┤
│ SEL=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=FUNC │
└─────────────────────────────────────────────┘
```
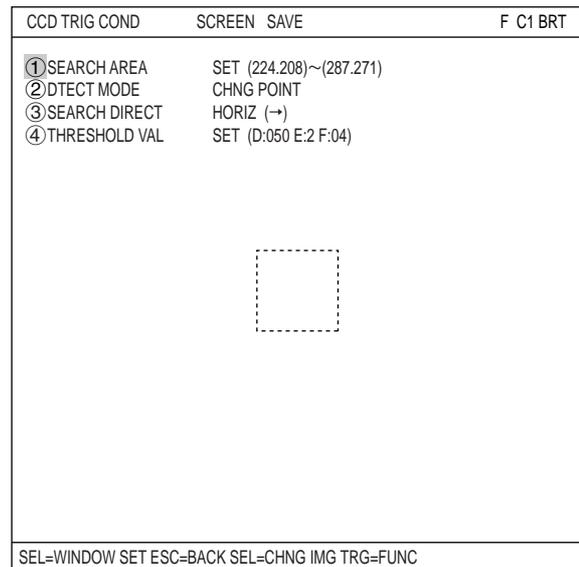
16-4 Setting for serial communications

When "PARALLEL+SERIAL" (general purpose serial) has been specified in item "①MEAS INP I/F" on the "I/O CONDITIONS" menu (page 16-1), and when "SERIAL" or "PC-LINK" has been specified in item "②OUT I/F (PARAL.)" the serial communication conditions must be set on the "COMM.SET" screen.

● **Set the items to match the communication conditions of the other device.**

Select "MAIN COND" -> "SYS-CND" -> "COMM.SET," in that order.

```
SELECT SYSTEM COND                              F  C1  BRT

SYS-CND
    ├─ I/O CONDITIONS           ① COMM.STANDARD
    ├─ COMM.SET                 ② BAUDRATE(k.bps)
    ├─ COMPUTER LINK            ③ NO. OF DATE BITS
    └─ GAIN-OFFSET              ④ PARITY CHECK
                                ⑤ NO. OF STOP BITS
                                ⑥ STATION NO.

SET=TO=NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```
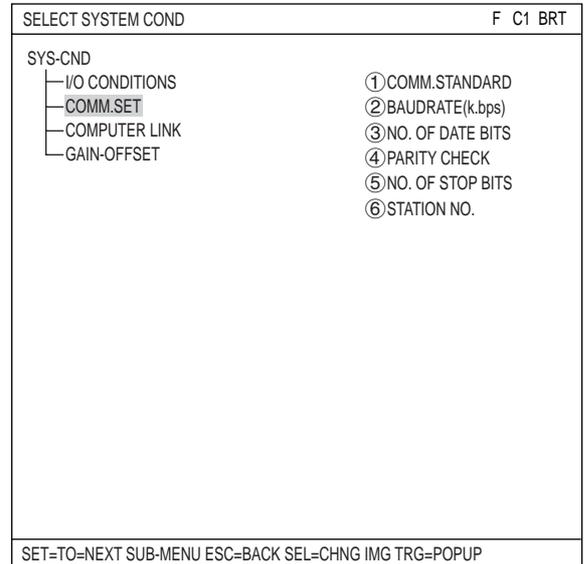
● **How to set the communication settings**
Adjust each item to match the equipment used to communicate.

① **COMM. STANDARD**

Select "RS232C," "RS422:4LINE," or "RS422:2LINE."

② **BAUDRATE (kbps)**

Set the communication speed: 2.4 Kbps, 4.8 Kbps, 9.6 Kbps, 19.2 Kbps, 38.4 Kbps, 57.6 Kbps, or 115.2 Kbps.

③ **NO.OF DATA BITS**

Select either 7-bit or 8-bit.

④ **PARITY CHECK**

Select "EVEN," "ODD," or "NO."

⑤ **NO.OF STOP BITS**

Set it to 1-bit or 2-bits.

⑥ **STATION NO.**

Select the station number for communication using the up and down arrow keys.

```
COMM.SET  SCREEN  COND  SAVE                    F  C1  BRT

① COMM.STANDARD    RS232C ─────────────►  RS232C
② BAUDRATE(k.bps)  115.2 ──────┐          RS422:4LINE
③ NO. OF DATE BITS 7BIT ─► 7BIT │          RS422:2LINE
④ PARITY CHECK     EVEN    8BIT │
⑤ NO. OF STOP BITS 2BIT          EVEN      2.4
⑥ STATION NO.      00(0~7F)      ODD       4.8
                                 NO        9.6
                        2BIT               19.2
                        1BIT               38.4
                                           57.6
                                           115.2

SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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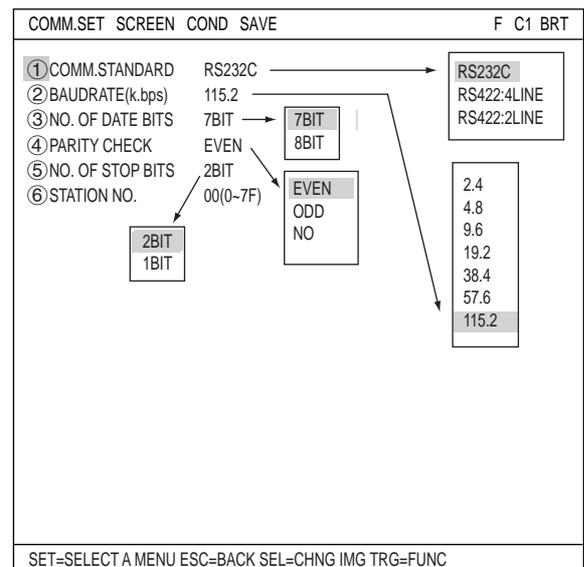
16-5 Computer link

When "PC-LINK" has been specified in item "②OUT I/F (PARAL.)" on the "I/O CONDITIONS" screen (page 16-1), the computer link conditions must be set on the "COMPUTER LINK" screen.

■ How to display the computer link setting screen

● **How to display the computer link setting screen**
Select "MAIN COND" -> "SYS-CND" -> "COMPUTER LINK," in that order.
The COMPUTER LINK screen will appear.

```
SELECT SYSTEM COND                             F  C1  BRT

SYS-CND
    ─ I/O CONDITIONS              ①PC MANUFACTURER
    ─ COMM.SET                    ②STATION NO.
      COMPUTER LINK               ③WRITE TOP ADRS
    ─ GAIN-OFFSET                 ④CONTROL PROC.
                                  ⑤BLK WRT COMMAND
```
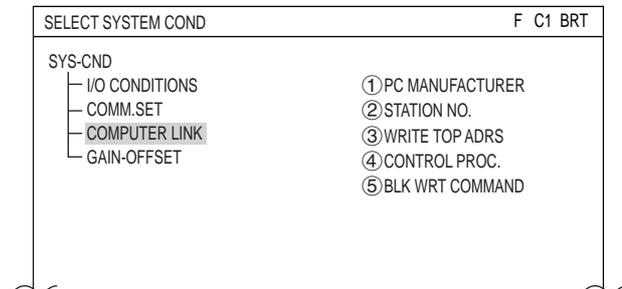
● **How to set up a computer link**
① **PC MANUFACTURER, ② STATION NO.,**
③ **WRITE TOP ADRS**
The details for "①PC MANUFACTURER," ②STATION NO.," and "③WRITE TOP ADRS" are as follows.

```
COMPUTER LINK  SCREEN  COND  SAVE            F  C1  BRT

①PC MANUFACTURER    SHARP(COMMPORT)
②STATION NO.        01
③WRITE TOP ADRS     09000
                              ┌─────────────────┐
                              │ SHARP(COMMPORT)  │
                              │ SHARP(LINK-MDL)  │
                              │ MITSUBISHI       │
                              │ OMRON            │
                              │ YOKOGAWA         │
                              └─────────────────┘
```

Item	Setting range
Station No.	- Sharp: 00 to 37$_{(8)}$ * - Mitsubishi: 00 to 31 - OMRON: 00 to 31 - Yokogawa: 01 to 32
Write address (max. 512 bytes)	- Sharp: 09000 to 99776 - Mitsubishi: D0000 to D9999 - OMRON: DM0000 to DM9999 - Yokogawa: D00001 to D16384

* In this book, octal notation is indicated by adding$_{(8)}$
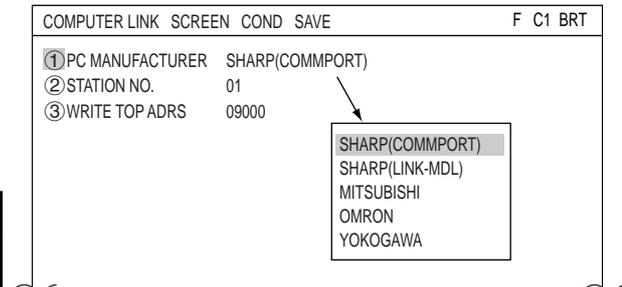
④ **CONTROL PROC. ,⑤ BLK WRT COMMAND**
When "MITSUBISHI" is selected on the "①PC MANUFACTURER" line, specify "④CONTROL PROC." and "⑤BLK WRT COMMAND."

```
COMPUTER LINK  SCREEN  COND  SAVE            F  C1  BRT

①PC MANUFACTURER    MITSUBISHI
②STATION NO.        00
③WRITE TOP ADRS     D0000
④CONTROL PROC.      FORM1 ──────────────►  FORM1
⑤BLK WRT COMMAND    WW ──────►  WW         FORM4
                                QW
```

Menu	Setting details
④ CONTROL PROC.	FORM 1: No line terminator FORM 4: With line terminators ・ "CR" + "LF"
⑤ BLK WRT COMMAND	WW: Data writing address range ・ D0000 to D1023 QW: Data writing address range ・ D000000 to D008191
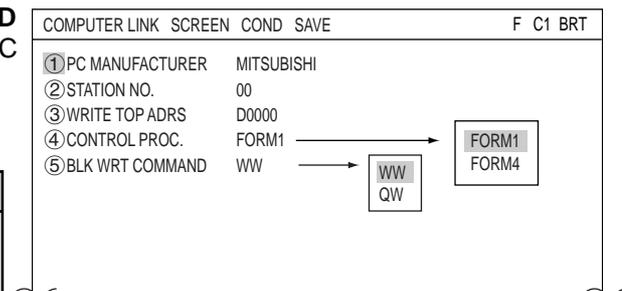
See "Chapter 18: Computer Link" for applicable models made by these manufacturers.
Note 1: Use an even address as the write start address.
Note 2: When 512 bytes are used for a write register on a Sharp model, select a write start address from the following addresses.
09000, 19000, 29000, 39000, 49000, 59000, 69000, 79000, 89000 , 99000

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16-6 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-S30J 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 17-3.
Specify the settings above on the "OBJ-TYPE I/O" screen ⇨ 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 18-3.)

■ **Write register map**

	Sharp	Mitsubishi		OMRON		Description
Result top write address (* 2) →	09000	D0000	L	DM0000	L	Termination code
	09001		H		H	Appended information
	:	:		:		:
	:	:		:		:
	:	:		:		:
	:	:	L	:	L	Output data from measurement No. 3 (block 0)
	:	:	H	:	H	
	:	:		:		:
	:	:		:		:
	:	:		:		:
Result top write address + 512 bytes (* 3) →	:	:	L	:	L	Data in a specified block
	:	:	H	:	H	:
	:	:		:		:
	:	:		:		:

* 2 Set the result top write address in item "③WRITE TOP ADRS" on the "COMPUTER LINK" screen. ⇨ See the preceding page.

* 3 The top address to which the data in the specified blocks will be written is obtained by adding 512 bytes to the result top write address.

- **Setting examples for various manufacturers**

	Sharp		Mitsubishi	OMRON
Result top write address	09000	09300	D0000	DM0000
Top address of data in specified blocks	19000	19300	D0256	DM0256

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(2) When the measurement is started by a CCD trigger or a parallel I/F signal and the results are output by a general purpose serial I/F signal

When the IV-S30J 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

				Object type	Output evaluation results				Measurement 0		Measurement 1	Measurement 2	Measurement 3	Measurement 4
:	1	1	RC (H)	RC (L)		Y0	Y1	...	Y15	Camera 1	Camera 2				

The Measurement 1–4 columns and Measurement 0 (Camera 1/Camera 2) are grouped under ①.

Measurement 0		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
Camera 1 data ②	Camera 2 data ②								

⇨ See page 17-7 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

■ **Setting (operating) procedure**

1. Select "MAIN COND" -> "OBJECT TYPE COND" -> "TYPE00" -> "OBJ-TYPE I/O" in that order.

```
SELECT OBJECT TYPE COND                        F  C1  BRT

OBJECT TYPE COND
 ┌─TYPE00                          ①TRIG CCD START
 │   ├─ TYPE RUN COND              ②CCD TRIG COND
 │   ├─ IMAGE-ADJ                  ③SHUTTER SPEED
 │   ├─ MEA-CND(CAMERA1)           ④SERIAL OUTPUT
 │   ├─ MEA-CND(CAMERA2)           ⑤SET SERIAL BLOCK
 │   ├─ FINAL NUM.CALC             ⑥CAM NO
 │   ├─ FINAL OUTPUT COND          ⑦CALIBRATION
 │   ├─ OBJ-TYPE I/O               ⑧CALIBRATION
 │   └─ OBJ-TYPE SYS.
 └─TYPE(NEW)




SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```
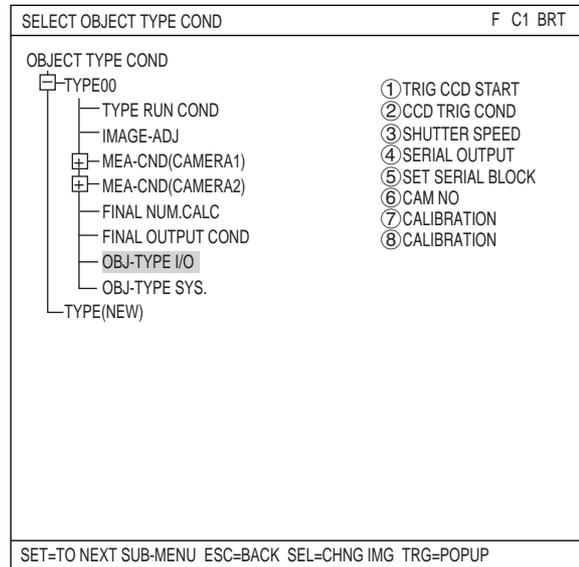
2. The "OBJ-TYPE I/O" screen will appear. Move the cursor to "③SERIAL OUTPUT" and press the SET key. A popup menu will appear. Select "BLOCK-ASSIGN" and press the SET key.

```
OBJ-TYPE I/O  SCREEN  SAVE                      F  C1  BRT

①TRIG CCD START      NO

②SHUTTER SPEED       1/00060(1/30~1/10000)       ┌─────────────┐
③SERIAL OUTPUT       BLOCK-ASSIGN ───────────▶   │ ANY         │
④SET SERIAL BLOCK    BLOCK00 MEAS0 CAM1          │ BLOCK-ASSIGN│
⑤CAM NO              1(1~2)                       └─────────────┘
⑥CALIBRATION         NO




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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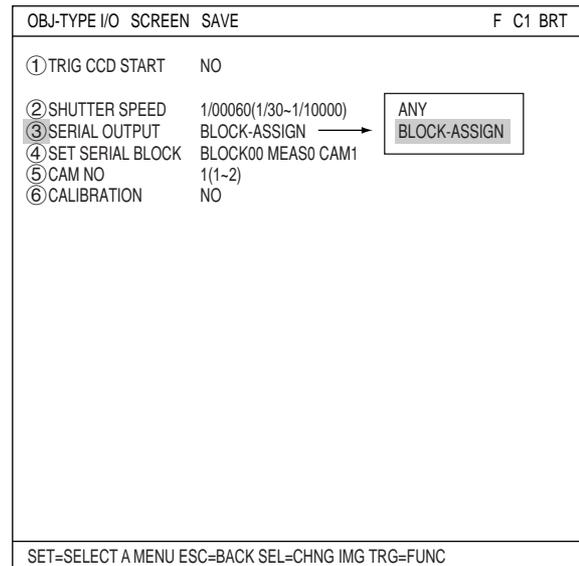
3. The "④SET SERIAL BLOCK" line will appear. Select this line and press the SET key. Enter the block No., measurement No. and camera No. of the measurement data to be output, using the left, right, up and down keys.
   - Specify a block number to be returned in addition to block 0 (00). If block 00 is specified, data from block 00 will not be returned a second time. After the settings are complete, press the SET key.

```
OBJ-TYPE I/O  SCREEN SAVE                          F  C1 BRT

①TRIG CCD START      NO

②SHUTTER SPEED       1/00060(1/30~1/10000)
③SERIAL OUTPUT       BLOCK-ASSIGN
④SET SERIAL BLOCK    BLOCK00 MEAS0 CAM1
⑤CAM NO              1(1~2)
⑥CALIBRATION         NO




SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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16-7 Setting the data output

When you communicate with the IV-S30J 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 18-16.
- Communication interface (general purpose serial IF): When executing a measurement run command 4 (processing code 14(H)) ⇨ Pages 17-8 and 17-10.

[1] Select "ANY" for the serial output

Select "ANY" in the "③SERIAL OUTPUT" item on the "OBJECT TYPE I/O" menu.

■ **Setting (operating) procedure**

1. Select "MAIN COND" -> "OBJECT TYPE COND" -> "TYPE00" -> "OBJ-TYPE I/O" in that order.

```
SELECT OBJECT TYPE COND                        F  C1  BRT

 OBJECT TYPE COND
 ┌─TYPE00                          ①TRIG CCD START
 │     ─ TYPE RUN COND             ②CCD TRIG COND
 │     ─ IMAGE-ADJ                 ③SHUTTER SPEED
 │  ┼─ MEA-CND(CAMERA1)            ④SERIAL OUTPUT
 │  ┼─ MEA-CND(CAMERA2)            ⑤SET SERIAL BLOCK
 │     ─ FINAL NUM.CALC            ⑥CAM NO
 │     ─ FINAL OUTPUT COND         ⑦CALIBRATION
 │     ─ OBJ-TYPE I/O              ⑧CALIBRATION
 │     ─ OBJ-TYPE SYS.
 └─TYPE(NEW)









SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG  TRG=POPUP
```
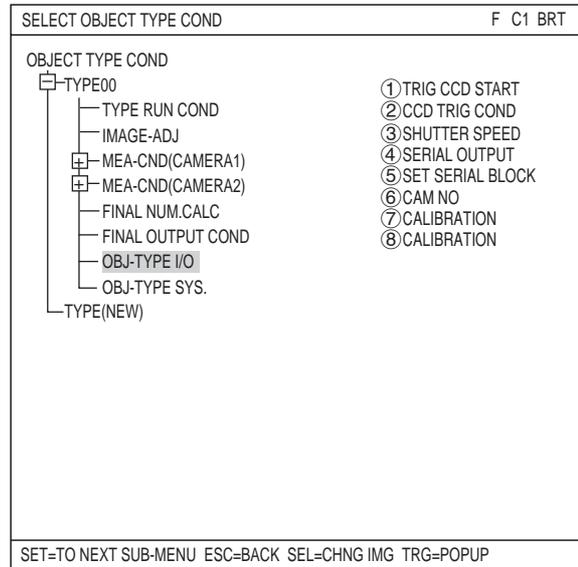
2. The "OBJ-TYPE I/O" screen will appear. Move the cursor to "③SERIAL OUTPUT" and press the SET key. A popup menu will appear. Select "ANY" and press the SET key.

```
OBJ-TYPE I/O  SCREEN SAVE                       F  C1  BRT

 ①TRIG CCD START      NO

 ②SHUTTER SPEED       1/00060(1/30~1/10000)
 ③SERIAL OUTPUT       ANY ─────────────►  ANY
                                          BLOCK-ASSIGN
 ④CAM NO              1(1~2)
 ⑤CALIBRATION         NO












SET=SELECT A MENU ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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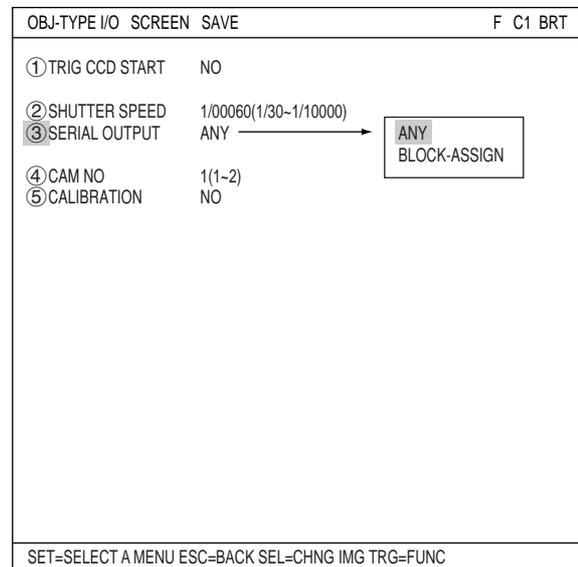
[2] Select "YES" or "NO" for output data

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.

On any condition setting screen, press the TRG/BRT key and the cursor will move to the upper function menu. Select "SCREEN" and press the SET key. A popup menu will appear. Select "SERIAL OUTPUT" and press the SET key.

- The "EVALUATION COND" screen for individual measurement program

```
EVALUAT COND  SCREEN  SAVE                  F  C1  BRT

                        [SERIAL OUTPUT]
①X COORD(MDL0)          NO      ◄──    NO
②Y COORD(MDL0)          NO             YES
③x DEVIATE(MDL0)        NO
④y DEVIATE(MDL0)        NO
⑤MATCH LVL(MDL0)        NO
⑥ANGULAR DEVIATE        NO
⑦X COORD(MD1)           NO
⑧Y COORD(MDL1)          NO
⑨x DEVIATE(MDL1)        NO
⑩y DEVIATE(MDL1)        NO
⑪MATCH LVL(MDL1)        NO




SEL=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC
```

(When measuring positional deviation)

- The "NUMERIC CALC" or "FINAL NUM. CALC" screen for individual measurement program

```
NUMERIC CALC  SCRREN  SAVE                  F  C1  BRT

                        [SERIAL OUTPUT]
①OUTPUT                 NO




```

(When the numerical calculation condition menu is displayed)

- The "DIST&AGL COND" screen

```
DIST&AGL COND  SCREEN  SAVE                 F  C1  BRT

                        [SERIAL OUTPUT]
①DISTANCE EVALUATION    NO




```

(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).

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16-8 Calibrating the IV-S30J

The IV-S30J calibration can be adjusted, e.g. "1 pixel = 1 mm", and the data can be displayed as actual dimensions.

● **How to display the CALIBRATION setting screen**

1) Select "MAIN COND" and then "OBJECT TYPE COND."

```
MAIN MENU                                    F  C1  BRT

IVS30J
          ┌─── SYS-CND
          ├─── OBJECT TYPE COND
          ├─── SET WIZARD
          ├─── EDIT MAIN OPS MENU
          └─── OPTION
```
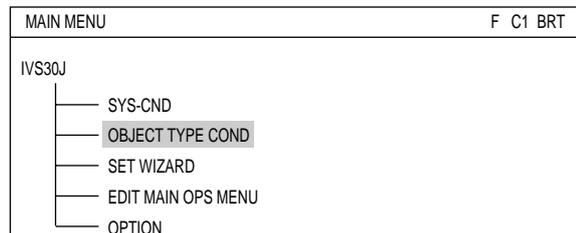
2) On the "OBJECT TYPE COND" screen, move the cursor to any "TYPExx" that you want to calibrate, and press the SET key.

3) Move the cursor to the "OBJ-TYPE I/O" line and press the SET key.

```
SELECT OBJECT TYPE COND                       F  C1  BRT

OBJECT TYPE COND
 ├─TYPE00                            ①TRIG CCD START
 │    ├── TYPE RUN COND              ②CCD TRIG COND
 │    ├── IMAGE-ADJ                  ③SHUTTER SPEED
 │    ├┼─ MEA-CND(CAMERA1)           ④SERIAL OUTPUT
 │    ├┼─ MEA-CND(CAMERA2)           ⑤SET SERIAL BLOCK
 │    ├── FINAL NUM.CALC             ⑥CAM NO
 │    ├── FINAL OUTPUT COND          ⑦CALIBRATION
 │    ├── OBJ-TYPE I/O               ⑧CALIBRATION
 │    └── OBJ-TYPE SYS.
 ├─TYPE01
 └─TYPE(NEW)
```
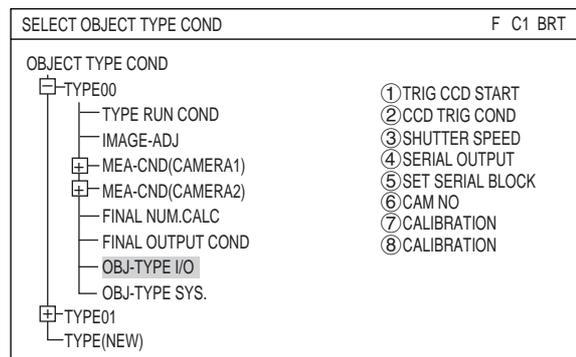
4) On the "OBJ-TYPE I/O" setting screen, move the cursor to the "⑦CALIBRATION" line and press the SET key twice, to bring up the sub-menu.

   Note: Depending on settings for the "①TRIG CCD START" and "④SERIAL OUTPUT" items, the number of the "CALIBRATION" line will vary between ⑥ and ⑧.

```
OBJ-TYPE I/O  SCREEN  SAVE                     F  C1  BRT

①TRIG CCD START    BIN
②CCD TRIG COND     (TO NEXT SUB-MENU)
③SHUTTER SPEED     1/00060(1/30~1/10000)
④SERIAL OUTPUT     BLOCK-ASSIGN
⑤SET SERIAL BLOCK  BLOCK00 MEAS0 CAM1
⑥CAM NO            1(1~2)                   ┌──────────┐
⑦CALIBRATION       MANUAL ───────────────► │ NO       │
⑧CALIBRATION       (TO NEXT SUB-MENU)       │ MANUAL   │
                                            │ EDGE DTECT│
                                            └──────────┘
```
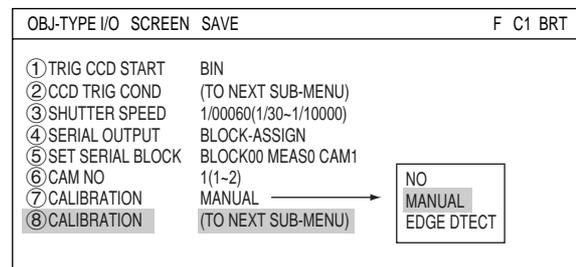
5) Set the calibration details on the "CALIBRATION" setting screen.
   Put a ruler in the camera's field of view.

```
CALIBRATION  SCREEN  SAVE                      F  C1  BRT

①CURSOR1-COORD    SET (256.240)
②CURSOR2-COORD    SET (256.240)
③SCALE            000.00
④SCALE(UNIT)      mm
⑤REG              EXEC
  1PIXEL          CBP 000.0000 mm
  1mm             CBM 000.0000 PIXEL
```

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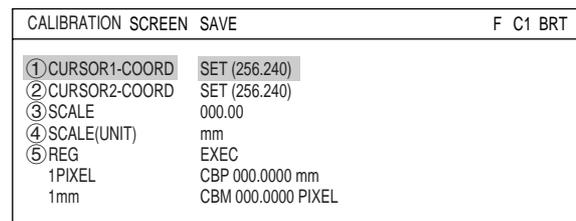
● **When "MANUAL" is selected on the "CALIBRATION" line**

1. Move the cursor to "①CURSOR1-COORD" and press the SET key.

2. While the cursor is on the "①CROSS CURSOR" line on the CROSS CURSOR screen, press the SET key. Move the crosshair cursor to the tick marks on the ruler using the up/down/left/right arrow keys and set coordinate 1.

```
CLOSS CURSOR  RESET  RETURN                    F  C1  BRT

①CLOSS CURSOR      (256.240)



                        |||||||||||||||||||||||||||||||||

                         40      30      20      10

                        |||||||||||||||||||||||||||||||||
                                              +
                                                  X:256  Y:200
```
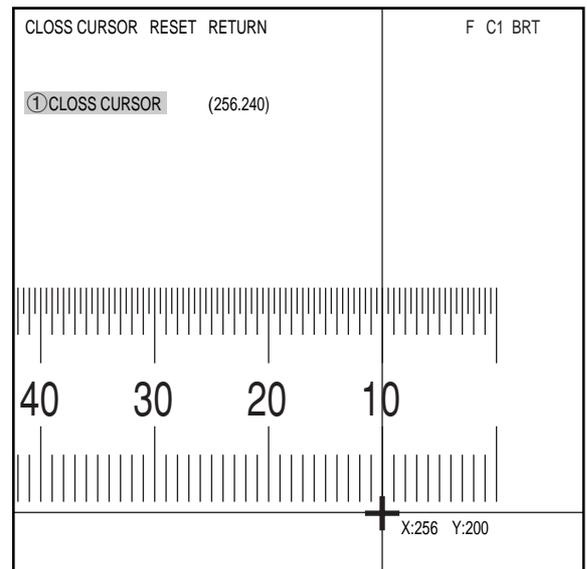
3. Then move the cursor on the CROSS CURSOR screen to the "②CUSOR2-COORD" line and set coordinate 2 using the same procedure.

```
CLOSS CURSOR  RESET  RETURN                    F  C1  BRT

①CLOSS CURSOR      (143.200)



                        |||||||||||||||||||||||||||||||||

                         40      30      20      10

                        |||||||||||||||||||||||||||||||||
                                  +
                                              X:143  Y:200
```
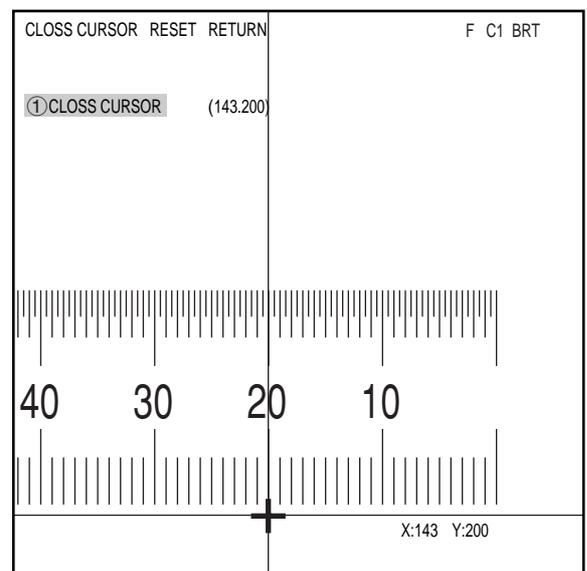
4. Select the "③SCALE" line and enter the actual value of the distance between coordinates 1 and 2. In this example, the distance is 10 mm. Therefore, enter "10."

5. Select the "④SCALE(UNIT)" line and select the unit of distance between coordinates 1 and 2. In this example, select "mm."

6. Select the "⑤REG" (register) line and while the cursor is on "EXEC" (execute) press the SET key again. The controller will be calibrated to read "1 pixel = 1 mm."

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● **Setting the register conditions for edge detection**

① **SEARCH AREA**
Select "①SEARCH AREA (MDL0)" and press the SET key to go to the setting screen.

② **DTECT MODE**
Select an image processing method for the edges.

③ **SEARCH DIR**
Specify a search direction.
⇨ For details, see page 4-8.

④ **THRESHOLD**
Specify a threshold value for binary conversion.
⇨ For details, see page 3-11.

```
REG COND          SCREEN  COND  SAVE DATAIL        F  C1  BRT

① SEARCH AREA(MDL0)    SET(224,208)~(287,271)
② DTECT MODE(MDL0)     CHNG POINT ──────────┐      ┌──────────┐
③ SEARCH DIR(MDL0)     HORIZ(→)          │      │ CHNG POINT│
④ THRESHOLD(MDL0)      SET(D:050 E:2 F:04)       │ DRK→BRT   │
⑤ REF COORD(MDL0)      SET KEY(256.240)          │ BRT→DRK   │
                                                  │ CENT(BRT) │
⑥ SEARCH AREA(MDL1)    SET(224,208)~(287,271)     │ CENT(DRK) │
⑦ DTECT MODE(MDL1)     CHNG POINT                 └──────────┘
⑧ SEARCH DIR(MDL1)     HORIZ(→)                   ┌──────────┐
⑨ THRESHOLD(MDL1)      SET(D:050 E:2 F:04)        │ HORIZ(→) │
⑩ REF COORD(MDL1)      SET KEY(256.240)           │ HORIZ(←) │
                                                  │ VERT(↓)  │
⑪ SCALE               000.00                      │ VERT(↑)  │
⑫ SCALE(UNIT)         mm                          └──────────┘
⑬ REG                 EXEC
   1PIXEL             CBP 000.0000 mm
   1mm                CBM 000.0000 PIXEL

SET=WINDOW SET ESC=BACK SEL=CHNG IMG TRG=POPUP
```


Edge width / Flat width / Light level / Density difference / A / B

Automatic setting
Select "AUTO-REG" from the upper function menu on the THRESHOLD setting screen. The controller will set the optimum value automatically.

⑤ **REF COORD (reference coordinates)**
You can change the reference coordinates to any desired position.

⑪ **SCALE**
Enter the actual value of the distance between coordinates 1 and 2. In this example, the distance is 10 mm. Therefore, enter "10."

⑫ **SCALE (UNIT)**
Select unit of distance between coordinates 1 and 2. In this example, select "mm."

⑬ **REG (register)**
While the cursor is on "EXEC" (execute) press the SET key again. The controller will be calibrated to treat 1 pixel = 1 mm.

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6) Using the CBP value that was set in the calibration function, you can execute numeric calculations.

1. Press the ESC key twice to show the menu tree. Select the "NUM-CALC" line for the same object type and measurement number, and press the SET key.

```
SELECT OBJECT TYPE COND                            F C1 BRT
OBJECT TYPE COND
  ├─ TYPE00                                        N00
  │   ├─ TYPE RUN COND
  │   ├─ IMAGE-ADJ                                 N01
  │   ├─ MEA-CND(CAMERA1)
  │   │   ├─ MEAS0                                 N02
  │   │   ├─ POSI-CORRECT
  │   │   ├─ MEAS01(POSI-DEVIATION)                N03
  │   │   ├─ MEAS02(POSI-DEVIATION)
  │   │   │   ├─ IMG PRE-PROC                      N04
  │   │   │   ├─ MEAS CND
  │   │   │   ├─ EVALUATION COND                   N05
  │   │   │   ├─ DISTANCE&ANGLE COND
  │   │   │   ├─ NUM-CALC                          N06
  │   │   │   └─ OUT-COND
  │   │   └─ MEAS(NEW)                             N07
  │   ├─ MEA-CND(CAMERA2)
  │   ├─ FINAL NUM.CALC
  │   ├─ FINAL OUTPUT COND
  │   └─ OBJ-TYPE I/O
SET=TO NEXT SUB-MENU ESC=BACK SEL=CHNG IMG TRG=POPUP
```

2. Relay numbers N00 to N07 are displayed on the first screen. To display relay numbers N08 to N15, press the SET key while the cursor is on the "CHG-CALC" item.

```
NUMERIC CALC  SCREEN  COND  SAVE              F C1 BRT
【N08-N15】
CHG-CALC
①RUN A TEST          (SET KEY)
       TYPE  FORMULA
N00
N01
N12
N03
N04
N05
N06
N07
SET=EXEC ESC=BACK SEL=CHNG IMG TRG=FUNC
```

3. On the "NUMERIC CALC" screen, use the up and down arrow keys to move the cursor to a cell in the "TYPE" column on the desired relay number line. Press the SET key. A popup menu will appear and you can select the calculation result you want to output. In this example, select "DEV -x" (deviation on the X-axis)

```
NUMERIC CALC  SCREEN  COND  SAVE              F C1 BRT
【N00-N07】
CHG-CALC
①RUN A TEST          (SET KEY)
       TYPE  FORMULA
N00          CRD-X
             CRD-Y
N01          DEV-x
             DEV-y
N12          MATCH M
             ANGL-B
N03          NUM-CAL [NC]
             CNST [C]
N04          NO
N05
N06
N07
SET=SELECT TYPE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

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4. Next, move the cursor to the "FORMULA" column and press the SET key. Another popup menu will appear allowing you to select the type of formula you want to use for calculations. In this case, select "CBP."

```
NUMERIC CALC  SCREEN  COND  SAVE                    F  C1  BRT
 【N00-N07】
 CHG-CALC
 ①RUN A TEST           (SET KEY)
        TYPE │ FORMULA
 N00                  ┌─────────────────
 ─────────────────────│ OBJECT TYPE      ────────────────
 N01                  │ CALC RESULT
 ─────────────────────│ CNST             ────────────────
                      │ SUM
 N12                  │ AVG              ────────────────
 ─────────────────────│ CBP
 N03                  │ CBM              ────────────────
 ─────────────────────│ DEL
 N04                  └─────────────────
 ──────────────────────────────────────────────────────
 N05
 ──────────────────────────────────────────────────────
 N06
 ──────────────────────────────────────────────────────
 N07
 ──────────────────────────────────────────────────────
 SET=SELECT TYPE ESC=BACK SEL=CHNG IMG TRG=FUNC
```

5. After completing these settings, deviation on X-axis will be output as a CBP value (in unit of mm).

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16-32

Chapter 17: Communication (General Purpose Serial Interface)

The IV-S30J can communicate with a personal computer that transmits commands and receives responses to measurement execution commands.

17-1 List of processing functions

The following functions can be used for communication between the IV-S30J and a personal computer (using the general-purpose serial interface).

Cate-gory	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-S30J.
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-S30J.
	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.

Shown below is the relationship of each selection when code 10 to 14 are specified is shown below. The conditions below are what is shown when the "PARALLEL+SERIAL" is selected on the "①MEAS INP I/F" on the "I/O CONDITIONS" selection screen.

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/YOKOGAWA	Parallel
	General-purpose serial	Response output from command codes 11	Parallel

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Communication (General Purpose Serial Interface)

The conditions below are what is shown when the "TRIG CCD START" is selected on the "①MEAS INP I/F" on the "I/O CONDITIONS" selection screen.

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/YOKOGAWA	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

Category	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.
	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.

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17-2 Data flow

The data flow between the IV-S30J 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 and parallel port**

IV-S30J

Measuring (for each object type)

① Receiving a command

② Transmitting a response
(measurement data, etc.)

Personal computer
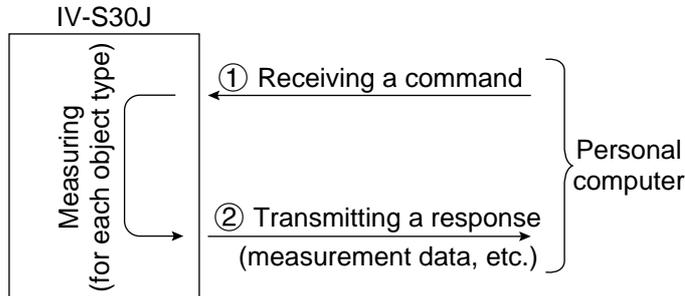
[2] Measurement execution 2: Response processing for command 11

● **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.

IV-S30J

Measuring (for each object type)

① Inputting a trigger

CCD camera or programmable controller

② Transmitting a response
(Command 11, measurement data, etc.)

Personal computer or programmable controller
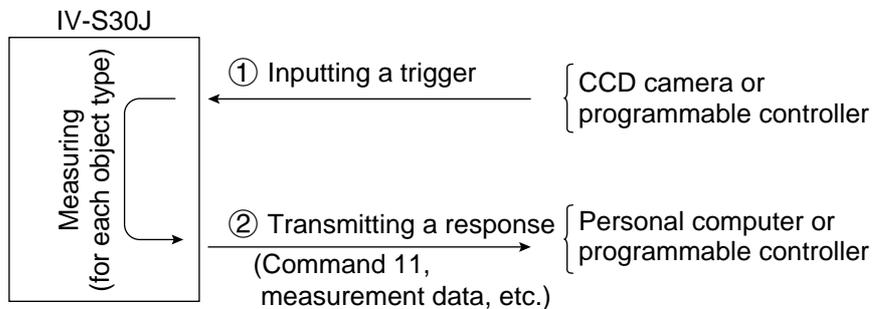
- You can specify the response block on the "OBJECT TYPE I/O" screen ⇨ see page 16-23.

● **Select the measurement start method = CCD trigger, start sampling & output results = general purpose serial**

IV-S30J

Measuring (for each object type)

① Inputting a trigger
(Start sampling CCD trigger.)

CCD camera or programmable controller

② CCD trigger

CCD camera

③ Transmitting a response
(Command 11, measurement data, etc.)

Personal computer or programmable controller

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17-3
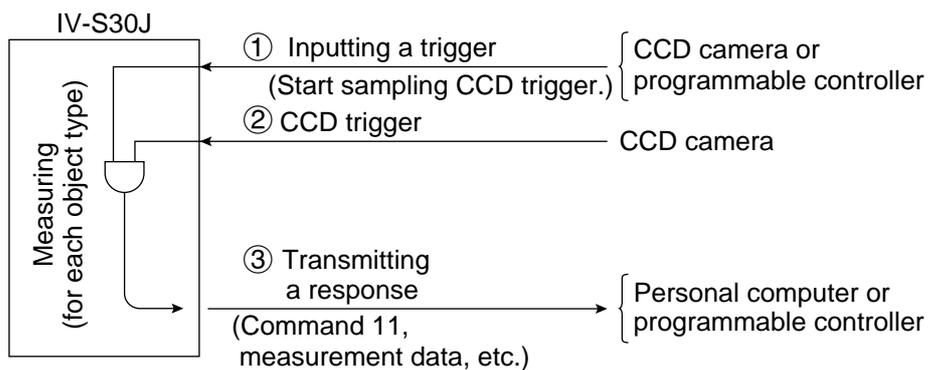
[3] Measurement execution 3: Command 14
● **Select measurement start input source = general purpose serial and parallel port**

[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."

IV-S30J

① Receiving a command
(Packet = 0: Measurement execution)

② Transmitting a response
(Measurement codes, measurement data, etc.)

Measuring
(for each object type)

Personal
computer

① Receiving a command
(Packet = 1: No measurement execution)

② Transmitting a response
(Next measurement codes, measurement data, etc.)

[(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
- Operation screen: 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.

IV-S30J

① Receiving a command

Operating

Personal
computer

② Transmitting a response

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17-4
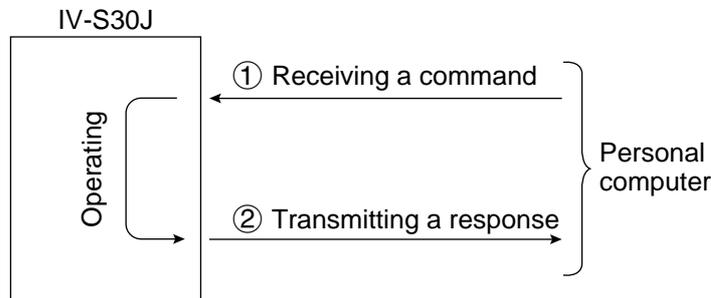
17-3 Communication format

The communication formats of the commands and responses between the IV-S30J and a personal computer are outlined below.

■ Command

Header | *1 Station No. | *2 Processing code | *2 Text | *4 Checksum code | Terminator

```
:  Station   * * * *  .............. * *  SC SC  CR
   No.                                    H  L
```

■ Response

Header | *1 Station No. | *2 Processing code | *3 Termination code | *2 Text | *4 Checksum code | Terminator

```
:  Station   * *  RC RC  * *  ............. * *  SC SC  CR
   No.           H  L                          H  L
```
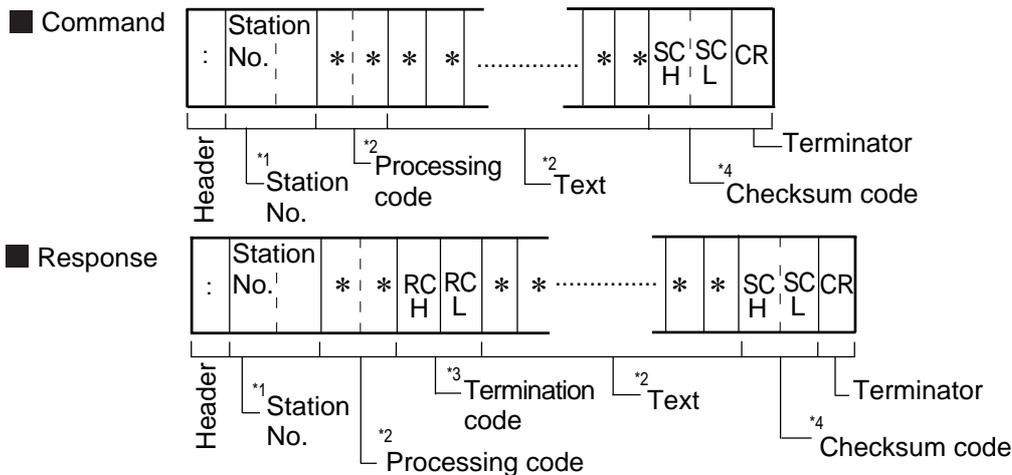
*1 Station No.: 00 to 7F(H)

*2 Processing code and text
  - They depend on the contents of communication. ⇨ See pages 17-1 and 17-7 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 19-3.

*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-S30J 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.

Value increment range for checksum

■ Command

```
:  Station   * * * *  .............. * *  SC SC  CR
   No.                                    H  L
```

Header | Station No. | Processing code | Text | Checksum code | Terminator

Value increment range for checksum

■ Response

```
:  Station   * *  RC RC  * *  ............. * *  SC SC  CR
   No.           H  L                          H  L
```

Header | Station No. | Processing code | Termination code | Text | Checksum code | Terminator

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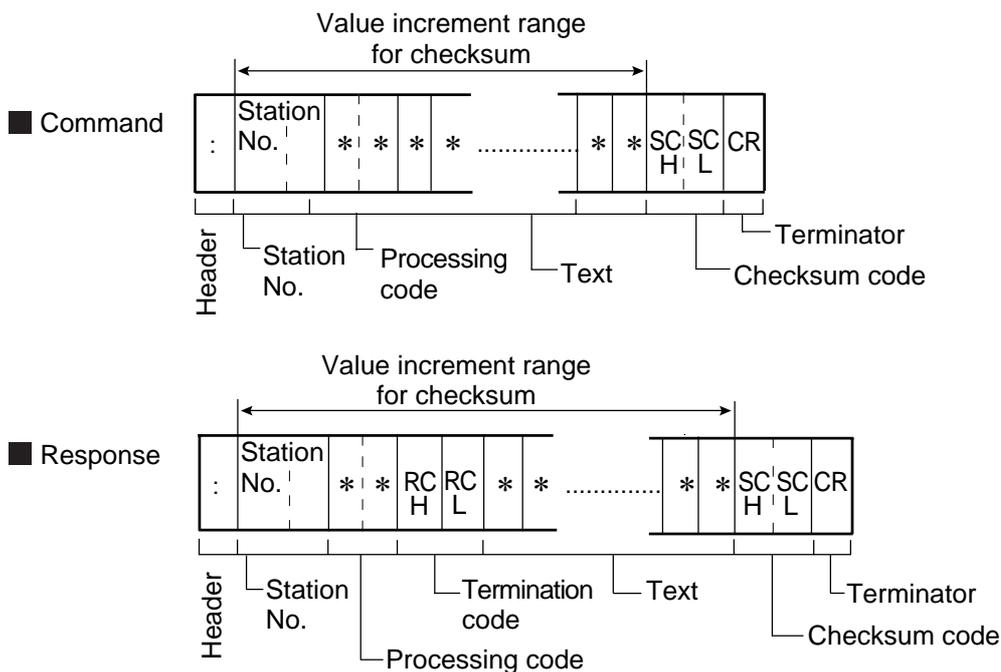
[Method for creating a checksum code]
The ASCII code for each byte of data, from the processing code to the end of text (prior to the checksum code) is added together. The lower 1 byte of this sum is divided into the upper 4 bits and the lower 4 bits. The hex character (0 to F) is converted to the ASCII 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))

:	Station No.	1	0	0	1	C	2	CR

—— ASCLII data

```
1.................31
0.................30
0.................30
1.................31
```
Checksum code : C2 ←—— C2
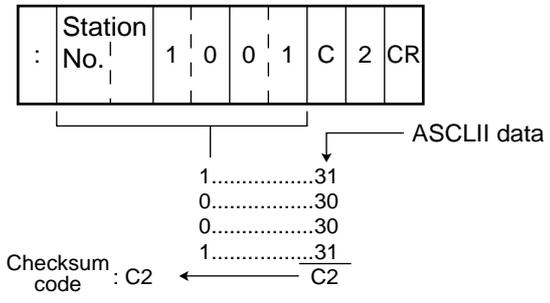
Ex. 2 Command for the measurement execution function 7 (code 1A(H))

:	Station No.	1	A	1	6	4	0	1	6	E	CR

—— ASCLII data

```
1.................31
A.................41
1.................31
6.................36
4.................34
0.................30
1.................31
```
Checksum code : 6E ←—— 16E
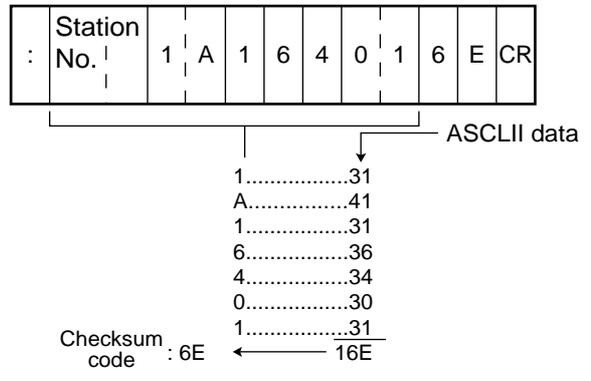
Note

- This manual uses the following notation to represent addresses and set values.

Octal number .... (8)	Ex. 377(8)
Decimal number .... None	Ex. 255
Hexadecimal number .... (H)	Ex. FF(H)

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17-4 Processing functions

[1] Measurement execution functions

(1) Measurement execution function 1: code 10(H)

This command will cause the IV-S30J 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 17-1 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 3F
- 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 17-3.

(2) Measurement execution function 2: code 11(H)

This command will cause the IV-S30J 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 17-1 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

①

:	Station No.	1	1	RC (H)	RC (L)	Object type	Execution camera	Final output evaluation result Y0 Y1 ··· Y15	Measurement 0 Camera 1 / Camera 2	Measurement 1	Measurement 2	Measurement 3	Measurement 4

Measurement 0 Camera 1 data ②	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 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, 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 18, "Computer link.")
- Data flow ⇨ See page 17-3.

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(3) Measurement execution function 3 : code 12(H)

This command will cause the IV-S30J 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 17-1 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 18, "Computer link.")
- Data flow

(4) Measurement execution function 4: code 14(H)

This command will cause the IV-S30J 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-S30J can be output as the response.

On page 17-1 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 3F
- 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

- Data flow

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[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 18: Computer link."

(1) Measurement data reading function 1: code 20(H)

This command will cause the IV-S30J 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 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

(2) Measurement data reading function 2: code 21(H)

This command will cause the IV-S30J 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

①

:	2	1	RC (H)	RC (L)	Object type	Execution camera	Final output evaluation result Y0 Y1 ··· Y15	Measurement 0 Camera 1	Camera 2	Measurement 1	Measurement 2	Measurement 3	Measurement 4

Measurement 0 Camera 1 data ②	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 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 → Measurement programs 0 to 4

  0 = none, 1 = positional deviation measurement, 2 = degree of match inspection, 3 = lead 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-S30J 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-S30J to read the results of the last measurement.
Any numeric value data will be output as a response. ⇨ See page16-26.
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 17-16.

(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	10^2	10^1	10^0	10^{-1}	SC (H)	SC (L)	CR

(Illuminance spans the 10^2, 10^1, 10^0, 10^{-1} columns.)

- 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	±	10^2	10^1	10^0	10^{-1}	10^2	10^1	10^0	10^{-1}	SC (H)	SC (L)	CR

(Corrected light level spans the first 10^2–10^{-1} group; Reference light level spans the second 10^2–10^{-1} group.)

- 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)

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[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
		`: │ Station No. │ 5 │ 0 │ SC(H) │ SC(L) │ CR`
		■ Response
		`: │ Station No. │ 5 │ 0 │ RC(H) │ RC(L) │ ① │ SC(H) │ SC(L) │ CR`
		①→Operation screen lock [0 : Lock OFF / 1 : Lock ON]

Set operation screen lock status	51	■ Command
		`: │ Station No. │ 5 │ 1 │ ① │ SC(H) │ SC(L) │ CR`
		①→Operation screen lock [0 : Lock OFF / 1 : Lock ON]
		■ Response
		`: │ Station No. │ 5 │ 1 │ RC(H) │ RC(L) │ SC(H) │ SC(L) │ CR`

Read from the English or Japanese display	52	■ Command
		`: │ Station No. │ 5 │ 2 │ SC(H) │ SC(L) │ CR`
		■ Response
		`: │ Station No. │ 5 │ 2 │ RC(H) │ RC(L) │ ① │ SC(H) │ SC(L) │ CR`
		①→English or Japanese display [0 : Japanese / 1 : English]

Set items on the English or Japanese display	53	■ Command
		`: │ Station No. │ 5 │ 3 │ ① │ SC(H) │ SC(L) │ CR`
		①→English or Japanese display [0 : Japanese / 1 : English]
		■ Response
		`: │ Station No. │ 5 │ 3 │ RC(H) │ RC(L) │ SC(H) │ SC(L) │ CR`

Read object type number	54	■ Command
		`: │ Station No. │ 5 │ 4 │ SC(H) │ SC(L) │ CR`
		■ Response
		`: │ Station No. │ 5 │ 4 │ RC(H) │ RC(L) │ Object type │ SC(H) │ SC(L) │ CR`
		①→Type number(00 to 3F)

Assign object type number	55	■ Command
		`: │ Station No. │ 5 │ 5 │ Object type │ SC(H) │ SC(L) │ CR`
		①→Type number(00 to 3F)
		■ Response
		`: │ Station No. │ 5 │ 5 │ RC(H) │ RC(L) │ SC(H) │ SC(L) │ CR`

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Process function	Process code	Communication format
Read the image status	56	■ Command : / Station No. / 5 / 6 / SC(H) / SC(L) / CR ■ Response : / Station No. / 5 / 6 / RC(H) / RC(L) / Output / Brightness / SC(H) / SC(L) / CR ① → Output ⌈ 0 : Freeze ⌉ ⌊ 1 : Through ⌋ ② → Light ⌈ 0 : Full ⌉ ⌊ 1 : Half ⌋
Set the image status	57	■ Command : / Station No. / 5 / 7 / Output / Brightness / SC(H) / SC(L) / CR ■ Response : / Station No. / 5 / 7 / RC(H) / RC(L) / SC(H) / SC(L) / CR ① → Output ⌈ 0 : Freeze ⌉ ⌊ 1 : Through ⌋ ② → Light ⌈ 0 : Full ⌉ ⌊ 1 : Half ⌋
Read out image camera condition	58	■ Command : / Station No. / 5 / 8 / SC(H) / SC(L) / CR ■ Response : / Station No. / 5 / 8 / RC(H) / RC(L) / ① / ② / SC(H) / SC(L) / CR ① Camera 1 ② Camera 2 Camera1 display ① ② 8 / 0 / 4 / 0 Camera2 display ① ② 4 / 0 / 8 / 0 Horizontal division display ① ② 0 / X₁ / 0 / X₂
Set output image camera condition	59	■ Command : / Station No. / 5 / 9 / ① / ② / SC(H) / SC(L) / CR ■ Response : / Station No. / 5 / 9 / RC(H) / RC(L) / SC(H) / SC(L) / CR ① Camera 1 ② Camera 2 Camera1 display ① ② 8 / 0 / 4 / 0 Camera2 display ① ② 4 / 0 / 8 / 0 Horizontal division display ① ② 0 / X₁ / 0 / X₂
Read the shutter speed for each object type	5A	■ Command : / Station No. / 5 / A / SC(H) / SC(L) / CR ■ Response : / Station No. / 5 / A / RC(H) / RC(L) / Shutter speed / SC(H) / SC(L) / CR ① → Shutter speed (001E to 2710(H) : 1/30 to 1/10000)
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)

Individual conditions

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	Process function	Process code	Communication format
Individual conditions	Register a reference image	5E	■ Command : │ Station No. │ 5 │ E │ ① Object │ Measure-ment No. │ SC (H) │ SC (L) │ CR │ ① → 0: Measurement program / 1: Comparative calculations between images ■ Response : │ Station No. │ 5 │ E │ RC (H) │ RC (L) │ SC (H) │ SC (L) │ CR
—	Initialize all parameters	60	■ Command : │ Station No. │ 6 │ 0 │ ① │ SC (H) │ SC (L) │ CR │ ① → Initialize memory / 0 : Flash memory and RAM / 1 : RAM ■ Response : │ Station No. │ 6 │ 0 │ RC (H) │ RC (L) │ SC (H) │ SC (L) │ CR
—	Self diagnosis	68	■ Command : │ Station No. │ 6 │ 8 │ SC (H) │ SC (L) │ CR │ ■ Response : │ Station No. │ 6 │ 8 │ RC (H) │ RC (L) │ SC (H) │ SC (L) │ CR
—	Reset	69	■ Command : │ Station No. │ 6 │ 9 │ SC (H) │ SC (L) │ CR │ ■ Response : │ Station No. │ 6 │ 9 │ RC (H) │ RC (L) │ SC (H) │ SC (L) │ CR

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Process function	Process code	Communication format

Read the manual measurement coordinates	70	■ Command
		
		`: │Station No.│ 7 │ 0 │SC(H)│SC(L)│CR`
		
		① → X coordinate 0X of the 0th detection (000 to IFF(H)) : 0 to 0511
		② → Y coordinate 0Y of the 0th detection (000 to IDF(H)) : 0 to 479
		③ → X coordinate 1X of the 1st detection (000 to IFE(H)) : 0 to 511
		④ → Y coordinate 1Y of the 1st detection (000 to IDF(H)) : 0 to 479
		
		■ Response
		
		`: │Station No.│ 7 │ 0 │RC(H)│RC(L)│ ① │ ② │ ③ │ ④ │SC(H)│SC(L)│CR`

Set the manual measurement coordinates	71	■ Command
		
		`: │Station No.│ 7 │ 1 │ ① │ ② │ ③ │ ④ │SC(H)│SC(L)│CR`
		
		■ Response
		
		`: │Station No.│ 7 │ 1 │RC(H)│RC(L)│SC(H)│SC(L)│CR`
		
		① → X coordinate 0X of the 0th detection (000 to IFF(H)) : 0 to 0511
		② → Y coordinate 0Y of the 0th detection (000 to IDF(H)) : 0 to 479
		③ → X coordinate 1X of the 1st detection (000 to IFE(H)) : 0 to 511
		④ → Y coordinate 1Y of the 1st detection (000 to IDF(H)) : 0 to 479

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[4] Setting numerical data of the any output measuring

Numerical data of the any setting of the response at measuring (code 14$_{(H)}$: page 17-8) and reading measurement data 4 (code 24$_{(H)}$: page 17-10) is as follows.

[Ex.] Response to code 24

| : | Station No. | 2 | 4 | RC(H) | RC(L) | Object type | Execution camera | Measurement code | Any numerical data | SC(H) | SC(L) | CR |

[Any type of numerical data]

| ① | Output code ② | Numeric result data ③ |

① → Delimiter between output data:","(Space 20$_{(H)}$ + comma 2C$_{(H)}$)
② → Output code list
③ → Numeric result data
   Output only the registered data in each specified measurement, in register order.
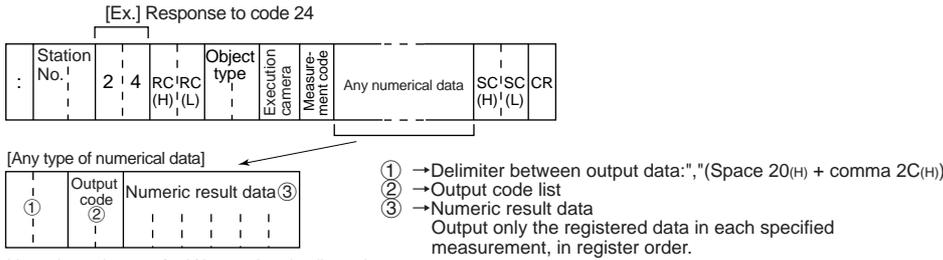
Note: A maximum of 1 K bytes data is allowed.

[Ex.] A numerical data of the any setting when outputting coordinate X and coordinate Y with the positional deviation measurements.

| , | 0 | 2 | Registration 0 (Model 0) | Registration 0 (Model 1) | : | Registration N (Model 1) | , | 0 | 3 | Registration 0 (Model 0) | : | Registration N (Model 1) |

● **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 measurement	Degree of match inspection	Lead 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
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			
Area of each label	CUR.	11	4						O			
	MAX.	12										
	MIN.	13										
X coordinate of gravity center/Distance between gravity centers X	CTR. OF GRAVITY	14	2							O		
	MAX. DIST.	15										
	MIN. DIST.	16										
Y coordinate of gravity center/Distance between gravity centers Y	CTR. OF GRAVITY	17	2							O		
	MAX. DIST.	18										
	MIN. DIST.	19										

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Output data				Measurement program								
Kind of output		Output code	No. of bytes	Positional deviation measurement	Degree of match inspection	Lead 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										
	MIN.	1C										
Fillet diameter Y	CUR.	1D	2						O			
	MAX.	1E										
	MIN.	1F										
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		

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Chapter 18: Computer Link

A programmable controller (hereafter referred to as a PC) can be connected to the IV-S30J, so that the computer link can be used to have the IV-S30J execute measurements.

18-1 Compatible models

The IV-S30J is applicable with the computer links for the following models of Sharp, Mitsubishi, OMRON, and Yokogawa.

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]

Yokogawa
- F3SP21-0N
- F3SP05-0P   CPU for F3SC21-1N
- F3SP08-0P   CPU for F3SC22-1F/2F/1A
- F3SP25-2N
- F3SP28-3N
- F3SP35-5N
- F3SP38-6N
- F3SP53-4H
- F3SP58-6H
- F3SP28-3S
- F3SP38-6S
- F3SP53-4S
- F3SP58-6S
- F3SP59-6S

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18-2 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.

The data flow for a measurement start input (CCD trigger/parallel) signal and an object type change command (parallel) is shown below.
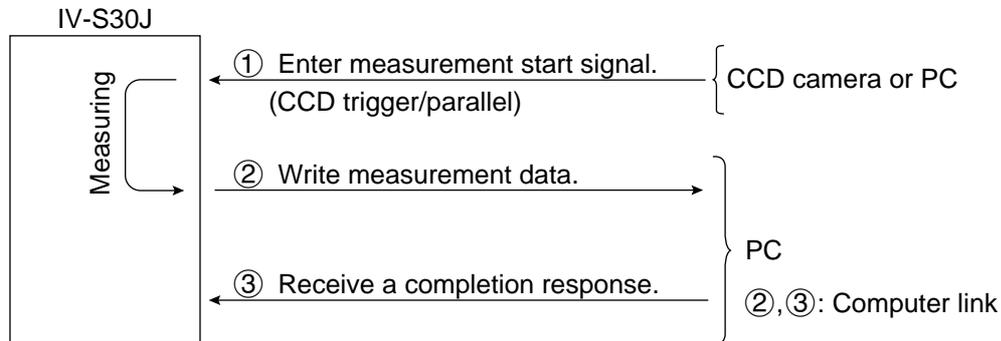
The block of measurement data to be written from the IV-S30J to the PC, in step ②, can be specified on the "OBJ-TYPE I/O" screen.

● **When a Sharp PC is connected**
   The IV-S30J sends write enable command (EWR) to the PC in the following cases.
   - When the power is applied to the IV-S30J.
   - 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, OMRON, or Yokogawa PC is connected**
   The data in items ② and ③ are divided into packets for transmission.

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18-3 Register setting

Use PC register (writing: up to 512 bytes) to provide the IV-S30J 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 - Yokogawa: D00001 to D16384	► See page 16-22.

Enter the write start address in item "③WRITE TOP ADRS," on the "COMPUTER LINK" screen, under the "SELECT SYSTEM COND" screen.

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		Yokogawa		Contents	
09000	D0000	L	DM0000	L	D00001	L	Termination code (00(H): normal termination, codes other than 00(H) abnormal termination ⇨See page 19-3.)	
09001		H		H		H	Appended information (error code in an error response)	*1
09002	D0001	L	DM0001	L	D00002	L	Object type number (0 to 63: 00 to 3F(H))	
09003		H		H		H	Measurement number when outputting results (0 to 5)	*2
09004	D0002	L	DM0002	L	D00003	L	Result output (Y0 to Y15)	
09005		H		H		H		*3
09006	D0003	L	DM0003	L	D00004	L	Measurement function 0 using camera 1	
09007		H		H		H	Measurement function 0 using camera 2	*4
09010	D0004	L	DM0004	L	D00005	L	Measurement function 1	
09011		H		H		H	Measurement function 2	
09012	D0005	L	DM0005	L	D00006	L	Measurement function 3	*5
09013		H		H		H	Measurement function 4	
09014	D0006	L	DM0006	L	D00007	L	Output data from measurement 0 camera 1 (block 0)	
09015		H		H		H	:	
:	:	L	:	L	:	L	Output data from measurement 0 camera 2 (block 0)	
:		H		H		H	:	
:	:	L	:	L	:	L	Output data from measurement 1 (block 0)	
:		H		H		H	:	
:	:	L	:	L	:	L	Output data from measurement 2 (block 0)	*6
:		H		H		H		
:	:	L	:	L	:	L	Output data from measurement 3 (block 0)	
:		H		H		H	:	
							:	
:	:	L	:	L	:	L	Output data from measurement 4 (block 0)	
:		H		H		H	:	
19000	D0256	L	DM0256	L	D00257	L	Assigned block data	
19001		H		H		H	·	*7
·	·		·		·		·	
·	·		·		·		·	

*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	Yokogawa
Write start address	09000	D0000	DM0000	D00001

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*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)

```
              H (09005)                    L (09004)
Bit   7  6  5  4  3  2  1  0     7  6  5  4  3  2  1  0

     Y15 Y14 Y13 Y12 Y11 Y10 Y9 Y8   Y7 Y6 Y5 Y4 Y3 Y2 Y1 Y0
```
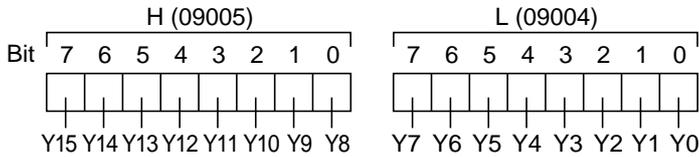
*4 Measurement program for measurement 0

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, 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 16-23 to 16-27.

● **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 18-6 to 18-13, for details about the measurement data in block 0.

● **When "ANY" is selected for the output**
⇨ See page 18-16.

*7 Assigned block data
When the SERIAL OUTPUT item is set to "BLOCK-ASSIGN," the IV-S30J will 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 16-23 and 16-25.
- No data is output if block 0 (00) is specified.

⇨ For details about the measurement data block, see pages 18-5 to 18-15.

- The top address where the specified block of data is written will be an address made by adding 512 bytes to the top address for writing results.

	Sharp	Mitsubishi		OMRON		Yokogawa		Contents
Top address for writing results →	09000	D0000	L	DM0000	L	D00001	L	Termination code
	09001		H		H		H	Appended information
	:	:		:		:		:
	:		L		L		L	Output data from measurement 4 (block 0)
	:		H		H		H	:
	:	:		:		:		:
Top address for writing results + 512 bytes →	19000	D0256	L	DM0256	L	D00256	L	Assigned block data
	19001		H		H		H	:
	:	:		:		:		:

18-4 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	18-6
	Degree of match inspection	0, 1	18-7
	Lead inspection	0, 1	
	Area measurement by binary conversion	0	18-8
	Object counting by binary conversion	0	
	Object identification (labeling) by binary conversion	0	18-8 to 10
	Point measurement	0, 1 (when binary processing is selected) 0 to 4 (when average density is selected)0 to 4	18-11 to 12
	Multiple positional measurement	0 to 4	18-13
	Multiple degree of match inspections	0 to 4	
Distance and angle measurement		58	18-14
Numerical calculation		51	18-15

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[2] Contents of the measurement result block (for each measurement function)
(1) Positional deviation measurement

Block	Item			Sign (+/-)	No. of bytes	Decimal point (digit)
0	Registration No. 0	1st point (center coordinates)	X	None	2	1
			Y	None	2	1
		2nd point (center coordinates)	X	None	2	1
			Y	None	2	1
		Angular deviation		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 "+" plus 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**

```
0 8 2 0   0 5 2 8   0 F A 0   0 E B 0   F F 7 6
    X         Y         X         Y      Angular
                                         deviation
Center coordinates  Center coordinates
   of 1st point        of 2nd point
              Registration No. 0
```

- These data are in hexadecimal. They are converted to the actual decimal measurements as shown below.

		Data (hexadecimal)	Decimal number	Measurement result (value)
Center coordinates of 1st point	X	820	2080	208.0
	Y	528	1320	132.0
Center coordinates of 2nd point	X	FA0	4000	400.0
	Y	EB0	3760	376.0
Angular deviation		FF76	—138	—13.8

Block	Item				Sign (+/-)	No. of bytes	Decimal point (digit)
1	Registration No. 0	Degree of match	1st point		Provided	2	None
			2nd point		Provided	2	None
		Deviation amount	1st point	X	Provided	2	1
				Y	Provided	2	1
			2nd point	X	Provided	2	1
				Y	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.

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(2) Degree of match inspection

Block	Item			Sign (+/-)	No. of bytes	Decimal point (digit)
0	Registration No. 0	Degree of match (positioning)	1st point	Provided	2	None
			2nd point	Provided	2	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.				

Block	Item				Sign (+/-)	No. of bytes	Decimal point (digit)
1	Registration No. 0	Coordinate	1st point	X	None	2	1
				Y	None	2	1
			2nd point	X	None	2	1
				Y	None	2	1
		Average light level	1st point		None	2	1
			2nd point		None	2	1
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.					

(3) Lead inspection

Block	Item		Sign (+/-)	No. of bytes	Decimal point (digit)
0	Registration No. 0	Number of objects	None	2	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.			

Block	Item			Sign (+/-)	No. of bytes	Decimal point (digit)
1	Registration No. 0	Distance	Maximum	None	2	1
			Minimum	None	2	1
			NG No.	None	2	None
			No. of NG	None	2	None
		Lead width	Maximum	None	2	1
			Minimum	None	2	1
			NG No.	None	2	None
			No. of NG	None	2	None
		Lead length	Maximum	None	2	1
			Minimum	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.				

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(4) Area measurement by binary conversion

Block	Item		Sign (+/-)	No. of bytes	Decimal point (digit)
0	Registration No. 0	Area	None	4	None
	Registration No. 1 to 15	Registration No. 1 to 15 contain the same data as the registration No. 0.			

(5) Object counting by binary conversion

Block	Item		Sign (+/-)	No. of bytes	Decimal point (digit)
0	Registration No. 0	No of labels	None	2	None
		Total area	None	4	None
	Registration No. 1 to 3	Registration No. 1 to 3 contain the same data as the registration No. 0.			

(6) Object identification by binary conversion

Block	Item			Sign (+/0)	No. of bytes	Decimal point (digit)
0	Registration No. 0	No. of labels		None	2	None
		Total area		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	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
		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		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	Provided	2	1
	Registration No. 1 spindle angle	Label 0 to 127	1B	Provided	2	1
69	Registration No. 2 spindle angle	Label 0 to 127	1B	Provided	2	1
	Registration No. 3 spindle angle	Label 0 to 127	1B	Provided	2	1
70	Registration No.0 fillet dia.	Label 0	X	None	2	None
			Y	None	2	None
		to		to		
		Label 127	X	None	2	None
			Y	None	2	None
71	Registration No.1 fillet dia.	Label 0 to 127		Each label contains the same data as block 70.		
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				

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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				

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(7) 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 = white	None	2	None
	Registration No. 16 to 31	Black and white information	0 = black 1 = white	None	2	None
	:	:		:		
	Registration No. 240 to 255	Black and white information	0 = black 1 = white	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 = white	None	1	None
	Registration No. 8 to 15	Evaluation information	0 = NG 1 = OK	None	1	None
		Black and white information	0 = black 1 = white	None	1	None
	:	:		:		
	Registration No. 248 to 255	Evaluation information	0 = NG 1 = OK	None	1	None
		Black and white information	0 = black 1 = white	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 increment (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 in block 0**

		Data	Contents
White/black information	White/black information	F A (H)	F A 1 1 1 1 1 0 1 0 Point No. — P7 P6 P5 P4 P3 P2 P1 P0 White/black — White White White White White Black White Black 0: black, 1: white

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.

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(8) Multiple positional 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
			Coodinate X	None	2	None
			Coodinate 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					

(9) Multiple degree of match 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
			Coodinate X	None	2	None
			Coodinate 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.

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(10) 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.

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(11) Numerical calculation

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.

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18-5 Specifications for any output data

When the serial output is set to "ANY" (page 16-26), the measurement results for the output data that is set to "YES" will be written into the write register map "output data from measurements 0 to 4 (block 0): *6 on page 18-3," 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
		to
		Degree of match for register number 7
	Output code 02 (coordinate X)	Coordinate X for register number 0
		Coordinate X for register number 1
		to
		Coordinate X for register number 7
	to	to
	Output code 40 (numeric calculation)	Numeric calculation result for register number 0
		Numeric calculation result for register number 1
		to
		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	Register 0 (degree of match, coordinate X, coordinate Y deviation) for measurement 1 (position deviation measurement)
09015		H		H	01	01 = output code (degree of match)	
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	
09021		H		H	02	02 = output code (X coordinate)	
09022	D0009	L	DM0009	L	92	$0992_{(H)}$: $2450_{(D)}$ = 245.0 (coordinate value)	
09023		H		H	09		
09024	D0010	L	DM0010	L	00	$0005_{(H)}$: 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	$0001_{(H)}$: 00 = fixed value	Register 0 (degree of match) for measurement 3 (degree of match inspection)
09031		H		H	00	01 = output code (degree of match)	
09032	D00013	L	DM00013	L	28	$2628_{(H)}$: $9752_{(D)}$ = 97.52%	
09033		H		H	26		

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● **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 measurement	Degree of match inspection	Lead 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
Distance MAX.	09	2			O						
Distance MIN.	0A	2			O						
Lead width MAX.	0B	2			O						
Lead width MIN.	0C	2			O						
Lead length/ lead width 2 MAX.	0D	2			O						
Lead length/ lead width 2 MIN.	0E	2									
Total area	10	4				O	O	O			
Area of each label CUR.	11	4						O			
Area of each label MAX.	12										
Area of each label MIN.	13										
X coordinate of gravity center/Distance between gravity centers X CTR. OF GRAVITY	14	2						O			
X coordinate of gravity center/Distance between gravity centers X MAX. DIST.	15										
X coordinate of gravity center/Distance between gravity centers X MIN. DIST.	16										
Y coordinate of gravity center/Distance between gravity centers Y CTR. OF GRAVITY	17	2						O			
Y coordinate of gravity center/Distance between gravity centers Y MAX. DIST.	18										
Y coordinate of gravity center/Distance between gravity centers Y MIN. DIST.	19										
Fillet diameter X CUR.	1A	2						O			
Fillet diameter X MAX.	1B										
Fillet diameter X MIN.	1C										
Fillet diameter Y CUR.	1D	2						O			
Fillet diameter Y MAX.	1E										
Fillet diameter Y MIN.	1F										

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Output data			Measurement program								
Kind of output	Output code	No. of bytes	Positional deviation measurement	Degree of match inspection	Lead 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
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 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 X	34	4
	Y slice length	35	

3. 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		

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18-6 Interface

The interface between the IV-S30J and a programmable controller from each manufacturer is described below.

```
┌──────────┐              ┌──────────────┐
│ IV-S30J  │──────────────│ Programmable │
└──────────┘              │  controller  │
     │                    └──────────────┘
     │                           │
  └─ Settings for the IV-S30J    ├─ Sharp      →  [2]
                                 ├─ Mitsubishi →  [3]
      →  See item [1] below.     ├─ OMRON      →  [4]
                                 └─ Yokogawa
```
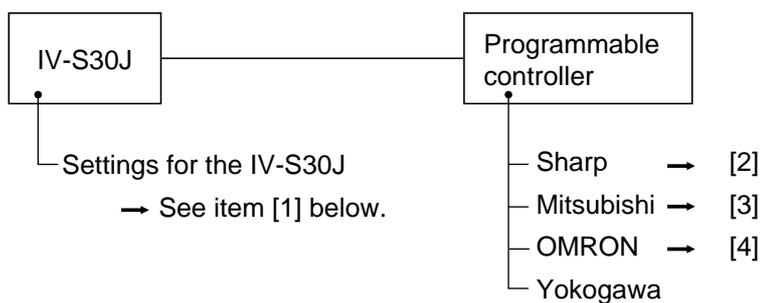
[1] Setting items for the IV-S30J

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 Yokogawa: 01 to 32
Write address (up to 512 bytes)	Sharp: 09000 to 99776 Mitsubishi: D0000 to D9999 OMRON: DM0000 to DM9999 Yokogawa: D00001 to D16384

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[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.
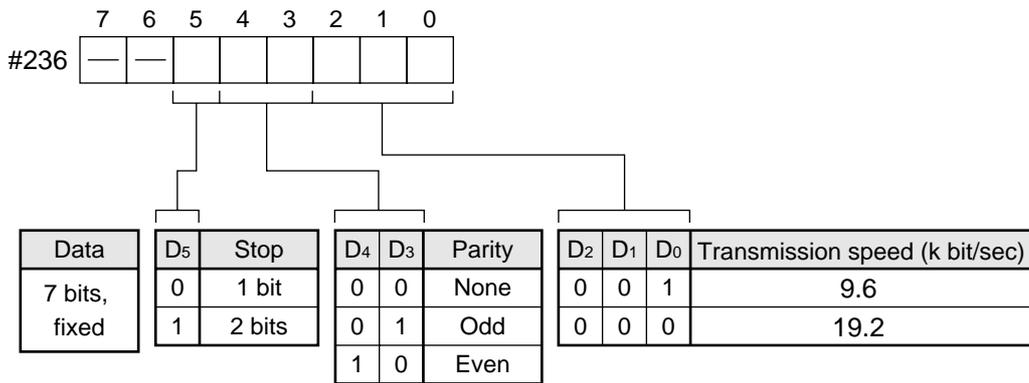
```
        7   6   5   4   3   2   1   0
#236  ──┬──┬──┬──┬──┬──┬──┬──┬──┬──
```

Data	D_5	Stop	D_4	D_3	Parity	D_2	D_1	D_0	Transmission speed (k bit/sec)
7 bits,	0	1 bit	0	0	None	0	0	1	9.6
fixed	1	2 bits	0	1	Odd	0	0	0	19.2
			1	0	Even				

#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.

```
        7   6   5   4   3   2   1   0
#234  ──┬──┬──┬──┬──┬──┬──┬──┬──┬──
```

Data	D_5	Stop	D_4	D_3	Parity	D_2	D_1	D_0	Transmission speed (k bit/sec)
7 bits,	0	1 bit	0	0	None	0	0	1	9.6
fixed	1	2 bits	0	1	Odd	0	0	0	19.2
			1	0	Even	1	1	1	38.4
						1	1	0	57.6
						1	0	1	115.2
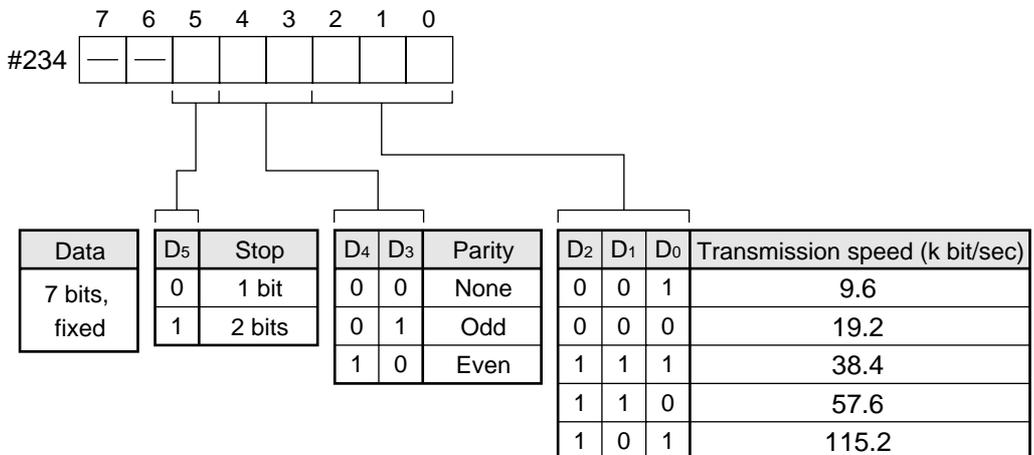
* Applicable only to
 the JW-32CUH1/33CUH1/33CUH2/33CUH3

#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.

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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 $00_{(H)}$.

```
      7   6   5   4   3   2   1   0
#236 |—|—|  |  |  |  |  |  |      Set bits $D_0$ to $D_5$ in memory address #236.
```

Data		D_5	Stop		D_4	D_3	Parity		D_2	D_1	D_0	Transmission speed (k bit/sec)
7 bits,		0	1 bit		0	0	None		0	0	1	9.6
fixed		1	2 bits		0	1	Odd		0	0	0	19.2
					1	0	Even		1	1	1	38.4
									1	1	0	57.6
									1	0	1	115.2
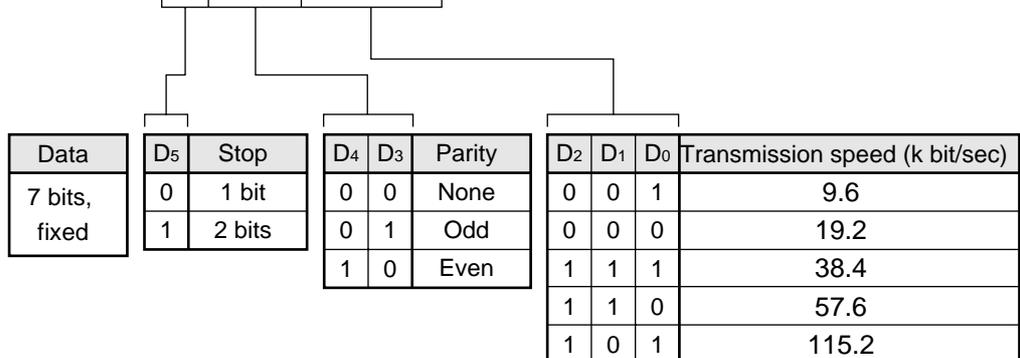
* Applicable only to
  the JW-32CUH1/33CUH1/33CUH2/33CUH3

#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).
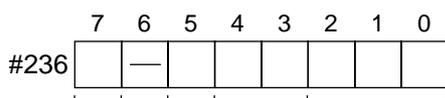
```
      7   6   5   4   3   2   1   0
#236 |  |—|  |  |  |  |  |  |      Set bits $D_0$ to $D_5$ and $D_7$ in memory address #236.
```
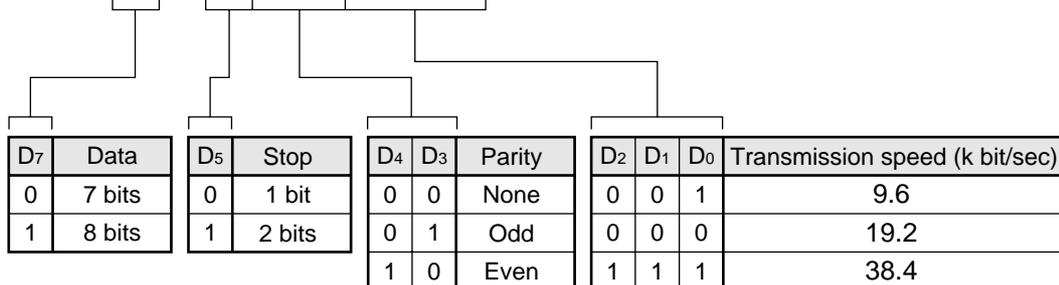
D_7	Data		D_5	Stop		D_4	D_3	Parity		D_2	D_1	D_0	Transmission speed (k bit/sec)
0	7 bits		0	1 bit		0	0	None		0	0	1	9.6
1	8 bits		1	2 bits		0	1	Odd		0	0	0	19.2
						1	0	Even		1	1	1	38.4

#237 | Station No. | $(001$ to $037_{(8)})$

Enter the station No. for the current station.

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In the initial state, addresses #234, #236 and #237 are set to 000.

2. When the MMI port is used

Store the communication conditions in system memory addresses #226 and #227. Set bits D_0 to D_5 in memory address #226.
Use of the MMI port ensures a one-to-one connection between the IV-S30J 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. | $(001_{(8)})$
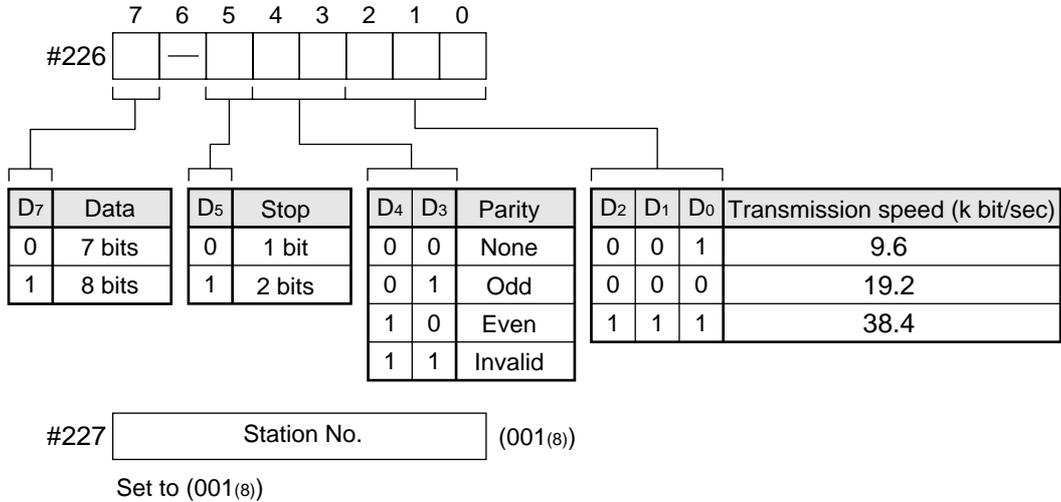
Set to $(001_{(8)})$

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.

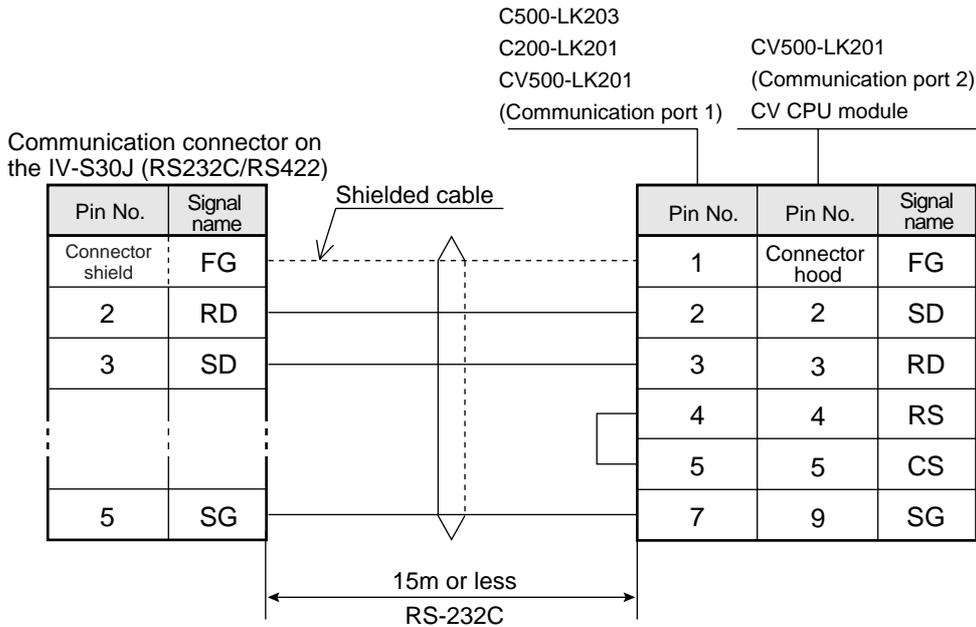| Switch	Setting	Set value
SW0	Computer link	4
SW1	Station No. (upper bit)	01 to $37_{(8)}$
SW2	Station No. (lower bit)	
SW3-1	Invalid	OFF
SW3-2	Only the 2-wire system can be used.	OFF
SW3-3	Invalid	OFF
SW3-4	Odd parity (OFF), even parity (ON)	OFF or ON
SW4	Transmission speed (k bit/sec) 19.2 (0), 9.6 (1)	0 or 1
SW7	With a termination resistance	ON

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(2) Using memory

To allow the memory to be used by the IV-S30J, enter a result write start address in the following range.

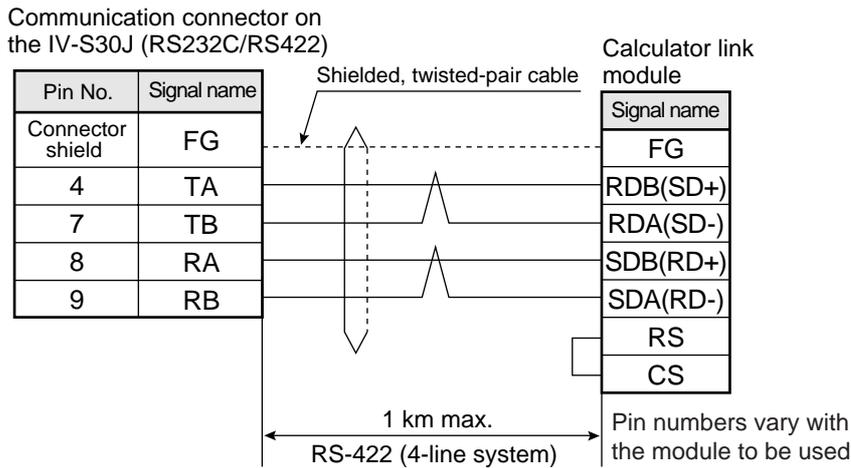| Memory	Range (address)
Register	09000 to 99776

(3) Connections

① **When a JW-22CU or JW-70CUH/100CUH is used**

1. Communication through the RS-232C port

Communication connector on
the IV-S30J (RS232C/RS422)

JW-22CU
JW-70CUH/100CUH
(Communication port)

Pin No.	Signal name		Pin No.	Signal name
Connector shield	FG		1	FG
3	SD		3	RD
2	RD		2	SD
5	SG		7	SG
			12	Short-circuit terminal
			14	
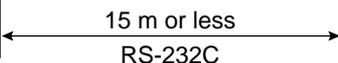
15 m or less
RS-232C

2. Communication through the RS-422 port (4-wire system)

Communication connector on
the IV-S30J (RS232C/RS422)

JW-22CU
JW-70CUH/100CUH
(Communication port)

Pin No.	Signal name		Pin No.	Signal name
4	TA		12	RD (+)
7	TB		13	RD (−)
8	RA		10	SD (+)
9	RB		11	SD (−)
Connector shield	FG		1	FG

Shielded, twisted-pair cable

1 km or less
RS-422
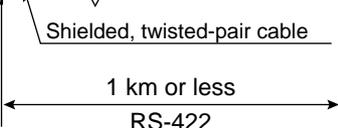
② **When a JW-32CUH/33CUH or JW-32CUH1/33CUH1/33CUH2/33CUH3 is used**

1. Communication through the RS-232C port

Communication connector on
the IV-S30J (RS232C/RS422)

JW-32CUH/33CUH
JW-32CUH1/33CUH1
/33CUH2/33CUH3
(PG/COMM2 port)

Pin No.	Signal name		Pin No.	Signal name
Connector shield	FG		1	FG
3	SD		4	RD
2	RD		2	SD
5	SG		7	SG
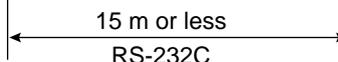
15 m or less
RS-232C

2. Communication through the RS-422 port (4-wire system)

Communication connector on
the IV-S30J (RS232C/RS422)

JW-32CUH/33CUH
JW-32CUH1/33CUH1
/33CUH2/33CUH3
PG/COMM1 port
PG/COMM2 port

Pin No.	Signal name		Pin No.	Signal name
4	TA		9	RD (+)
7	TB		10	RD (−)
8	RA		3	SD (+)
9	RB		11	SD (−)
Connector shield	FG		1	FG

Shielded, twisted-pair cable

1 km or less
RS-422

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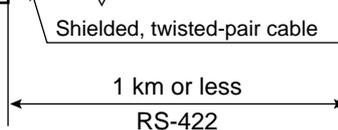
③ **When a JW-1324K/1342K/1424K/1442K/1624K/1642K is used**

The IV-S30J 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

Communication connector on the IV-S30J (RS232C/RS422)

JW-1324K/1342K/1424K /1442K/1624K/1642K (Communication port)

Pin No.	Signal name
4	TA
8	RA
7	TB
9	RB
Connector shield	FG

Terminal name
L1
L2
SHLD

Shielded, twisted-pair cable

1 km or less

RS-422 (2-wire system)

2. When the MMI port is used

Communication connector on the IV-S30J (RS232C/RS422)

JW-1324K/1342K/1424K /1442K/1624K/1642K (MMI port)

Pin No.	Signal name
4	TA
7	TB
8	RA
9	RB
Connector shield	FG

Pin No.	Signal name
2	RX
7	／RX
3	TX
8	／TX
4	PG／COM
5	GND

Shielded, twisted-pair cable

1 km or less

RS-422 (4-wire system)

④ **When a Z-311J/312J is used**

1. Communication through the RS-232C port

Communication connector on the IV-S30J (RS232C/RS422)

Z-311J/312J (Communication port CN3)

Pin No.	Signal name
Connector shield	FG
3	SD
2	RD
5	SG

Pin No.	Signal name
1	FG
3	RDc
2	TDc
7	GND
6	Short-circuit terminal
8	

15m or less

RS-232C

2. Communication through the RS-422 port (4-wire system)

Communication connector on the IV-S30J (RS232C/RS422)

Z-311J/312J (Terminal block TC1)

Pin No.	Signal name
4	TA
7	TB
8	RA
9	RB
Connector shield	FG

Pin No.	Signal name
3	RD
4	/RD
1	TD
2	/TD
5	FG

Shielded, twisted-pair cable

1 km or less

RS-422

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18-24
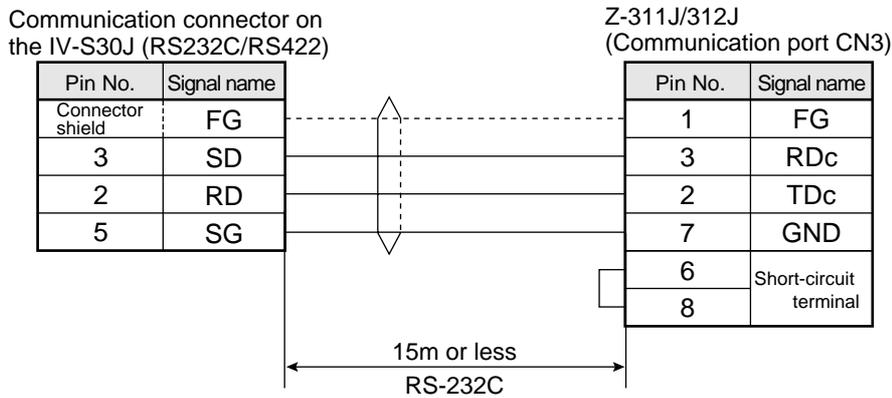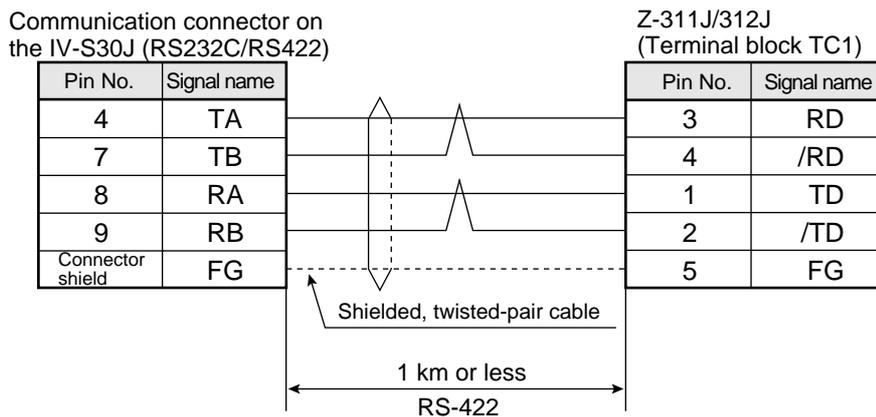
⑤ **When a JW-21CM or JW-10CM is used**
 - Communication through the RS-422 port (4-wire system)

Communication connector on
the IV-S30J (RS232C/RS422)

JW-21CM
JW-10CM

Pin No.	Signal name
4	TA
7	TB
8	RA
9	RB
Connector shield	FG

Signal name
L3
L4
L1
L2
SHIELD
GND

Ground

Shielded, twisted-pair cable

1 km or less
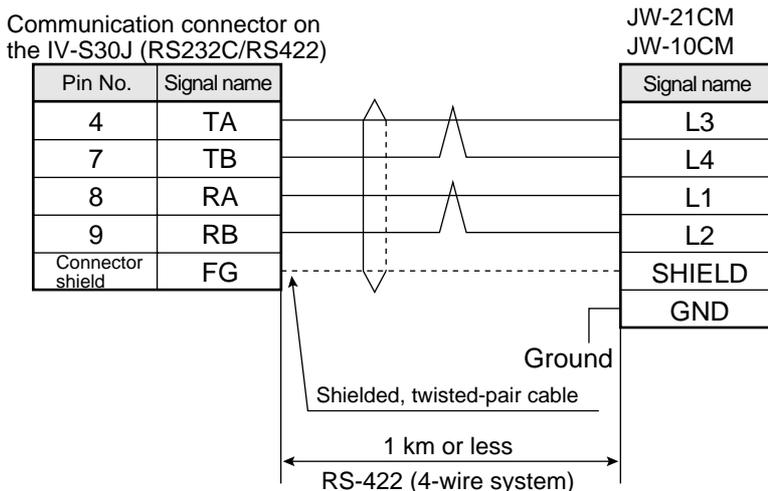
RS-422 (4-wire system)

⑥ **When a Z-331J/332J is used**
 - Communication through the RS-422 port (2-wire system)

Communication connector on
the IV-S30J (RS232C/RS422)

Z-331J/332J
(Host communication port T1)

Pin No.	Signal name
4	TA
8	RA
7	TB
9	RB
Connector shield	FG

Terminal name
L1
L2
S
FG

Shielded, twisted-pair cable

1 km or less

RS-422 (2-wire system)

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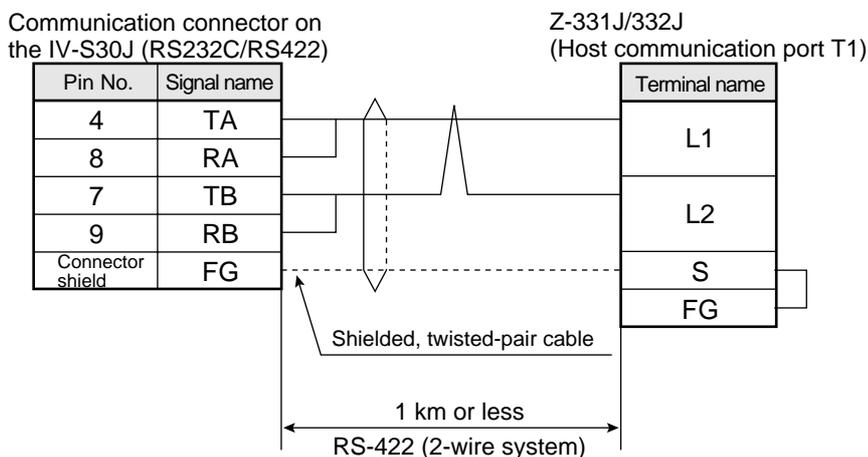
[3] Connection with a Mitsubishi PC

● **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 1ﬁ1
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
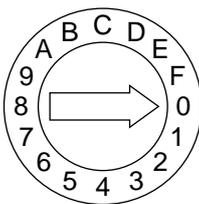
STATION No. × 10   STATION No. × 1   MODE
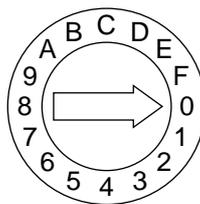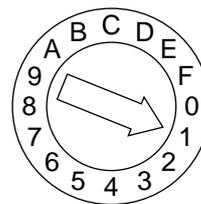
- DIP switches

SW11 to 13	SW14 to 24
OFF	ON

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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
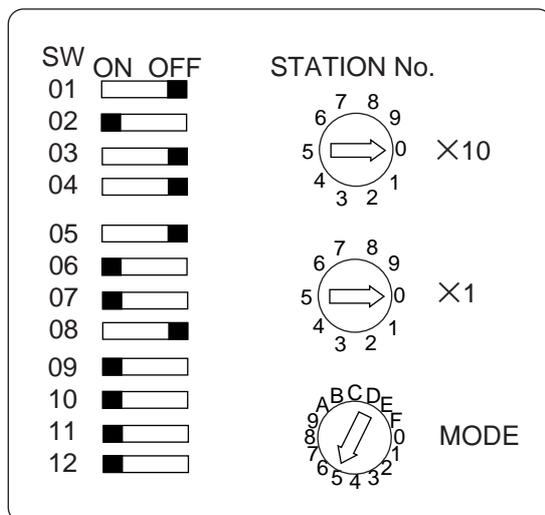
(2) Using memory
To allow the memory to be used by the IV-S30J, use a result write start address within the following range.

Memory	Range (address)
D (data register)	0 to 9999/0 to 999900

Note: To write data from the IV-S30J 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 16-22.

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(3) Connections

Shown below are the connections with a calculator link module.

① **Example of RS-232C connection**

Communication connector on
the IV-S30J (RS232C/RS422)

Calculator link module
In case of 25 pins connector   In case of 9 pins connector

Pin No.	Signal name
Connector shield FG	FG
2	RD
3	SD
5	SG

Shielded cable

Pin No.	Pin No.	Signal name
1	—	FG
2	3	SD
3	2	RD
4	7	RS
5	8	CS
20	4	DTR
6	6	DSR
7	5	SG

15m or less
RS-232C
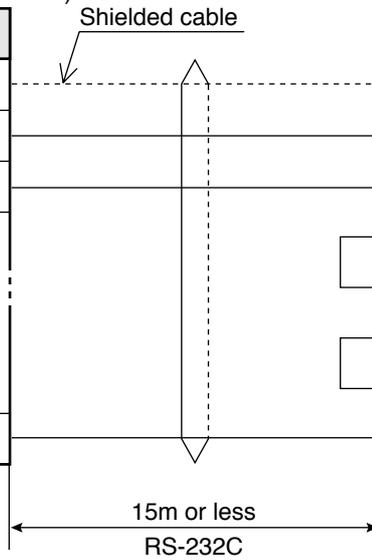
Note: Jumper the RS, CS, DR and CD lines.

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.
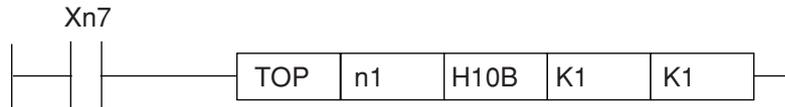
Xn7

TOP	n1	H10B	K1	K1

② **Example of RS-422 communication**

Communication connector
on the IV-S30J
(RS232C/RS422)

Calculator link module

Shielded, twisted-pair cable

Pin No.	Signal name
Connector shield	FG
4	TA
7	TB
8	RA
9	RB
5	SG

Signal name
FG
RDA
RDB
SDA
SDB
SG

1 km max.
RS-422 (4-wire system)

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[4] Connection with an OMRON PC
● Applicable models

Host link modules
1. C500-LK203 (C1000H)
2. C200-LK201 (C200H RS-232C)
3. C200-LK202 (C200H RS-422)
4. CV CPU link port (CV1000, CVM1)
5. CV500-LK201 (CV1000, CVM1)
6. CS1W-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.
>
> | | Memory module initial setting switch | | |
> |---|---|---|---|
> | **Installed support tool** | **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.
>
> ```
>           AR1001
> 00000 ───┤ ├────────────────┌──────────┐
>                              │  FUN49   │
>                              ├──────────┤
>                              │  #A302   │
>                              ├──────────┤
>                              │   000    │
>                              ├──────────┤
>                              │   000    │
>                              └──────────┘
> ```
>
> *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	Data bit	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-S30J, 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.

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(2) Using memory

To allow the memory to be used by the IV-S30J, enter a result write start address within the following setting range.

Memory	Range (address)
DM (data register)	0 to 9999

Note: The IV-S30J 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**

C500-LK203
C200-LK201
CV500-LK201
(Communication port 1)

CV500-LK201
(Communication port 2)
CV CPU module

Communication connector on the IV-S30J (RS232C/RS422)

Shielded cable

Pin No.	Signal name		Pin No.	Pin No.	Signal name
Connector shield	FG		1	Connector hood	FG
2	RD		2	2	SD
3	SD		3	3	RD
			4	4	RS
			5	5	CS
5	SG		7	9	SG

15m or less

RS-232C

② **Example of RS-422 communication**

Communication connector on the IV-S30J (RS232C/RS422)

Calculator link module

Shielded, twisted-pair cable

Pin No.	Signal name		Signal name
Connector shield	FG		FG
4	TA		RDB(SD+)
7	TB		RDA(SD-)
8	RA		SDB(RD+)
9	RB		SDA(RD-)
			RS
			CS

1 km max.

RS-422 (4-line system)

Pin numbers vary with the module to be used

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18-7 Program examples

An example of measurements using the IV-S30J and a Sharp PC (JW70H) (2-point search for positional deviation measurement) is explained below, using data flow, a flowchart and a timing chart.

Input terminal

IV-S30J main housing
(plan view)

Sharp's PC (JW70H)

Communication port

Output module

VIDEO CAMERA1 CAMERA2 RS232C/RS422 REMOTE

IV-S30J main housing
(side view)

Camera 1

Communication connector
(RS232C/RS422)

Camera 1 connector

(1) Data flow

Sharp PC (JW70H)

IV-S30J

Output relay	Description
00040	Start output

① Output a start signal.

② Write data into the register.

③ Transmit completion response.

Execution of measurement

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		
09005	00	(Only Y0 is OK.)		
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, OMRON, or Yokogawa 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-S30J, 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-S30J.

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(2) Flow chart

```
                    ( Power ON )
                         |
                         v
                    /‾‾‾‾‾‾‾‾‾‾‾\        N
                   < 15 second interval >---->
                    _____/
                         | Y
                         v
                    /‾‾‾‾‾‾‾‾\
                   /  Camera  \       N
                  <  starts    >----->
                   \ operation /
                    \(00040=ON)/
                      _____/
                         | Y
                         v
          +-----------------------------------+
          | Starting the time-out detection timer |
          +-----------------------------------+
                         |
                         v
                    /‾‾‾‾‾‾‾\      Y
                   <  Time-out >---->
                    _____/
                         | N
                         v
        Y          /‾‾‾‾‾‾‾‾‾‾‾\
       <----------< Normal termination >
                   _____/
        |                | N
        v                v
+------------------+  /‾‾‾‾‾‾‾\   N
| * Transferring   | < Error occurs. >---->
|  the result      |  _____/
|  output (Y0 to Y15)     | Y
|  from registers  |       v
|  09004 and       |  +----------------------+
|  09005 to        |  | Turning ON relay 00013 |
|  addresses ]0412 |  +----------------------+
|  and ]0413       |       |
+------------------+       v
        |            /‾‾‾‾‾‾‾‾‾\
        v           /  Error    \   N
+------------------+<  recovery   >---->
| Turning ON relay |  \(00041=ON)/
|      00010       |   _____/
+------------------+       | Y
        |                  v
        v
+------------------+
|  Outputting Y0   |
+------------------+
        |
        v
+------------------+
|  Outputting Y1   |
+------------------+
        |
        v
```

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(3) Program

Ladder diagram:

Rung	Content
1	07377 (NC) —— TMR 000 / 0050
2	00040 —— ( ) 00000
3	T000 —— 00000 —— F-044 (↑) —— 04100 (NC) —— 00006 (NC) —— ( ) 00007
4	00007 —— F-008 OCT / 377 / 09000
5	00007 —— 04100 (NC) —— 04101 (NC) —— TMR 001 / 0030
6	T001 —— ( ) 04107
7	00007 —— Fc012 CMP / 09000 / 000
8	07357 —— ( ) 04100
9	07354 —— 07357 (NC) —— Fc012 CMP / 09000 / 377
10	07356 —— ( ) 04101
11	04100 —— F-000w XFER / 09004 /]0412
12	04100 / 00010 —— 00040 (NC) —— ( ) 00010
13	04120 / 00011 —— 00040 (NC) —— ( ) 00011
14	04121 / 00012 —— 00040 (NC) —— ( ) 00012
15	04101 / 04107 / 00013 —— 00041 (NC) —— ( ) 00013
16	04101 / 04107 —— 00041 —— ( ) 00006

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● **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-S30J 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
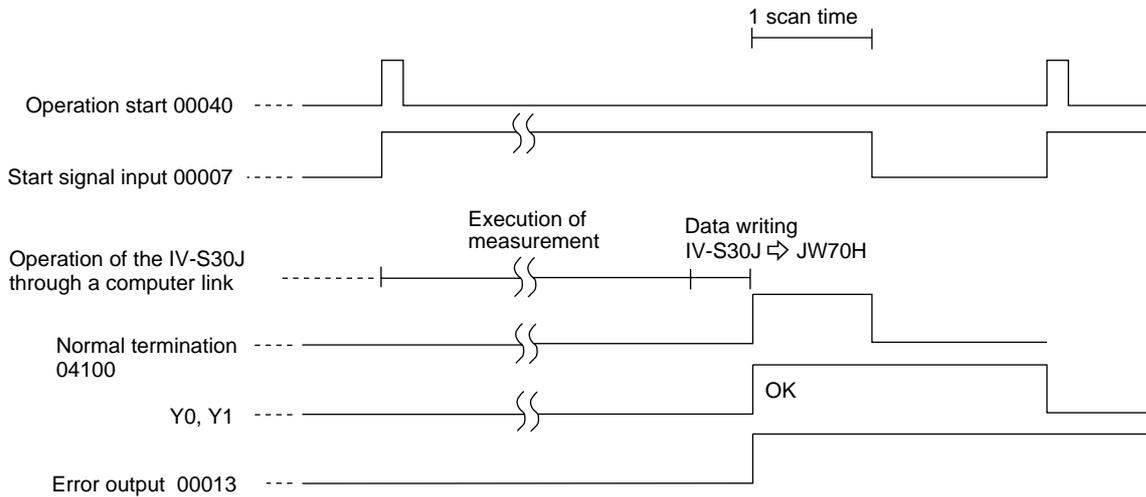
Chapter 19: Troubleshooting

Item [1] shows problems which may occur when the IV-S30J measurement system is started. If any error (the termination code is not 00(H)) occurs during image processing on the IV-S30J, 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-S30J does not light.)	1.	Make sure that the power cord has been connected properly to the DC power terminal block on the IV-S30J.
	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 operation screen 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-S30J.
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 properly connected.
	3.	Make sure that the communication conditions (standard, speed, and parity check) in the personal computer conform to those of the IV-S30J.
	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 operation screen is displayed on the screen.

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* You can change to the through mode screen using the "TYPE RUN COND" screen.

- Continued on the following page -

Phenomenon		Checks
Communications through a computer link cannot be established.	1.	Make sure that the communication cable has been correctly connected.
	2.	Make sure that the communication cable route does not run near electrically noisy devices.
	3.	Make sure that each terminal of the camera cables is properly connected.
	4.	Make sure that the communication conditions (standard, speed, and parity check) in the personal computer conform to those of the IV-S30J.
	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 operation screen 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-S30J main housing.
	4.	Make sure that you waited about 15 seconds after you turned ON the power.
	5.	Make sure that the operation screen 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-S30J main housing.
	3.	Make sure that you waited about 15 seconds after you turned ON the power.
	4.	Make sure that the operation screen 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.

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[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.

	Termi-nation 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 check sums. - 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-S30J 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-S30J 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	
	26	Number of labels exceeds the specified amount	
	27	No setting for number o fimage lines	
	28	"0" subtraction error (numeric calculation	

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Termination code (H)	Cause	Remedy
29	Overflow (numerical calculation)	
2A	No numerical calculation setting	
2B	No label (camera adjustment)	
2C	The search area is smaller than the reference image.	
2D	Equivalent label exceeded	
2E	Edge center point exceeded (lead inspection)	
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)	Check the abnormal setting.
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.	

Processing errors (vertical label spanning left of table)

19 (tab marker)

Termi-nation code (H)		Cause	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)	

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[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.)

CCD
section

A →

Front view
(view A) of the CCD

When an IV-S30C1 is used
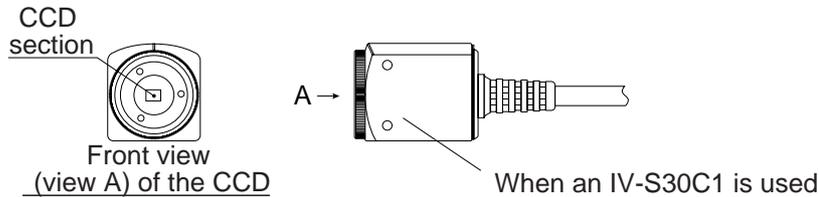
(3) When measurement errors and/or evaluation errors occur frequently, check:
- The illumination of the lighting equipment and lamps.
- The inspection object is within the window.
- The cables for looseness or disconnection.
- The lens for dirt and dust.
- The lens focus and aperture have not changed.
- 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.)

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