

## Compact image sensor camera

# IV-S30J

## User's Manual (Introduction and Hardware)

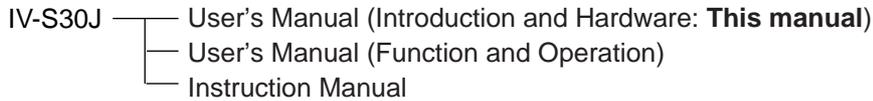


Thank you for purchasing the SHARP IV-S30J compact image sensor camera.

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 other IV-S30J manuals as follows. Read them in conjunction with this manual.



| Manual type   | Major subjects  | How to use   |
|---|---|--|
| IV-S30J<br>User's Manual<br>(Introduction and Hardware) | <ul style="list-style-type: none"> <li>- Outline of the IV-S30J (features and functions)</li> <li>- Description of the hardware</li> <li>- Startup method</li> <li>- General performance specifications.</li> <li>- Example of operation and instruction</li> </ul>                           | <ul style="list-style-type: none"> <li>- Become acquainted with the IV-S30J</li> <li>- Learn how to install the IV-S30J and wire it up</li> <li>- When mastering the outline of operation</li> </ul>   |
| IV-S30J<br>User's manual<br>(Function and Operation)    | <ul style="list-style-type: none"> <li>- Detailed explanations of all the measurement functions.</li> <li>- How to make menu selections for each measurement</li> <li>- Details of inputting and outputting data and communications with other devices.</li> <li>- Troubleshooting</li> </ul> | <ul style="list-style-type: none"> <li>- Learn how to specify measurement /inspection conditions, good or NG judgment conditions, etc.</li> <li>- Learn how to connect a programmable controller or personal computer.</li> <li>- Learn what to do if a problem occurs.</li> </ul> |

**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.

# Safety Precautions

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

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

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

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

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

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

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

## (1) Installation

### **Caution**

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

## (2) Wiring

### **Caution**

- Do not connect any camera not specified by SHARP to the controller. Connecting any other camera to the controller may damage the controller or the camera.
- Connect only to the specified power source. Connection to the wrong power source may cause a fire.
- Wiring should be performed by a qualified electrician. Improper wiring may lead to a fire, machine failure or electric shock.

## (3) Use

### **Danger**

- Don't touch the terminals while the power is turned ON or you may receive an electric shock.
- Assemble an external emergency stop circuit and interlock circuit (external to the IV-S30J compact image sensor camera). Otherwise a breakdown or damage to other equipment may occur due to a problem with the IV-S30J.

### **Caution**

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

#### (4) Maintenance



#### **Prohibit**

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



#### **Caution**

- Turn OFF the power source before connecting or disconnecting the IV-S30J.  
If you don't, electric shocks, malfunctions or breakdowns may occur.

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**Chapter 2: Precautions for Use**

**Chapter 3: System Configuration**

**Chapter 4: Part Names and Functions**

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# Chapter 1: Outline

The compact, image-sensor camera IV-S30J is a complete system containing a controller, camera, and keypad. This model is an excellent value, offering high performance at an economical price, with the following features.

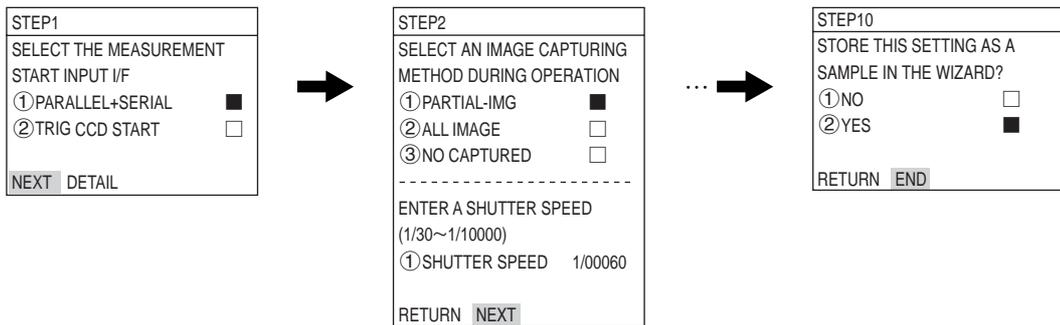
- High-speed processing — approximately double the speed of the IV-S20
- The functions are the same as found on the IV-S30 (IV-S31M)
- Easy to read menu screens
- Customizable screens

## 1-1 Features

### Easy operation menu

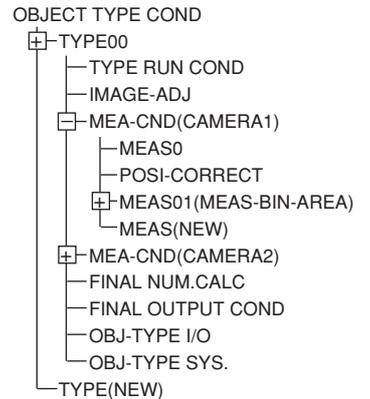
#### (1) Setting wizard

The IV-S30J wizard asks you to make selections using a questionnaire, thus allowing anyone to set up the measurement operations and preferences, and decrease the chance of mistaken settings.



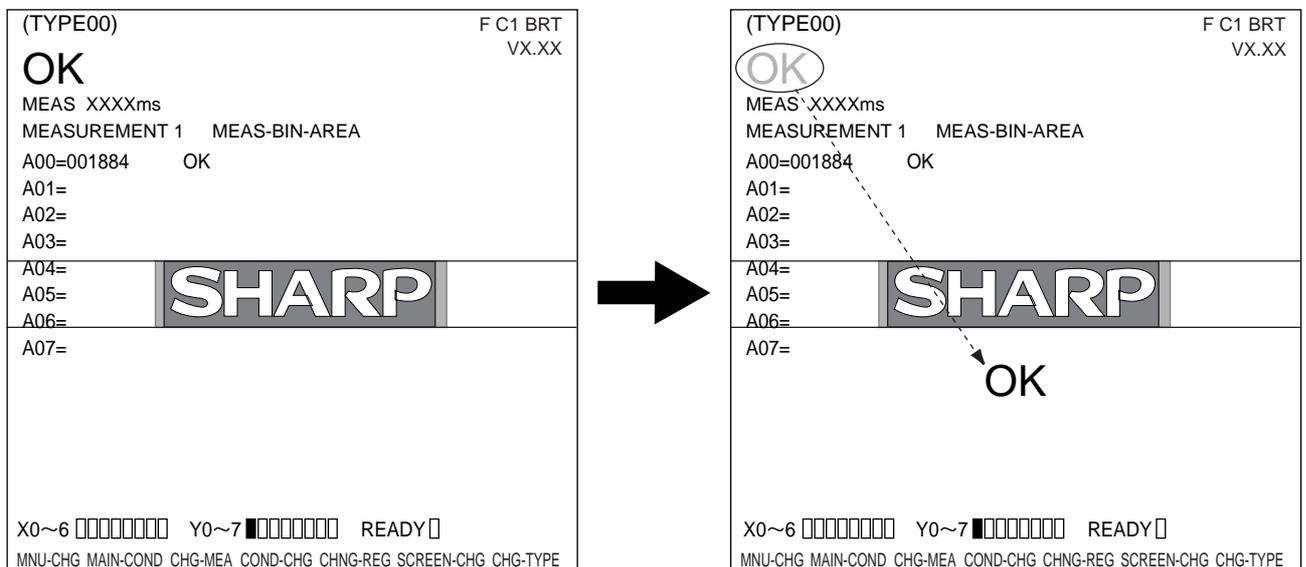
#### (2) Tree menu

The tree structure menu lets you find the setting parameter you need easily. Using the short cut function, you can move directly to a desired menu.



### Operation screen editing function

You can move, remove, enlarge, and decrease the size of the information displayed on the operation screen.

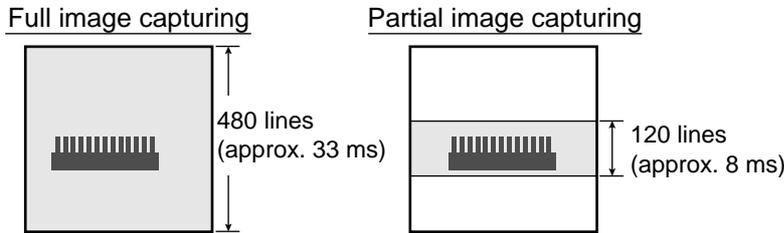


■ **Customize to your own specification**

An IV-S30LB1 image processing library and IV-S30SP parameter setting support software are both available. Using these tools, the menu screen can be modified to suit your specialized needs to create your own unique image processing system.

■ **Reads full and partial images**

Since image processing of some objects only requires capturing a portion of the available image, images can be captured and processed at high speed.



■ **Our high-precision gray search is also high speed**

We normalize images to a 256 grayscale standard, and perform a high-precision gray search by detecting features in sub-pixel units.

The IV-S30J can shorten this process using 15 ms\* high-speed processing.



\* When the search area is 256 x 256 pixels, the model is 64 x 64 pixels, and contraction is to set 3.

■ **The camera diameter is only 17 mm, so it can be installed in a very limited space**

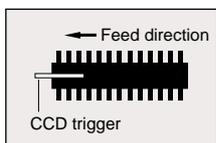
The IV-S30C2 camera is capable of capturing images at 4 times the speed of the standard camera, progressive scanning, and it uses a square grid. It is as small as your thumb. It can be installed in virtually any tiny space in even the smallest machines.

■ **Shorten the cycle time by connecting two cameras**

The IV-S30J can be simultaneously connected to two IV-S30C1/C2 standard cameras. By connecting two cameras, your system can reduce the processing time by positioning two areas at the same time, and then inspecting two areas at the same time.

■ **CCD trigger function does not need an external sensor**

After a trigger window is setup, the IV-S30J does not need an external sensor if it is scanning moving objects. To set up a trigger, you can select from binary image conversion, average density, and gray search techniques. The gray search mode is useful for a workpiece for which you cannot easily establish the density range.



■ **Shutter speed freely set**

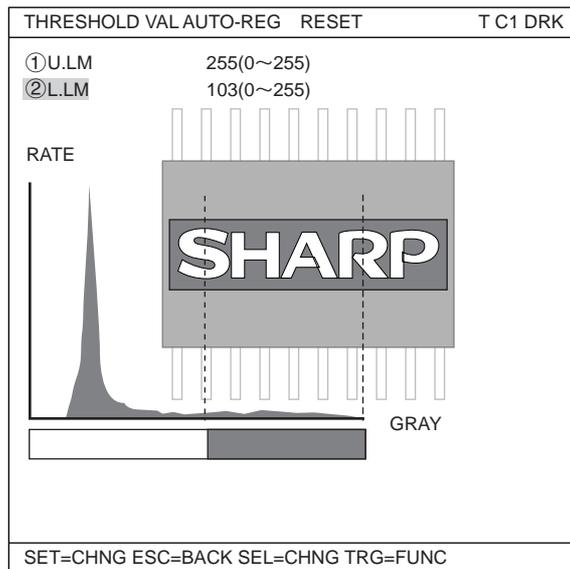
The shutter speed can be set anywhere between 1/30 and 1/10000 second for each object type. Practically, this means that the light level can be adjusted without changing the lighting equipment for each object type. The random shutter function is used to close the shutter when a trigger event is detected, so that precise still images of moving objects can be scanned.

■ **Easily and automatically set threshold value and judgement criteria**

Using the SET key, the IV-S30J can automatically set the threshold values (binary conversion, density difference, and edge width), that used to be set by entering numbers manually.

## ■ Histogram display of threshold values

In previous versions, the threshold values have only been displayed as numeric values. This model adds a graphic display so that you can view the threshold values as an image.



## ■ Automatic search reference images

The controller automatically searches for the maximum contrast area within the measurement area, and detects it virtually instantly. Mistake-free work can now be performed quickly.

- This can be used for mis-collation checks of printed matters.

## ■ Simple measurements of position, detection of the same workpiece and counting quantities

By using the degree of match inspection functions for multiple workpieces and position measurement for multiple workpieces, the controller can detect up to 128 workpieces in one image that meet or exceed a specified degree of match with the reference image. The controller can count quantities and measure the positions of workpieces that have complicated structures of light levels and are difficult to convert to binary images.

## ■ Effective when checking for angular deviation, very good as a robotic eye

The controller can detect objects turned through a full 360° of orientation. It can inspect printing at great angles off the main axis, and can be used in robotic inspection machines.

## ■ Integrated measuring programs allow the controller to be used for inspection and measurement immediately

Simple operations on the remote keypad let you select the desired measuring program to suit your application. Since there is no need to develop measuring programs, this unit is easy set up and you can start measuring products the same day you receive it.

- Various measuring programs

Positional deviation measurement, degree of match inspection, distance and angle measurement, lead inspection, area measurement by binary conversion, counting by binary conversion, label measurement by binary conversion, point measurement, multiple position measurement, and multiple degree of match inspection.

## ■ Integrated micro PC function

The IV-S30J has a micro PC function that allows it to determine unknown values by calculating the inspected and measured results and then output signals to lamps and plungers. You can construct a complete, simple inspection process with a single controller.

## 1-2 Controller

### [1] Software version of the controllers

This manual describes the controller and their respective software versions 3.04 below.

### [2] Differences between types of controllers

The controller IV-S30J have the following specifications.

| Item   |   | IV-S30J  | IV-S31M                                   | IV-S20                    |
|--|---|--|---|---------------------------|
| Number of object types handled                             |   | 16   | 16  | 16                        |
| Maximum number of reference images/ total number of images |   | 200/2  | 300/3                                     | 200/3                     |
| Measurement program  | Positional deviation measurement                      | ○  | ○   | ○                         |
|  | Degree of match inspection                            | ○  | ○   | ○                         |
|  | Area measurement by binary conversion                 | ○  | ○   | ○                         |
|  | Object counting by binary conversion                  | ○  | ○   | ○                         |
|  | Object identification (labeling) by binary conversion | ○  | ○   | ○                         |
|  | Point measurements                                    | ○  | ○   | ○                         |
|  | Lead inspection                                       | ○  | ○   | ○                         |
|  | BGA/CSP inspection                                    | —  | —   | —                         |
|  | Multiple position measurement                         | ○  | ○   | —                         |
| Distance and angle measurement                             | ○   | ○  | —   |                           |
| Communication method                                       |   | RS232C/<br>RS422   | RS232C/<br>RS422/USB                      | RS232C/<br>RS422          |
| Menu   |   | Setting window<br>Menu tree                                  | Simplified menu<br>Standard menu          | Standard menu             |
| Customize operation screen                                 |   | ○  | —   | —                         |
| Size (WxDxH)   |   | 130x92x30  | 130x100x42                                | 130x92x30                 |
| Polygonal window   |   | 32   | Octagonal<br>(binary mask only)           | —                         |
| CCD trigger  |   | Binary/average<br>density/<br>Gray search/<br>edge detection | Binary/average<br>density/<br>Gray search | Binary/average<br>density |
| Gray search time*  |   | 15 ms  | 18 ms                                     | 37 ms                     |
| Input terminal block                                       | Object type be changed                                | X1 to 4  | X1 to 4                                   | X0,X1 to 4                |
|  | External input  | X5 to 6  | X5 to 7                                   | X5 to 6                   |
| Power consumption  |   | 7 W  | 7 W                                       | 250 mA                    |

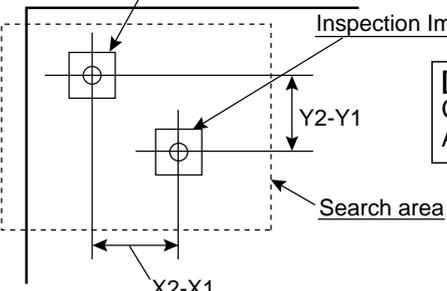
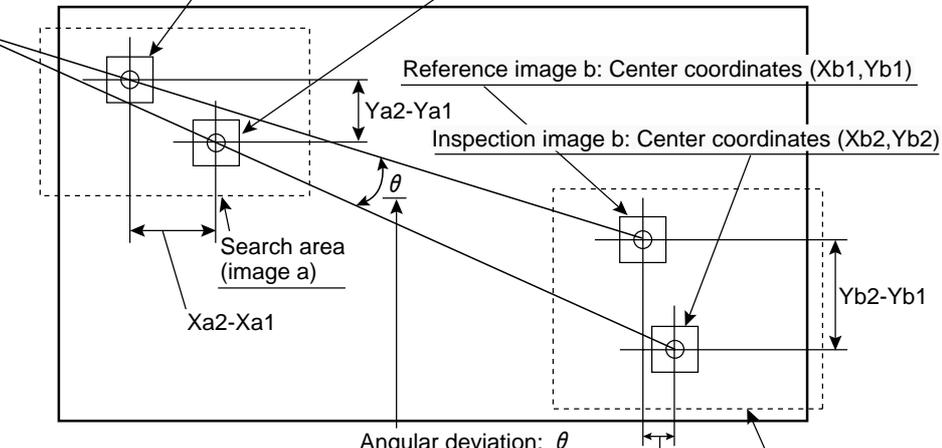
\* The gray search times given above are true when the search area is 256 x 256 pixels, the model is 64 x 64 pixels, and the contraction value is set to 3.

For other specifications, see pages 9-1 to 9-3 in "Chapter 9: Specifications."

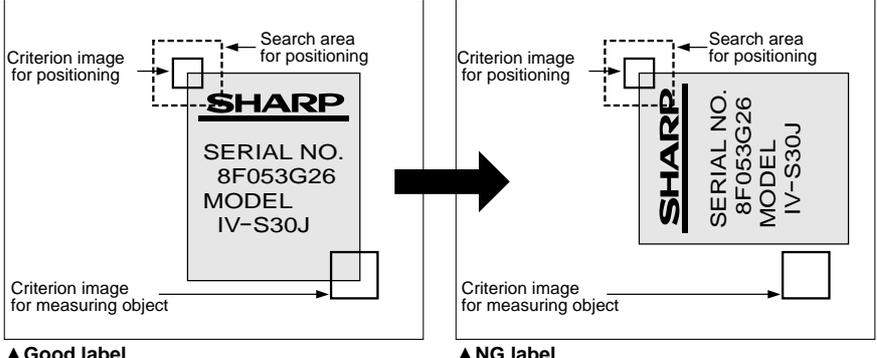
## 1-3 Measurement program

The IV-S30J integrates the following eight measurement programs: Positional deviation, degree of match inspection, lead inspection, area measurement by binary conversion, object counting by binary conversion, object identification (labeling) measurements by binary conversion, multiple position measurement, multiple degree of match inspection, point measurements and distance and angle measurement. You can select operating condition parameters to suit your application of the IV-S30J. A description of each screen area is shown below.

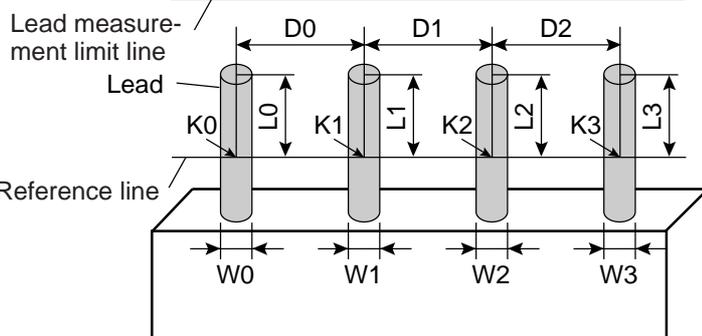
### [1] Positional deviation measurement

|                    |   |
|--------------------|---|
| <b>Purpose</b>     | <p>The gray scale search function and edge detection function* make possible measuring positional deviation as well as the absolute position.</p> <ul style="list-style-type: none"> <li>- It is also possible to detect the position of sub-pixel units with great accuracy.</li> <li>- A rotation angle of <math>360^\circ</math> can be detected. (When a one point gray search is selected).</li> </ul>   |
| <b>Application</b> | Used to determine the position of machine parts and substrates.   |
| <b>Example</b>     | <p><b>[Determining the location of the positioning (the fiducial mark) mark that identifies the position of the substrate]</b></p> <p><b>(1) 1 point search: Detecting the deviation in position in X and Y directions</b><br/> Reference image: Center coordinates <math>(X_1, Y_1)</math></p>  <p><b>[Measured result]</b><br/> Center coordinates: <math>(X_2, Y_2)</math><br/> Amount of deviation: <math>X_2 - X_1, Y_2 - Y_1</math></p> <p><b>(2) 2 point search: Determining positional deviation in X and Y directions as well as rotational deviation</b><br/> Reference image a: Center coordinates <math>(X_{a1}, Y_{a1})</math><br/> Inspection image a: Center coordinates <math>(X_{a2}, Y_{a2})</math></p>  <p><b>[Measured results]</b></p> <ul style="list-style-type: none"> <li>- Center coordinates of image a: <math>(X_{a2}, Y_{a2})</math></li> <li>- Amount of deviation of image a: <math>X_{a2} - X_{a1}, Y_{a2} - Y_{a1}</math></li> <li>- Center coordinates of image b: <math>(X_{b2}, Y_{b2})</math></li> <li>- Amount of deviation of image b: <math>X_{b2} - X_{b1}, Y_{b2} - Y_{b1}</math></li> <li>- Deviation angle: <math>\theta</math></li> </ul> <p>* Gray scale search / edge detection function<br/> Gray scale search: Compares a workpiece image with the 256-level gray-scale reference image to find an area that matches the reference image.<br/> ⇒ See G-6.<br/> Edge detection: Finds the boundary between light and dark areas in an image.<br/> ⇒ See G-3.</p> <p>- The deviation angle <math>\theta</math>, determined in the 2-point search, is used to readjust the rotation of the image for measurements 1 to 4.</p> |

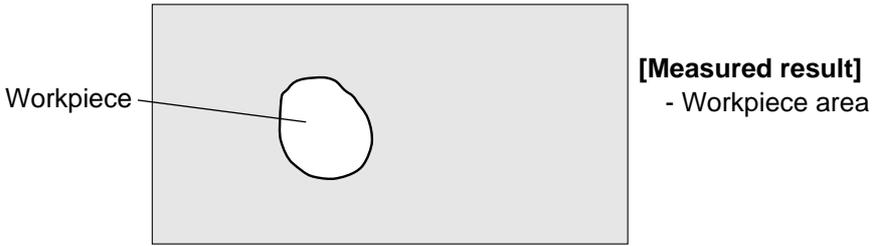
[2] Degree of match inspection

|                           |   |
|---------------------------|---|
| <p><b>Purpose</b></p>     | <p>Compare a good criterion image to a test image by inspecting matching levels using the gray scale search function. (Determine whether the part is acceptable or NG by checking similarities between the criterion image and the workpiece (test) image.)<br/>A matching level comparison using binary images is also possible.</p>   |
| <p><b>Application</b></p> | <p>Detect positional deviation of labels, detect contamination of different parts, inspect the mounting of electronic parts on PC boards, detect mis-prints, inspect for missing electric parts such as terminals, and simple letter inspection.</p>  |
| <p><b>Example</b></p>     | <p><b>[Detecting label deviations on packages]</b></p>  <p>▲ Good label                      ▲ NG label</p> <p><b>[Measured results]</b></p> <ul style="list-style-type: none"> <li>- Degree of match compared with the reference image</li> <li>- Detected coordinates (X/Y) of the measurement image.</li> <li>- Light level in the measured image (average light level/absolute value of difference)</li> </ul> <p><b>- Inspection procedure</b></p> <ol style="list-style-type: none"> <li>① Conduct a gray scale search of the criterion image position</li> <li>② Correct the position of the object being measured from the coordinates for the criterion image obtained in item ① above.</li> <li>③ If the matching level of the test image is low, the IV-S30J can determine that the label position is NG.</li> </ol> |

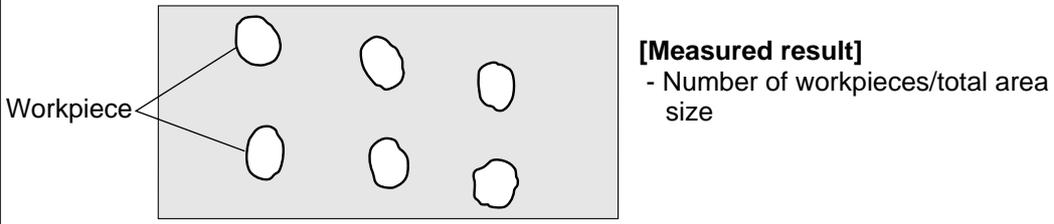
[3] Lead inspection

|                           |   |
|---------------------------|---|
| <p><b>Purpose</b></p>     | <p>Based on positional information obtained from the gray scale search function, inspect the condition of the IC leads and connector pins. (No. of lead pins that can be detected in one image: Max. 128.)</p>  |
| <p><b>Application</b></p> | <p>Inspect the IC leads and connector pins</p>  |
| <p><b>Example</b></p>     | <p><b>[Inspect the layout of the IC leads and connector pins]</b></p>  <p><b>[Lead inspection]</b></p> <ul style="list-style-type: none"> <li>- Number of leads K</li> <li>- D0 to D2: Distance between leads</li> <li>- W0 to W3: Lead width</li> <li>- L0 to L3: Lead length</li> </ul> <p><b>- Inspection procedure</b></p> <ol style="list-style-type: none"> <li>① Determine the measurement points (K0 to K3) from the mid points of the leads and the reference line.</li> <li>② Calculate the distances between the leads (D0 to D2) using the measurement points.</li> <li>③ Calculate the lead lengths (L0 to L3) from the measurement points (K0 to K3) toward the lead measurement limit line.</li> <li>④ Calculate the lead widths (W0 to W3) centering the measurement points.</li> </ol> |

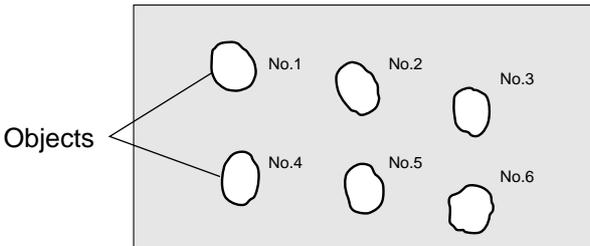
**[4] Area measurement by binary conversion**

|                    |  |
|--------------------|--|
| <b>Purpose</b>     | Detect the existence/absence and size of a workpiece when the workpiece is one point or "measurement position is fixed."<br>- Convert the specified pixel area to binary values and measure the size of the white area.  |
| <b>Application</b> | Check for the existence of bearings inserted by a bearing insert machine, prevent contamination of different parts in automobile production lines, determine the type of waterproof caps, check for the existence/absence of bottle labels, inspect the circuit traces on PWBs, check for the presence of grease, check for existence of frozen foods. |
| <b>Example</b>     | <div style="text-align: center;">  </div> <p><b>- Inspection procedure</b></p> <pre>                 Capture image → Convert to binary values → Measure (area)             </pre>  |

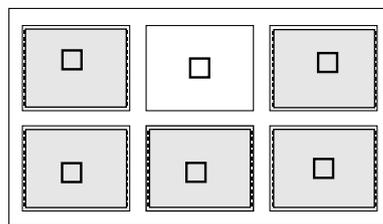
**[5] Object counting by binary conversion**

|                    |  |
|--------------------|--|
| <b>Purpose</b>     | Checks the number of objects (max. 3000 pcs.) when there is more than one object in an image arranged arbitrary.<br>- When the specified pixel field has been converted to a binary image, the white areas are measured or identified as separate objects and counted.                     |
| <b>Application</b> | Counting pieces of food or parts   |
| <b>Example</b>     | <div style="text-align: center;">  </div> <p><b>- Inspection procedure</b></p> <pre>                 Capture image → Convert to binary values → Measure (quantity, total area size)             </pre> |

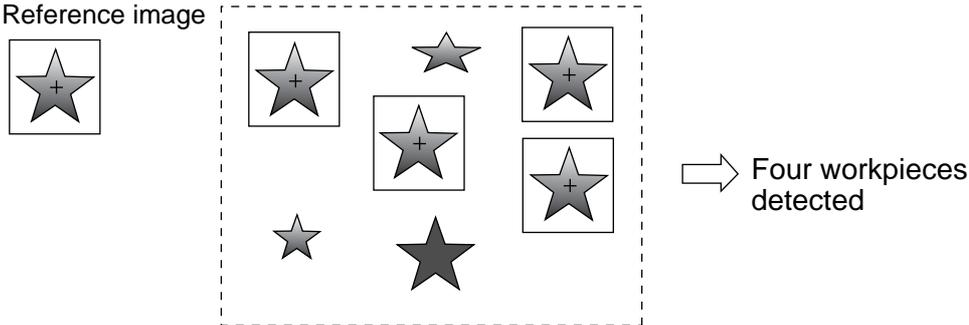
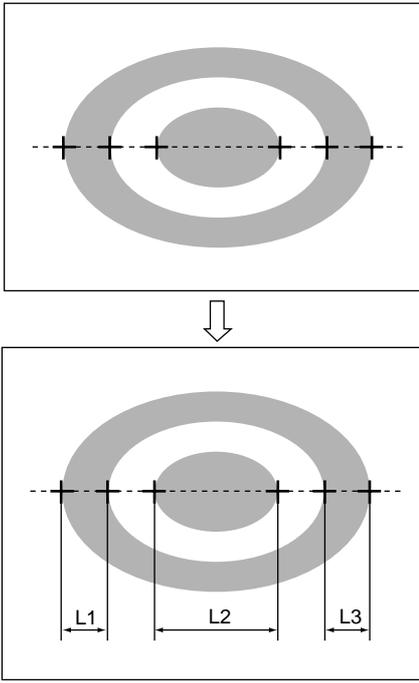
[6] Object identification (labeling) by binary conversion

|                           |  |
|---------------------------|--|
| <p><b>Purpose</b></p>     | <p>When there are several objects and the measuring position is arbitrary, the presence or absence of objects and the size of the objects can be determined.<br/>                 - 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, center point, and circumference of each white area can be measured.</p>  |
| <p><b>Application</b></p> | <p>Counting the number of food products or parts, measuring the sloped angle or center of gravity of parts, and measuring the size of food products.</p>   |
| <p><b>Example</b></p>     | <p><b>[Measurement of 6 objects]</b></p>  <p><b>[Measured result]</b></p> <ul style="list-style-type: none"> <li>- Object identification (numbering), number of objects present, total area.</li> <li>- Area of each object (No.1 to No. 6), center of gravity, main axis angle, fillet diameter, circumference, and center point of each object.</li> </ul> <p><b>- Inspection procedure</b></p> <pre>                 graph LR                 A[Image capture] --&gt; B[Convert to binary values]                 B --&gt; C[Object identification (numbering)]                 C --&gt; D[Measurement (area, gravity center, main axis angle, fillet diameter, circumference, and center point)]                 </pre> |

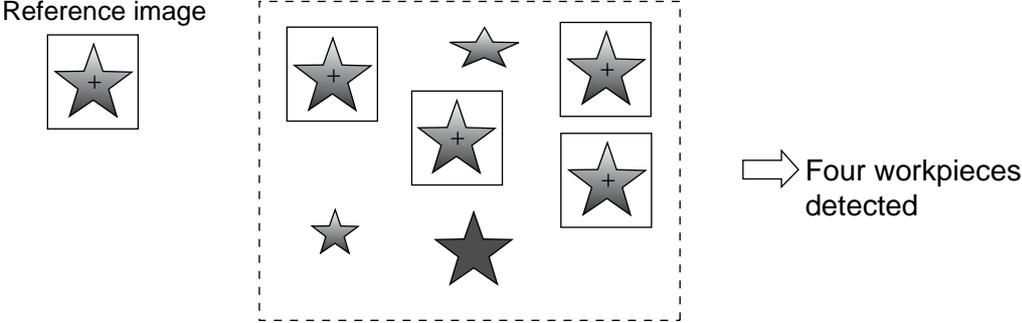
[7] Point measurements

|                            |  |
|----------------------------|--|
| <p><b>Purpose</b></p>      | <p>The presence or absence of target objects is examined.<br/>                 - A simple black or white evaluation is made in the specified pixel area of binary images.<br/>                 - The light level in the specified pixel area is averaged, and a decision is made whether or not it is within the specified lightness range in gray scale images.</p>   |
| <p><b>Applications</b></p> | <p>Checking the presence or absence of packed parts, inspecting the working condition of LEDs or fluorescent character display tubes, and sorting household electric appliances.</p>   |
| <p><b>Example</b></p>      | <p><b>[Inspection at 6 points]</b></p>  <p>Number of points (max.)<br/>                 : 128 points at average light levels<br/>                 256 points in binary images<br/>                 Point size: 2 m x 2n pixels<br/>                 (m, n = 1 to 16)</p> <p><b>- Inspection procedures</b></p> <pre>                 graph LR                 A[Image capture] --&gt; B[Binary conversion]                 A --&gt; C[Average light level]                 B --&gt; D[Black/white evaluation of points]                 C --&gt; E[Light level evaluation of points]                 </pre> |

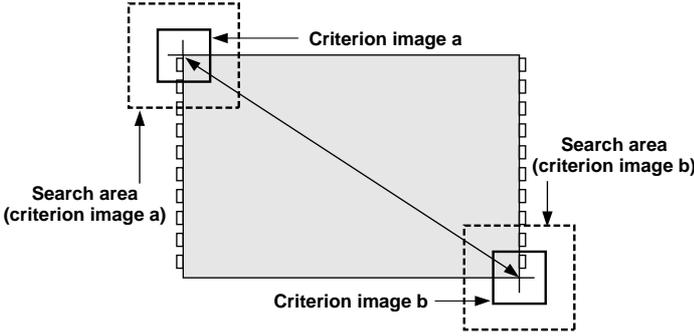
**[8] Multiple position measurement**

|                            |   |
|----------------------------|---|
| <p><b>Purpose</b></p>      | <p>The IV-S30J can detect up to 128 workpieces whose images exceed the specified matching level (gray search) or threshold value (edge detection) compared with the reference image.<br/>                 - 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.</p>  |
| <p><b>Applica-tion</b></p> | <p>Measure the position of workpieces with a complicated light level that cannot be converted into binary images.</p>   |
| <p><b>Example</b></p>      | <p>● <b>Gray search</b></p>  <p>Reference image</p> <p>Four workpieces detected</p> <p><b>[Measured results]</b></p> <ul style="list-style-type: none"> <li>- Number of images detected</li> <li>- Coordinates and degree of match detected for each image</li> </ul> <p>● <b>Edge detection</b></p>  <p><b>[Measured results]</b></p> <ul style="list-style-type: none"> <li>- Number of points detected</li> <li>- Coordinates detected for each points</li> </ul> <p>This is useful for obtaining the distance between the coordinates of a position.</p> <ul style="list-style-type: none"> <li>- L1 to L3 can be calculated by measuring distances and angles.</li> </ul> |

[9] Multiple degree of match inspection

|                            |   |
|----------------------------|---|
| <p><b>Purpose</b></p>      | <p>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.</p>  |
| <p><b>Applica-tion</b></p> | <p>Inspect (or count) workpieces that have complicated light levels and cannot be converted into binary images</p>  |
| <p><b>Exam-ple</b></p>     | <div style="text-align: center;">  <p>Reference image</p> <p>Four workpieces detected</p> <p><b>[Measured results]</b></p> <ul style="list-style-type: none"> <li>- Number of images detected</li> <li>- Degree of match, density (average/absolute difference), and detected coordinates</li> </ul> </div> |

[10] Distance and angle measurement

|                                 |   |
|---------------------------------|---|
| <p><b>Pur-<br/>pose</b></p>     | <p>Measure the distance and angle of two points using the center detection function in a gray scale search and the edge detection function, as well as center of gravity detection by functions.</p> <ul style="list-style-type: none"> <li>- 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.</li> <li>- 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.</li> </ul> |
| <p><b>Appli-<br/>cation</b></p> | <p>Measurement of mounted electronic parts</p>  |
| <p><b>Exam-<br/>ple</b></p>     | <p><b>[Measuring IC packages]</b></p> <div style="text-align: center;">  <p>Search area (criterion image a)</p> <p>Search area (criterion image b)</p> <p>Criterion image a</p> <p>Criterion image b</p> </div> <p>Register criterion image a and b by matching edges of the IC package.</p> <p><b>- Measurement procedures</b></p> <ol style="list-style-type: none"> <li>① Find the center points of criterion images a and b using a 2-point gray scale search.</li> <li>② Determine the distance between the two center points.</li> </ol>  |

## Chapter 2: Precautions for Use

Pay attention to the points below when handling the IV-S30J.

### (1) Installation

- Each device in the IV-S30J system must be installed in an environment as specified in this manual. (Operating ambient temperature: 0 to 45°C, operating ambient humidity: 35 to 85%RH (non-condensing.))
- Do not install the devices in the following locations. Installation in any of these locations may cause electrical shock, fire, or malfunction of the devices.
  1. Places exposed to direct sunlight
  2. Places with exposed to corrosive gases
  3. Places with excessive amounts of dust, salt, or metal powder in the air.
  4. Places exposed to water

### (2) Mounting

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

### (3) Power source

- Do not use the IV-S30J (power supply for the controller) power supply with any other equipment.
- Do not turn OFF the power while the menu is displayed or while communicating with external equipment. Turning OFF the power may erase the data settings.

### (4) Measurement settings

Make sure to specify 4000 ms (4 seconds) or less for the measurement processing time on each measurement item (MEASUREMENT 0 CAMERA 1, MEASUREMENT 0 CAMERA 2, and MEASUREMENT 1 to 4). For example, if the various tasks require 7000 ms of measurement processing time, assign 3500 ms to MEASUREMENT 1 and 3500 ms to MEASUREMENT 2 so that each of the assigned processing times is less than 4000 ms.

If the measurement processing time exceeds 4000 ms, the IV-S30J assumes that an abnormal operation has occurred and may try to reset the system.

### (5) Data saving

- The data set by using the remote keypad is temporarily stored in the memory (RAM) of the IV-S30J. However, it is not stored in the flash memory yet. Therefore, make sure to save the data settings before returning to the operation screen from any condition settings menu by pressing the SET key. If you do not save the data, the data will disappear when you turn OFF the power to the IV-S30J controller.
- We recommend that you save the data settings and reference images on a floppy diskette using the IV-S30SP parameter setting support software for the IV series.

### (6) Storing the devices

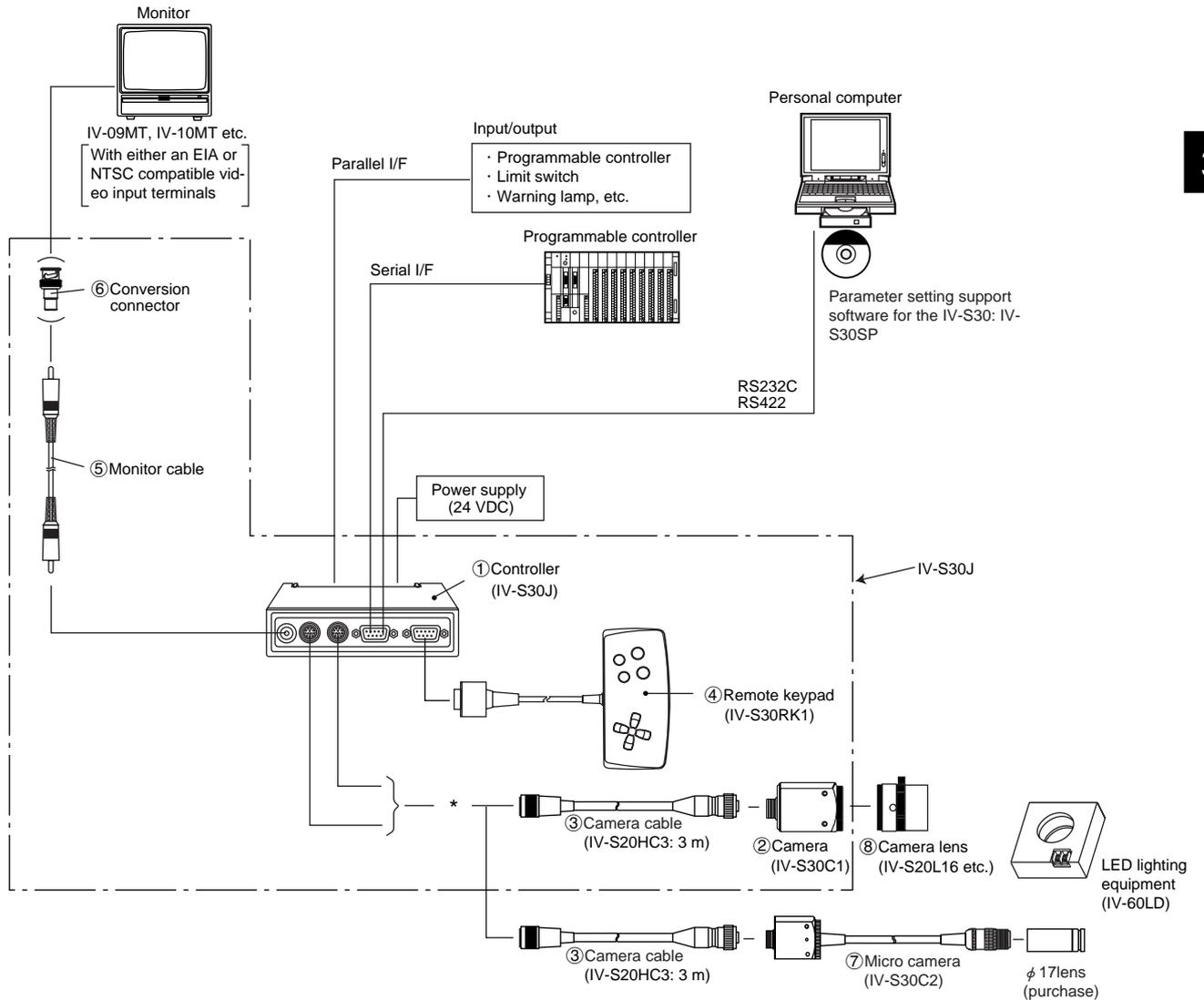
Do not put any object on top of any of the devices, or the device may malfunction.

### (7) Maintenance

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

# Chapter 3: System Configuration

## 3-1 Basic system configuration



\* Using IV-S20EC (2 m) or IV-S20EC4 (4 m) extension cables (sold separately), you can extend the cable length.

- A maximum of two cameras can be connected to the IV-S30J.
- IV-S20C1 camera (for IV-S20) can also be connected.
- Numbers in circles ① to ⑧ correspond to numbers in the "product configuration" section on the next page.
- Two cameras maximum can be connected to the IV-S30J main housing (connect to CAMERA1 and CAMERA2 terminals). However, the IV-S30J can be used by connecting only one camera. In such a case connect to the CAMERA1 connector.

### ■ Product configuration

Products configuration of the IV-S30J is as follows.

(Numbers in circles in the table correspond to numbers in circles on the previous page.)

| Model name | Products    |   |
|------------|-------------|---|
| IV-S30J    |             | - One set of IV-S30J main housing and parts (①: Controller)   |
|            | Accessories | <ul style="list-style-type: none"> <li>- One set of camera body and parts (②: IV-S30C1 or equivalent).</li> <li>- One set of camera cables (③: IV-S20HC3 or equivalent).</li> <li>- One set of remote key pads (④)</li> <li>- One camera angle bracket</li> <li>- Two main housing angle brackets</li> <li>- One set of monitor cables (⑤)</li> <li>- One conversion connector (⑥)</li> <li>- One D-sub connector<br/>(9-pin D-sub male connector with lock screw M2.6: For communication connector of the IV-S30J main housing.)</li> <li>- Six securing screws (M3 x 6: For securing angle brackets)</li> </ul> |
| IV-S30C1   |             | One set of camera parts (②)   |
|            | Accessories | <ul style="list-style-type: none"> <li>- One camera securing angle bracket.</li> <li>- Two securing screws (M3 x 6: For securing angle brackets)</li> </ul>   |
| IV-S30C2   |             | One micro camera (⑦)  |
|            | Accessories | <ul style="list-style-type: none"> <li>- One camera securing angle bracket</li> <li>- One camera head securing metal bracket</li> <li>- Three securing screws (M3 x 6)</li> </ul>   |
| IV-S20L16  |             | One camera lens (⑧)   |
| IV-S20EC2  |             | One extension camera cable (2 m)  |
| IV-S20EC4  |             | One extension camera cable (4 m)  |
| IV-S20HC3  |             | One camera conversion cable (3 m)   |
| IV-S30RK1  |             | One set of remote keypads (④)   |
| IV-S30SP * |             | One set of parameter setting support software for IV series (CD-ROM)  |
|            | Accessories | <ul style="list-style-type: none"> <li>- One set of RS-232C communication cables (1.5 m)</li> <li>- One set of USB cables (3 m)</li> <li>- One sheet of user registration card</li> </ul>   |
| IV-S30LB1  |             | One set of image processing library (CD-ROM)  |
|            | Accessories | <ul style="list-style-type: none"> <li>- One set of library instruction manuals</li> <li>- One USB cable</li> <li>- One RS232C communication cable</li> </ul>   |

\* Detailed description for the IV-S30SP parameter setting support software ⇨ See user's manual for IV-S30SP.

| Model name                     | Product  |
|--------------------------------|--|
| IV-09MT *1                     | One set of monochrome monitor and parts (9 inch)   |
| IV-10MT<br>/10MTV<br>/10MTK *2 | One set of LCD monitor<br><div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">                     IV-10MT: Pair chassis type, IV-10MTV: With installation frame<br/>                     IV-10MTK: Integrated remote keypad, with installation frame                 </div> |
|                                | Accessories  |
| IV-60LD *3                     | One set of LED lighting equipment main housing and parts   |
|                                | Accessories  |

\*1: Detailed description for the monochrome monitor IV-09MT ⇨ See page 9-6 in this manual.

\*2: Detailed description for the LCD monitor IV-10MT/10MTV/10MTK ⇨ See page 9-7 in this manual.

\*3: Detailed description for the LED lighting equipment IV-60LD ⇨ See page 5-2 and 9-8 in this manual.

### 3-2 System configuration examples

This section outlines the system configurations for measurement using an external trigger, such as measurement using a photo sensor, measurement using CCD trigger, and measurement triggered by a command from a personal computer.

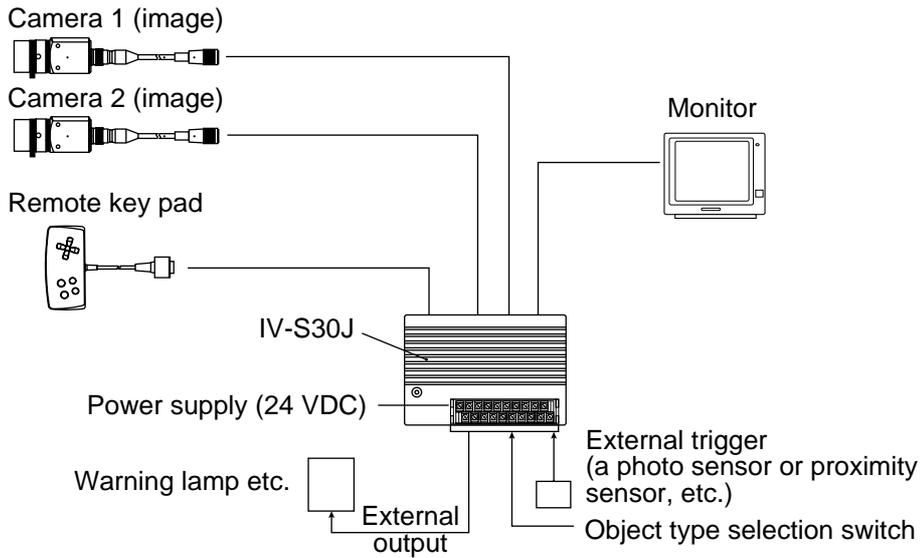
⇒ See "Chapter 17: Setting the Input/Output Conditions" in the IV-S30J User's Manual (Function and Operation).

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

##### (1) When IV-S30J is used in a stand-alone mode

###### - Purpose/application

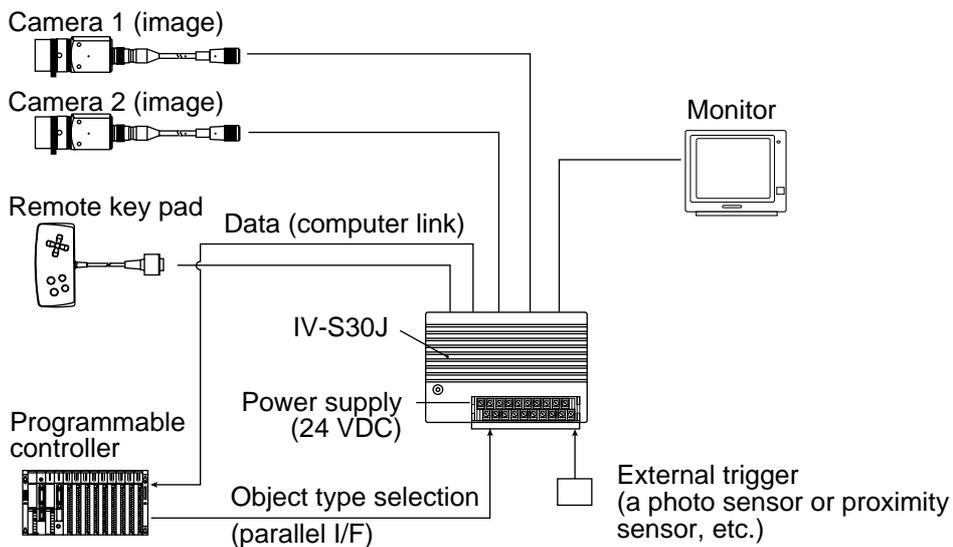
Measurement is started by an external trigger (a photo sensor or proximity sensor), and the measurement result is output externally (warning lamp). The object type number is selected by an external switch.



##### (2) When a programmable controller is connected

###### - Purpose/application

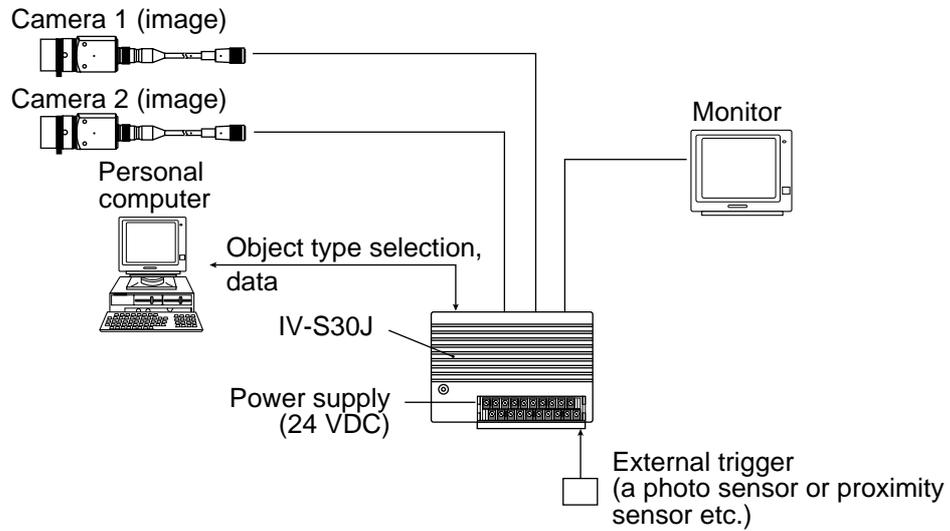
Measurement is started by an external trigger (a photo sensor or proximity sensor), and the measurement data is output to a programmable controller. The object type number is selected by the programmable controller.



**(3) When a personal computer is connected**

**- Purpose/application**

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



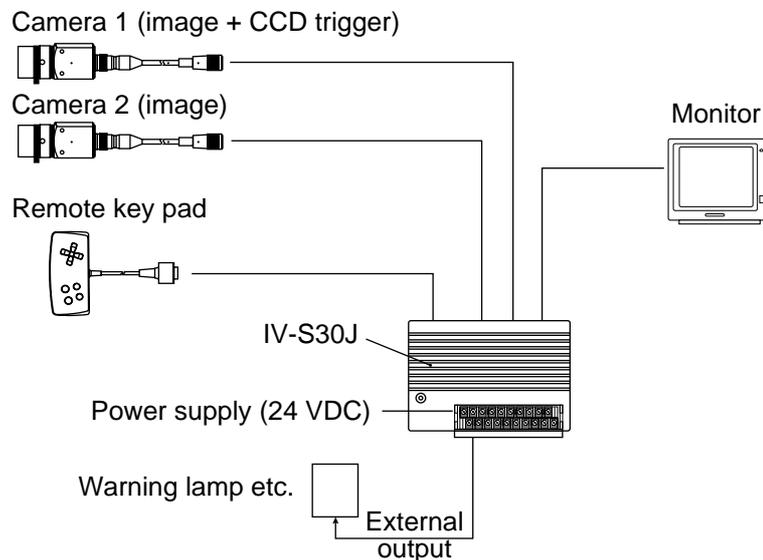
**[2] System configuration example for measurement triggered by the internal CCD sensor trigger**

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

**(1) When IV-S30J is used in a stand-alone mode**

**- Purpose/application**

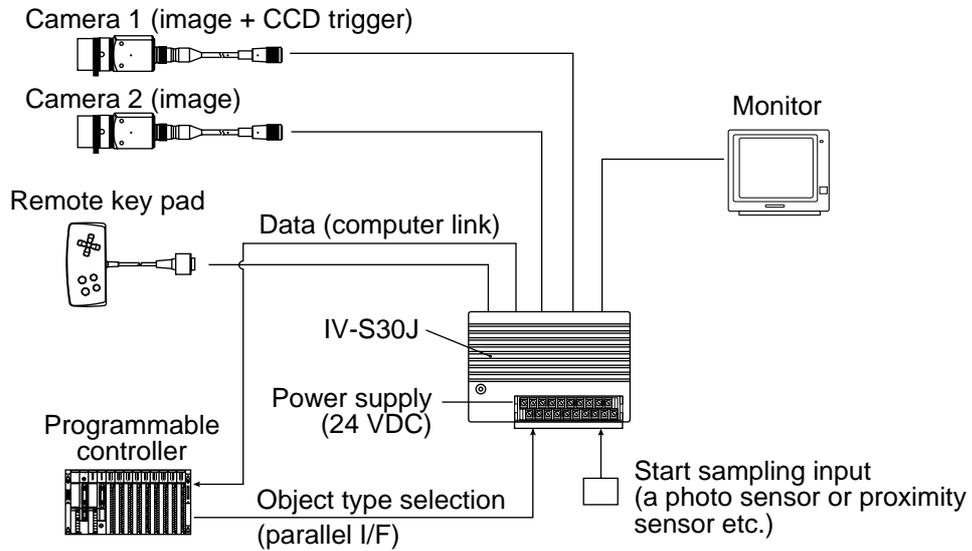
Measurement is started by a CCD trigger, and the measurement result is output externally (warning lamp etc.). In this case, sampling operation is automatically started.



**(2) When a programmable controller is connected**

**- Purpose/application**

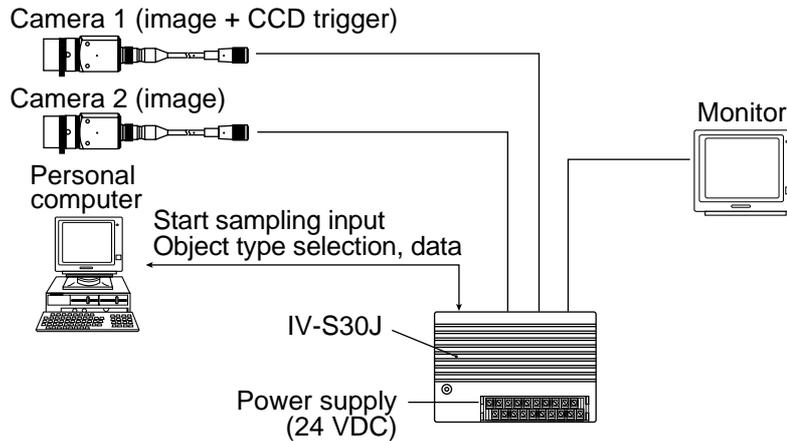
Measurement is started by a CCD trigger (sampling start input: a photo sensor etc.), and the measurement data is output to a programmable controller. The object type number is selected by the programmable controller.



**(3) When a personal computer is connected**

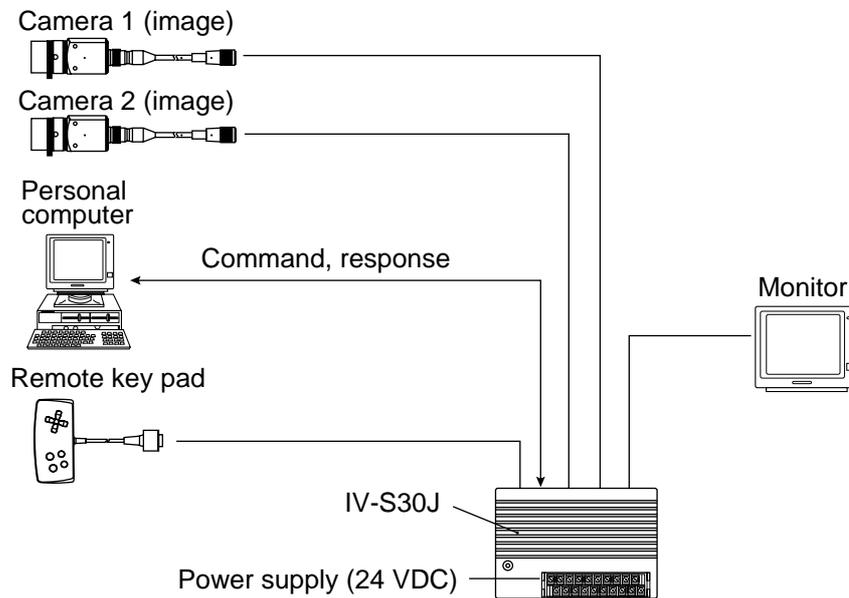
**- Purpose/application**

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



**[3] System configuration example for measurement triggered by a command from a personal computer****- Purpose/application**

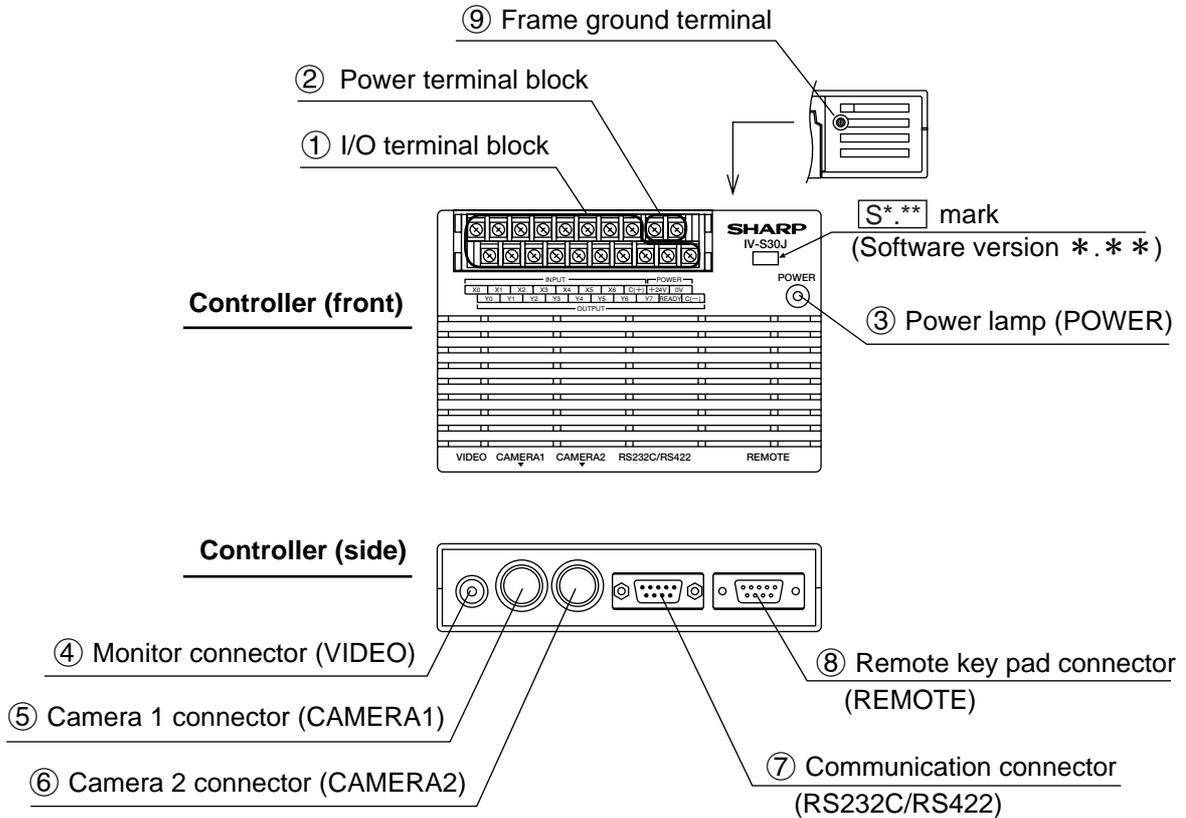
Measurement is started by a trigger from a personal computer, and the measurement data is output to the personal computer. The object type number is selected by the personal computer.



# Chapter 4: Part Names and Functions

This section describes the names and functions of the controller, camera (camera body, camera lens and camera cable), and the remote keypad which comprise the IV-S30J system. See section in Chapter 5 "Connection and Installation Methods" for details about the housing brackets, camera angle bracket and conversion connector.

## 4-1 Controller (IV-S30J)

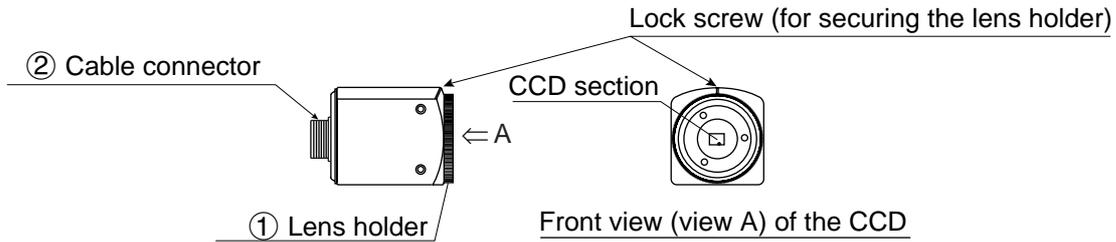


|   | Name   | Function  |
|---|--|---|
| ① | I/O terminal block<br>INPUT: X0 to X6, C (+)<br>OUTPUT: Y0 to Y7,<br>READY, C(-) | This block has 7 input terminals and 9 output terminals.<br>- External devices are connected to these terminals for input and output (parallel I/F). ⇨ See page 5-15 to 16.                         |
| ② | Power terminal block<br>(+24V, 0V)   | Commercially available constant-voltage power supply (24 V DC ± 10%, 500 mA or more) is connected here. ⇨ See page 5-13.  |
| ③ | Power lamp (POWER)   | When the power is applied to the controller, the green lamp will light.   |
| ④ | Monitor connector<br>(VIDEO)   | A monitor is connected here.<br>- The monitor connector is an RCA jack.   |
| ⑤ | Camera 1 connector<br>(CAMERA1)  | The camera cable connector is connected here.<br>- The camera connected to the CAMERA 1 position is camera 1, and the camera connected to the CAMERA 2 position is camera 2.                        |
| ⑥ | Camera 2 connector<br>(CAMERA2)  |   |
| ⑦ | Communication connector<br>(RS232C/RS422: 9-pin D-sub female, rock screw M2.6)   | This connector is used to connect a personal computer for communications (general purpose serial I/F) or to connect a programmable controller for a computer link. ⇨ See page 5-17.                 |
| ⑧ | Remote key pad connector<br>(REMOTE)   | The remote key pad connector is used to make selections from the menus on the screen (to set parameters). It is connected here.   |
| ⑨ | Frame ground terminal  | Be sure to ground the housing frame ground terminal together with the frame ground of the constant-voltage power supply in accordance with class D (class 3) grounding procedures. ⇨ See page 5-13. |

## 4-2 Camera

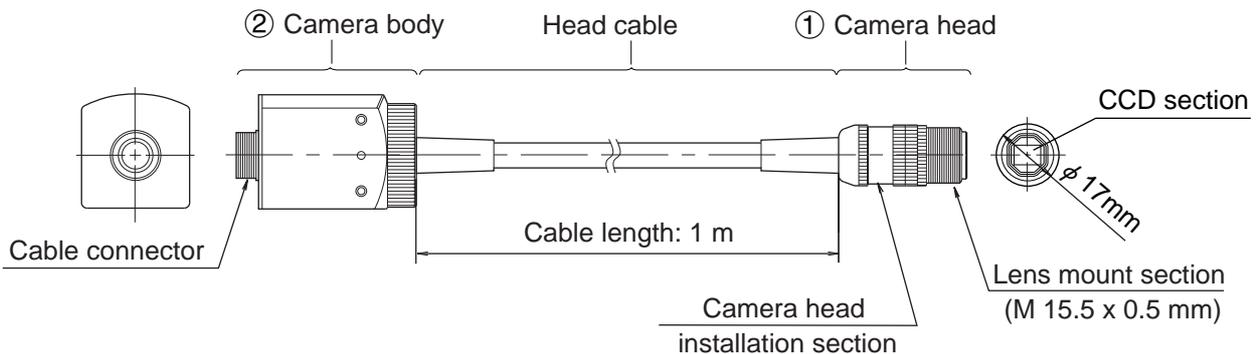
### [1] Camera

#### (1) Standard camera (IV-S30C1: Accessory)



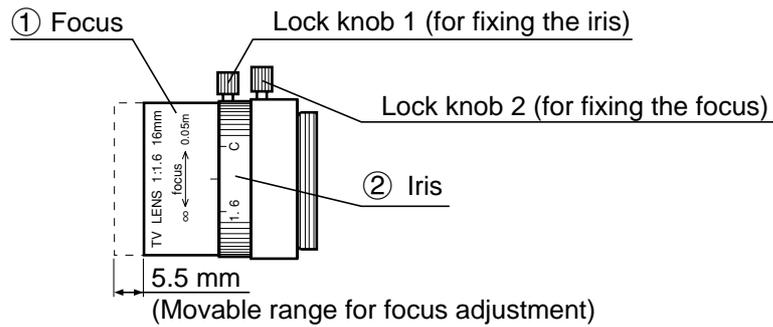
|   | Name            | Function  |
|---|-----------------|---|
| ① | Lens holder     | The holder is used to make fine adjustment to the distance (back plane focus) between the CCD section and camera lens using a focus fixed lens. (The distance has been adjusted before shipment. Usually, it does not need to be adjusted.)<br>- To adjust it, loosen the upper lock screw, and turn the lens holder counter-clockwise. The maximum allowable distance is 1.5 mm. |
| ② | Cable connector | Connect this connector to the camera conversion cable (IV-S20HC3).  |

#### (2) Micro camera (IV-S30C2: Optional)



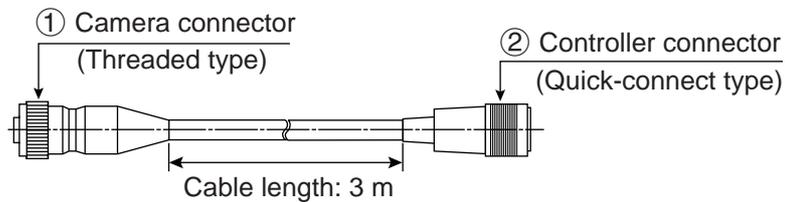
|   | Name        | Function   |
|---|-------------|--|
| ① | Camera head | Install a (commercially available) lens<br>- The maximum external diameter of the camera head is $\phi 17$ mm, and the one for lens mount is M 15.5 x 0.5 mm |
| ② | Camera body | Connect to the camera connector of the camera conversion cable (IV-S20HC3).  |

[2] Camera lens (IV-S20L16: Optional)



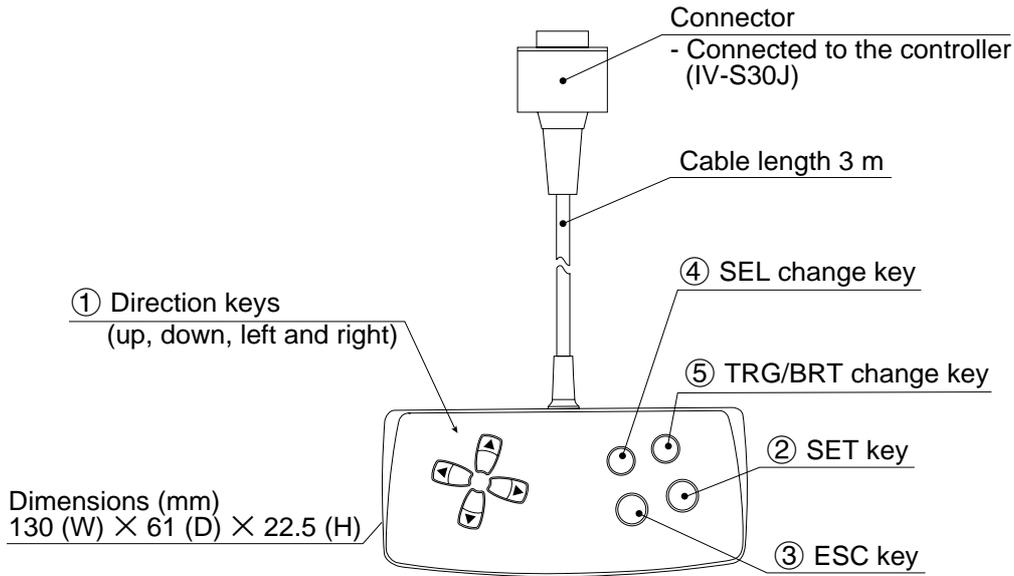
|   | Name  | Function  |
|---|-------|---|
| ① | Focus | To focus an image<br>-The focall enght (distance from an object) is 50 mm to infinity (from the front of lens). |
| ② | Iris  | To adjust the image brightness.<br>-The iris a perture can be set from 1.6mm to closed.                         |

[3] Camera conversion cable (IV-S20HC3: Accessory)



|   | Name                 | Function   |
|---|----------------------|--|
| ① | Camera connector     | Connect to a connector of camera cable (IV-S30C1/C2).                  |
| ② | Controller connector | Connect to camera 1 connector or camera 2 connector of the controller. |

### 4-3 Remote keypad (IV-S30RK1: Accessory)



|   | Key name                                      | Function   | Description  |
|---|---|--|--|
| ① | Direction keys*<br>(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.<br>- 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,<br>- 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-S30J will capture an image.<br>- Change the brightness of the image displayed on the screen.<br>On the setting screen,<br>- Press the left arrow key and the SEL key to change between Through and Freeze.<br>- 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 operation 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.

# Chapter 5: Connection and Installation Methods

## 5-1 Installation conditions

### [1] Lighting equipment

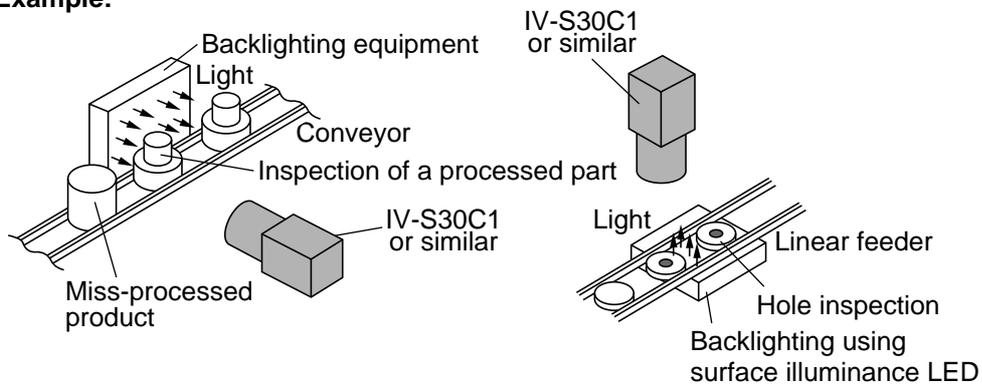
Lighting for the workpieces is an important factor in image processing. The lighting conditions affect the measurement results. Select the proper lighting equipment.

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

### (1) Backlighting

Light should uniformly illuminate the field behind an object, so that the IV-S30J measure the object with its shadow. Since the shadow picture will be converted to binary values, reliable measurements can be executed.

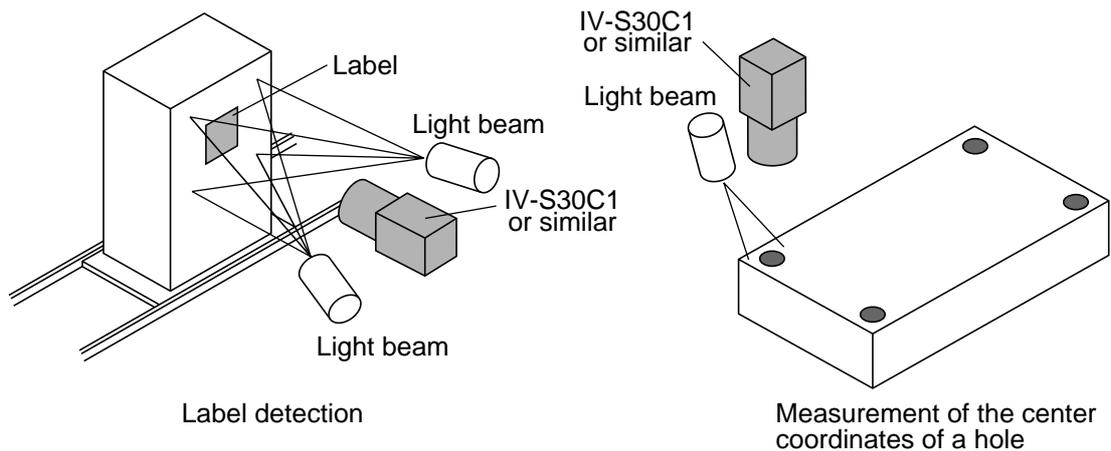
#### Example:



### (2) Reflective lighting

A light shone on the front of an object with angle will be reflected, and the IV-S30J will pick up the reflected light. If too much light is reflected, such as from a metallic surface or similar materials, a proper image may not be obtained.

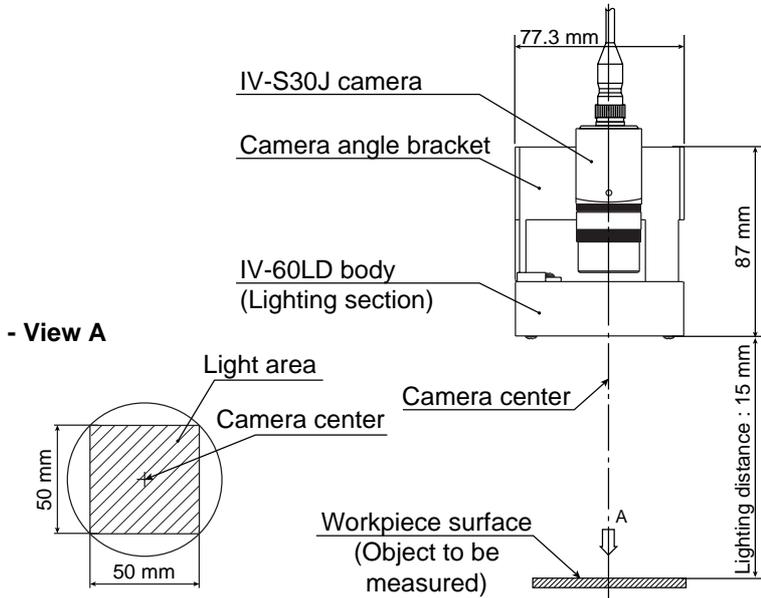
#### Example:



■ When using the IV-60LD

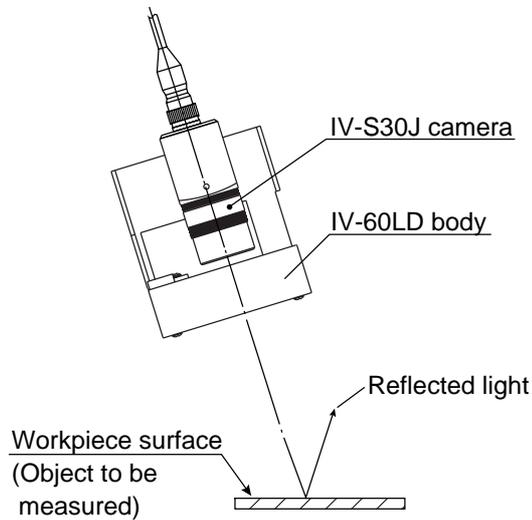
This paragraph describes how to use Sharp IV-60LD LED lighting equipment. For details about the installation and wiring of the IV-60LD, see the instruction manual.

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



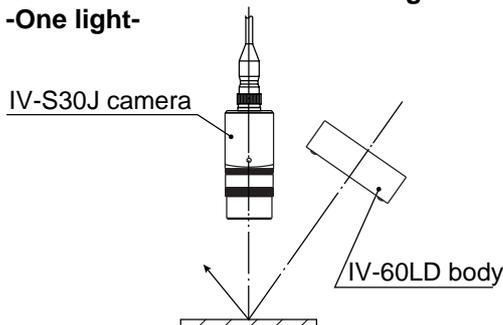
When the light is projected from above the object and if reflection off the object influences the image processing, try the following countermeasures.

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

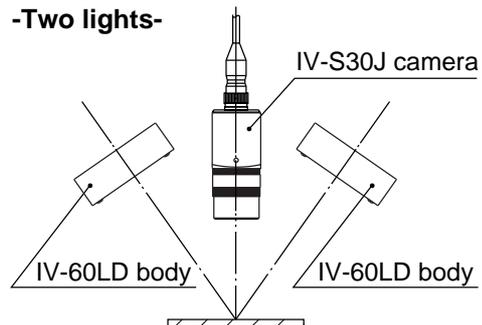


- 2) Separate the camera from the lighting equipment. Install the IV-60LD lighting equipment so that it will shine from an angle that prevents creation of the reflection.

-One light-



-Two lights-

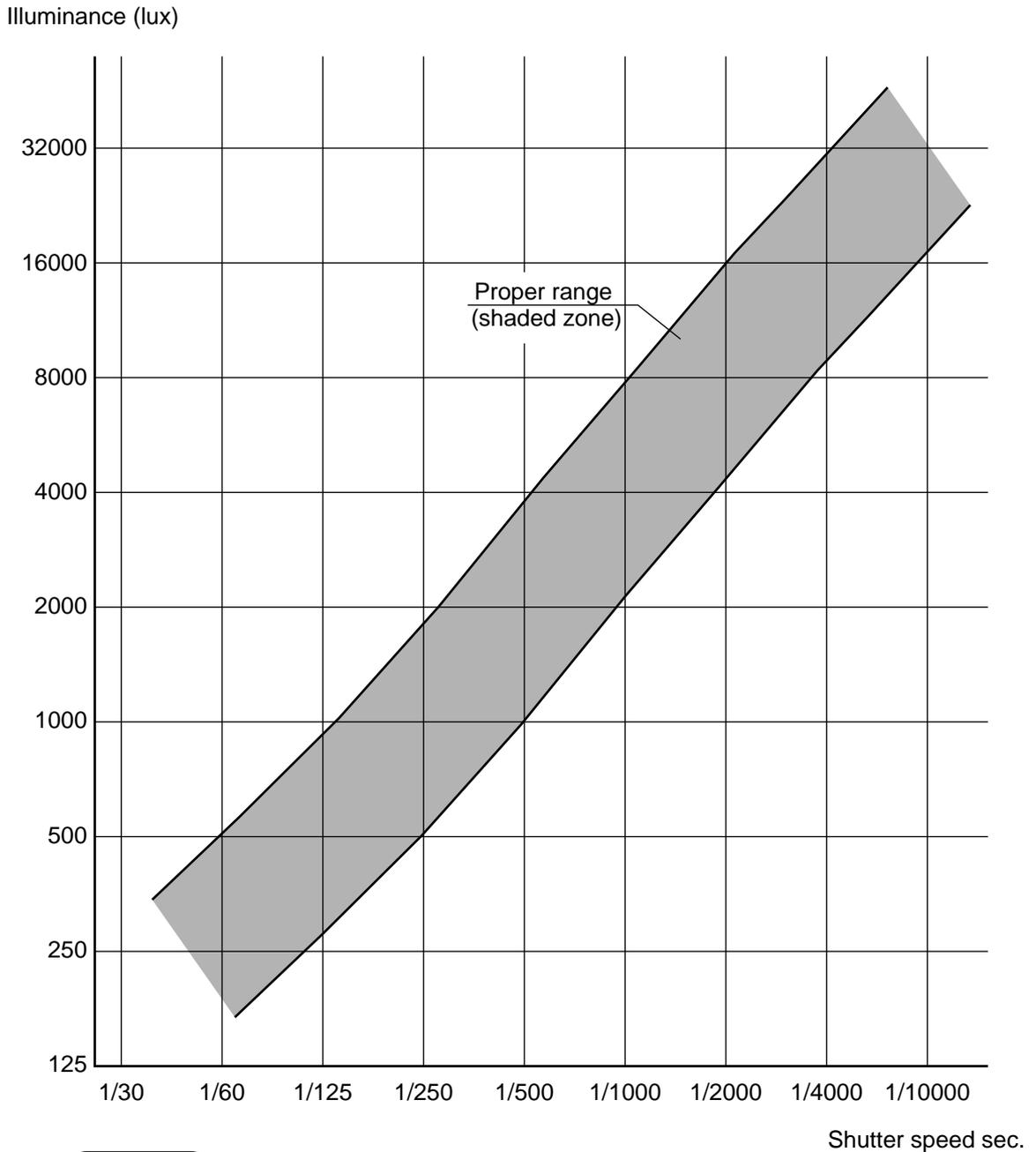


**[2] Illuminance and shutter speed**

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

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

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

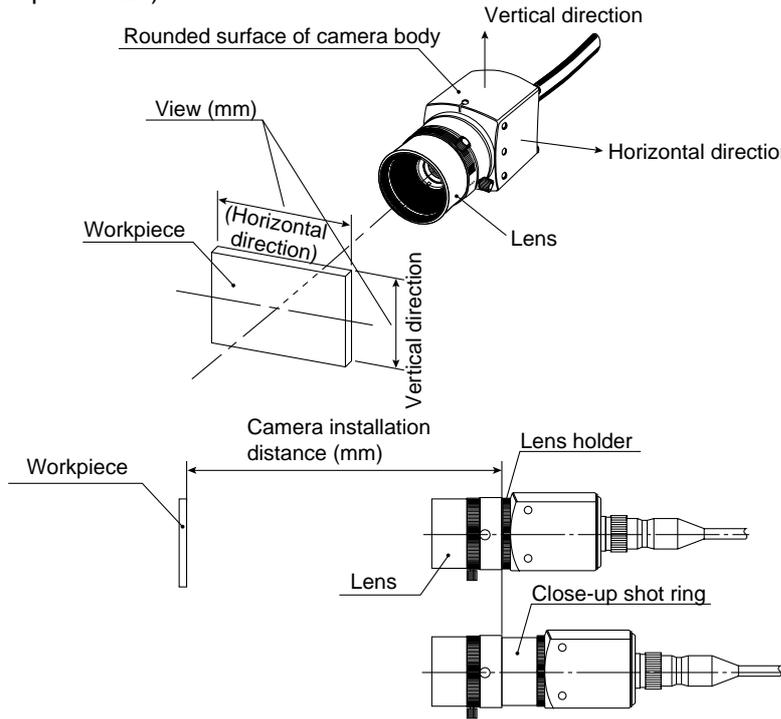


**Note**

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

**[3] Optimum lens and resolution**

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



There is a relationships as shown on page 5-6 to page 5-8, among the camera installation distance, the field of view (in the vertical/horizontal direction), the lens focal length  $f$ , the aperture setting, the focal length, and the resolution.

**[Example]**

When the IV-S30C1/C2 camera is used, the camera installation distance is 500 mm, and the field of view (in the horizontal direction) is 110 mm, the optimum lens can be selected as described in the following procedure. The required information is taken from the table on page 5-6.

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

**1) Selecting the lens focal length  $f$**

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

**2) Considering the focal length**

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

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

**3) Resolution**

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

$$\frac{114.6 \text{ mm}}{512 \text{ (pixel count)}} \approx 223.9 \text{ } \mu\text{m}$$

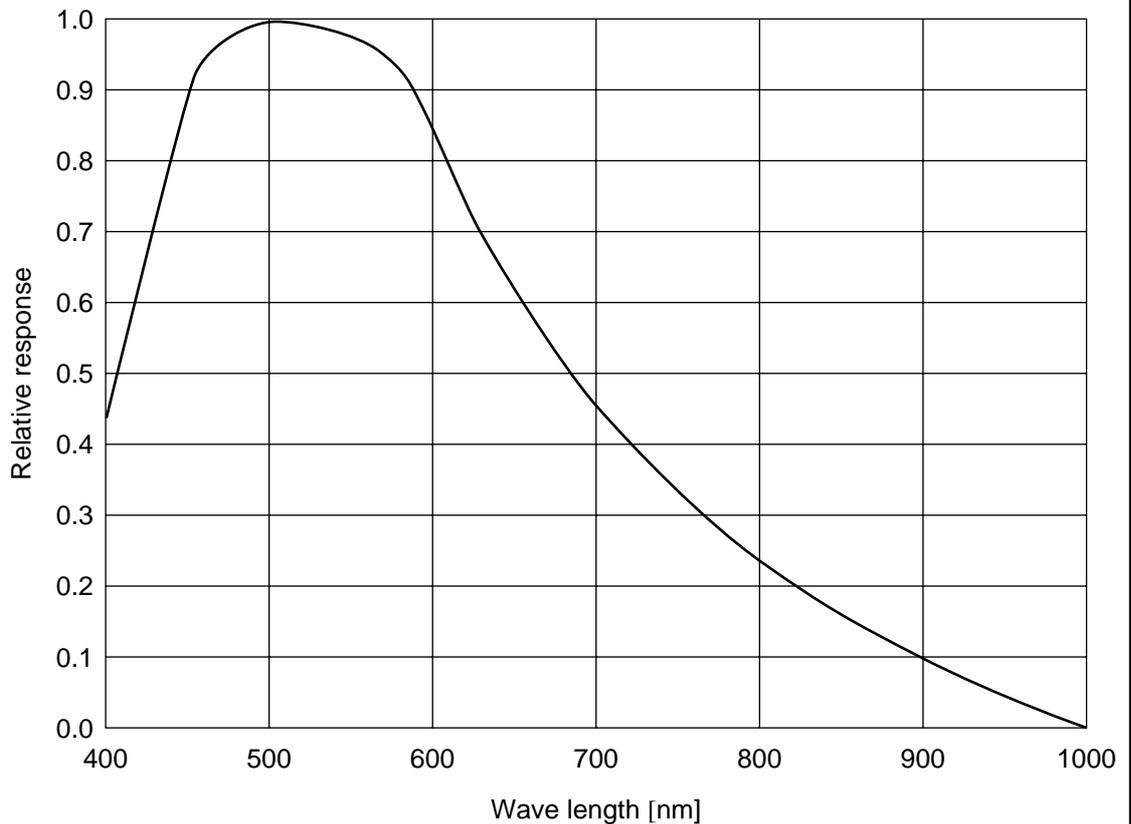
⇒ See "G-9" for the definition of resolution.

**Notes**

- The values shown in the tables on page 5-7 to 5-9 are only reference data for installation. These values may vary, according to the characteristics of lenses you are using. When using any lens, check the data using the actual equipment.
- If you want to use a camera lens other than the IV-S20L16, buy a lens with a C type lens base. (The IV-S20L16 has a C type lens base.)
- A lens with too short focal length ( $f = 4.2 \text{ mm}$  or  $8 \text{ mm}$ ) will distort the edges of the field of view.

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

**- Spectral sensitivity characteristics of the CCD element**



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

• When the IV-S30C1 camera is used

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

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

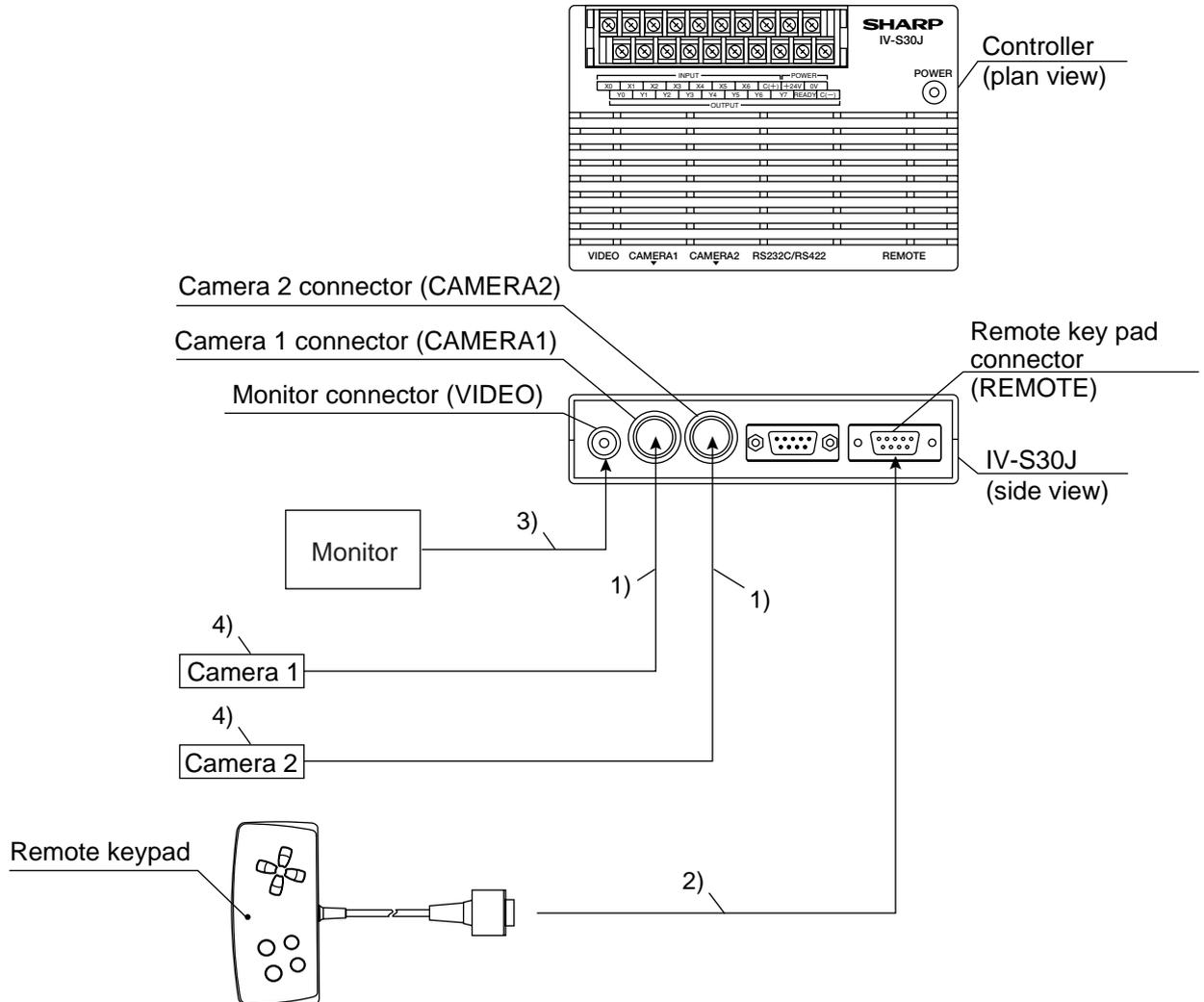
• When the IV-S30C2 camera is used

| Camera installation distance (mm) | Lens focal length f=7.5 mm |                         |                   |                 | Lens focal length f=15 mm |                          |                   |                 | Lens focal length f=24 mm |                          |                   |                 |
|-----------------------------------|----------------------------|-------------------------|-------------------|-----------------|---------------------------|--------------------------|-------------------|-----------------|---------------------------|--------------------------|-------------------|-----------------|
|                                   | Vertical direction         | Vertical direction 7.50 |                   |                 | Vertical direction        | Vertical direction 15.00 |                   |                 | Vertical direction        | Vertical direction 24.00 |                   |                 |
|                                   | Workpiece size (Hmm)       | Workpiece size (Hmm)    | Focal length (mm) | Resolution (μm) | Workpiece size (Hmm)      | Workpiece size (Hmm)     | Focal length (mm) | Resolution (μm) | Workpiece size (Hmm)      | Workpiece size (Hmm)     | Focal length (mm) | Resolution (μm) |
| 55                                | 18.7                       | 20.0                    | 9.0               | 39.0            | —                         | —                        | —                 | —               | —                         | —                        | —                 | —               |
| 60                                | 21.1                       | 22.5                    | 8.8               | 43.9            | 8.8                       | 9.3                      | 18.2              | 18.3            | 4.1                       | 4.4                      | 30.9              | 8.6             |
| 70                                | 25.8                       | 27.5                    | 8.6               | 53.8            | 11.1                      | 11.9                     | 17.6              | 23.2            | 5.6                       | 6.0                      | 29.1              | 11.7            |
| 80                                | 30.5                       | 32.6                    | 8.4               | 63.6            | 13.5                      | 14.4                     | 17.1              | 28.1            | 7.1                       | 7.6                      | 28.0              | 14.8            |
| 90                                | 35.3                       | 37.6                    | 8.3               | 73.5            | 15.9                      | 16.9                     | 16.8              | 33.1            | 8.6                       | 9.2                      | 27.3              | 17.9            |
| 100                               | 40.0                       | 42.7                    | 8.2               | 83.4            | 18.2                      | 19.5                     | 16.6              | 38.0            | 10.1                      | 10.7                     | 26.8              | 21.0            |
| 120                               | 49.5                       | 52.8                    | 8.1               | 103.1           | 23.0                      | 24.5                     | 16.2              | 47.9            | 13.0                      | 13.9                     | 26.2              | 27.1            |
| 140                               | 59.0                       | 62.9                    | 8.0               | 122.8           | 27.7                      | 29.6                     | 16.0              | 57.7            | 16.0                      | 17.1                     | 25.8              | 33.3            |
| 160                               | 68.4                       | 73.0                    | 7.9               | 142.6           | 32.4                      | 34.6                     | 15.9              | 67.6            | 18.9                      | 20.2                     | 25.5              | 39.5            |
| 180                               | 77.9                       | 83.1                    | 7.9               | 162.3           | 37.2                      | 39.7                     | 15.8              | 77.5            | 21.9                      | 23.4                     | 25.3              | 45.6            |
| 200                               | 87.4                       | 93.2                    | 7.8               | 182.0           | 41.9                      | 44.7                     | 15.7              | 87.3            | 24.9                      | 26.5                     | 25.1              | 51.8            |
| 250                               | 111.1                      | 118.5                   | 7.8               | 231.4           | 53.8                      | 57.3                     | 15.5              | 112.0           | 32.3                      | 34.4                     | 24.9              | 67.2            |
| 300                               | 134.7                      | 143.7                   | 7.7               | 280.7           | 65.6                      | 70.0                     | 15.4              | 136.7           | 39.7                      | 42.3                     | 24.7              | 82.6            |
| 350                               | 158.4                      | 169.0                   | 7.7               | 330.1           | 77.4                      | 82.6                     | 15.4              | 161.3           | 47.1                      | 50.2                     | 24.6              | 98.1            |
| 400                               | 182.1                      | 194.2                   | 7.7               | 379.4           | 89.3                      | 95.2                     | 15.3              | 186.0           | 54.5                      | 58.1                     | 24.5              | 113.5           |
| 450                               | 205.8                      | 219.5                   | 7.6               | 428.7           | 101.1                     | 107.9                    | 15.3              | 210.7           | 61.9                      | 66.0                     | 24.5              | 128.9           |
| 500                               | 229.5                      | 244.8                   | 7.6               | 478.1           | 113.0                     | 120.5                    | 15.3              | 235.3           | 69.3                      | 73.9                     | 24.4              | 144.3           |
| 600                               | 276.8                      | 295.3                   | 7.6               | 576.7           | 136.6                     | 145.8                    | 15.2              | 284.7           | 84.1                      | 89.7                     | 24.3              | 175.1           |
| 700                               | 324.2                      | 345.8                   | 7.6               | 675.4           | 160.3                     | 171.0                    | 15.2              | 334.0           | 98.9                      | 105.5                    | 24.3              | 206.0           |
| 800                               | 371.5                      | 396.3                   | 7.6               | 774.1           | 184.0                     | 196.3                    | 15.2              | 383.3           | 113.7                     | 121.2                    | 24.3              | 236.8           |
| 900                               | 418.9                      | 446.8                   | 7.6               | 872.8           | 207.7                     | 221.5                    | 15.1              | 432.7           | 128.5                     | 137.0                    | 24.2              | 267.6           |
| 1000                              | 466.3                      | 497.4                   | 7.6               | 971.4           | 231.4                     | 246.8                    | 15.1              | 482.0           | 143.3                     | 152.8                    | 24.2              | 298.5           |
| 1100                              | 513.6                      | 547.9                   | 7.6               | 1070.1          | 255.0                     | 272.1                    | 15.1              | 531.3           | 158.1                     | 168.6                    | 24.2              | 329.3           |
| 1200                              | 561.0                      | 598.4                   | 7.6               | 1168.8          | 278.7                     | 297.3                    | 15.1              | 580.7           | 172.9                     | 184.4                    | 24.2              | 360.2           |
| 1300                              | 608.3                      | 648.9                   | 7.5               | 1267.4          | 302.4                     | 322.6                    | 15.1              | 630.0           | 187.7                     | 200.2                    | 24.2              | 391.0           |
| 1400                              | 655.7                      | 699.4                   | 7.5               | 1366.1          | 326.1                     | 347.8                    | 15.1              | 679.4           | 202.5                     | 216.0                    | 24.1              | 421.8           |
| 1500                              | 703.1                      | 750.0                   | 7.5               | 1464.8          | 349.8                     | 373.1                    | 15.1              | 728.7           | 217.3                     | 231.8                    | 24.1              | 452.7           |
| 1600                              | 750.4                      | 800.5                   | 7.5               | 1563.5          | 373.4                     | 398.4                    | 15.1              | 778.0           | 232.1                     | 247.5                    | 24.1              | 483.5           |
| 1700                              | 797.8                      | 851.0                   | 7.5               | 1662.1          | 397.1                     | 423.6                    | 15.1              | 827.4           | 246.9                     | 263.3                    | 24.1              | 514.3           |
| 1800                              | 845.1                      | 901.5                   | 7.5               | 1760.8          | 420.8                     | 448.9                    | 15.1              | 876.7           | 261.7                     | 279.1                    | 24.1              | 545.2           |
| 1900                              | 892.5                      | 952.0                   | 7.5               | 1859.5          | 444.5                     | 474.1                    | 15.1              | 926.0           | 276.5                     | 294.9                    | 24.1              | 576.0           |
| 2000                              | 939.9                      | 1002.6                  | 7.5               | 1958.1          | 468.2                     | 499.4                    | 15.1              | 975.4           | 291.3                     | 310.7                    | 24.1              | 606.8           |
| 2500                              | 1176.7                     | 1255.2                  | 7.5               | 2451.5          | 586.6                     | 625.7                    | 15.0              | 1222.1          | 365.3                     | 389.6                    | 24.1              | 761.0           |
| 3000                              | 1413.5                     | 1507.8                  | 7.5               | 2944.9          | 705.0                     | 752.0                    | 15.0              | 1468.7          | 439.3                     | 468.6                    | 24.1              | 915.2           |
| 3500                              | 1650.3                     | 1760.4                  | 7.5               | 3438.2          | 823.4                     | 878.3                    | 15.0              | 1715.4          | 513.3                     | 547.5                    | 24.1              | 1069.4          |
| 4000                              | 1887.1                     | 2013.0                  | 7.5               | 3931.6          | 941.8                     | 1004.6                   | 15.0              | 1962.1          | 587.3                     | 626.4                    | 24.0              | 1223.5          |
| 4500                              | 2123.9                     | 2265.6                  | 7.5               | 4424.9          | 1060.2                    | 1130.9                   | 15.0              | 2208.8          | 661.3                     | 705.4                    | 24.0              | 1377.7          |
| 5000                              | 2360.7                     | 2518.2                  | 7.5               | 4918.3          | 1178.6                    | 1257.2                   | 15.0              | 2455.4          | 735.3                     | 784.3                    | 24.0              | 1531.9          |
| 5500                              | 2597.5                     | 2770.8                  | 7.5               | 5411.7          | 1297.0                    | 1383.5                   | 15.0              | 2702.1          | 809.3                     | 863.3                    | 24.0              | 1686.1          |
| 6000                              | 2834.3                     | 3023.4                  | 7.5               | 5905.0          | 1415.4                    | 1509.8                   | 15.0              | 2948.8          | 883.3                     | 942.2                    | 24.0              | 1840.2          |
| 6500                              | 3071.1                     | 3276.0                  | 7.5               | 6398.4          | 1533.8                    | 1636.1                   | 15.0              | 3195.5          | 957.3                     | 1021.1                   | 24.0              | 1994.4          |
| 7000                              | 3307.9                     | 3528.6                  | 7.5               | 6891.7          | 1652.2                    | 1762.4                   | 15.0              | 3442.2          | 1031.3                    | 1100.1                   | 24.0              | 2148.6          |
| 7500                              | 3544.7                     | 3781.2                  | 7.5               | 7385.1          | 1770.6                    | 1888.7                   | 15.0              | 3688.8          | 1105.3                    | 1179.0                   | 24.0              | 2302.8          |

## 5-2 Installing, connecting and wiring the IV-S30J

### [1] Connecting equipment to the controller

Connect the cameras (up to 2 cameras), remote keypad, and monitor to the controller (IV-S30J).



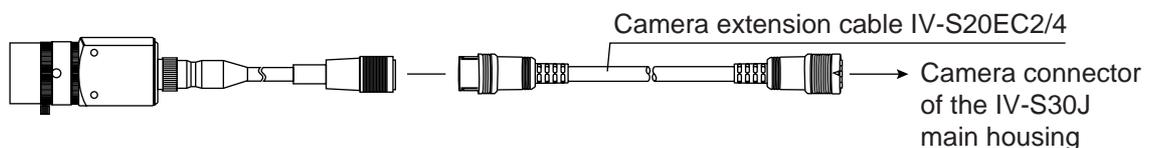
- 1) Connect the camera cable to the camera 1 (CAMERA1) and camera 2 (CAMERA2) connectors on the IV-S30J.

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

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

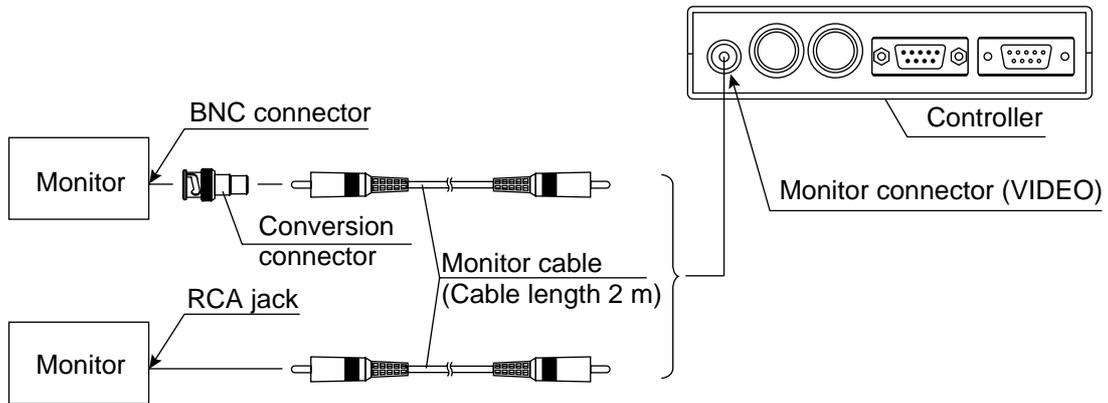
Note: You must have a camera connected to the camera 1 connector.

- Cable length of the camera cable is 3 m. If you want a longer camera cable than 3 m, please purchase camera extension cable IV-S20EC2 (cable length: 2 m) or IV-S20EC4 (cable length: 4 m).



## Connection and Installation Methods

- 2) Plug the remote keypad (IV-S30RK1) connector into the remote keypad connector (REMOTE) on the controller.
- 3) Connect the monitor to the monitor connector (VIDEO: RCA jack) on the controller using the monitor cable (supplied with the controller) and a conversion connector (supplied with controller). If the monitor has an RCA jack, the conversion connector is not required.
  - Use a monitor with either an EIA or NTSC compatible video input terminal.
  - Connect the cable to the monitor connector straight and treat it carefully.

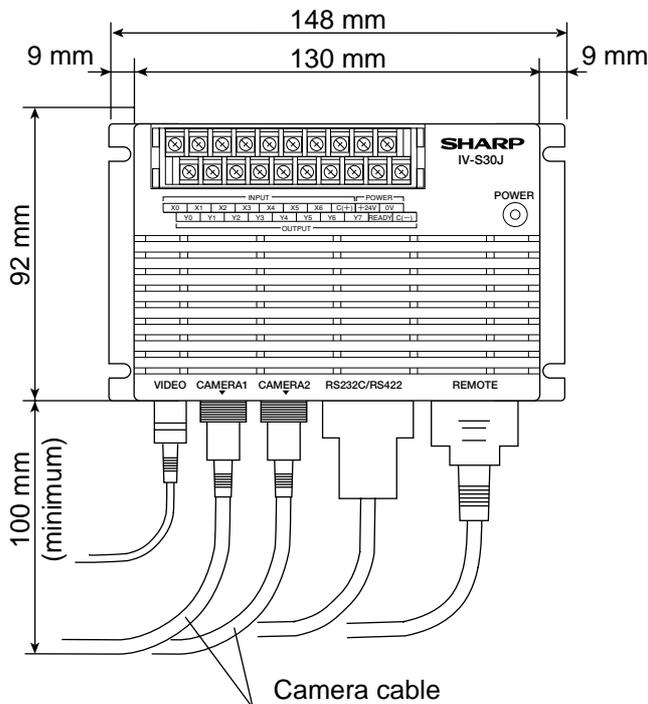


- If you need a monitor cable longer than 2 m, you can purchase a one at a video store.

- 4) For details about connecting and installing cameras, see page 5-20 and after in this manual.

### ■ Leave enough space around the controller (IV-S30J)

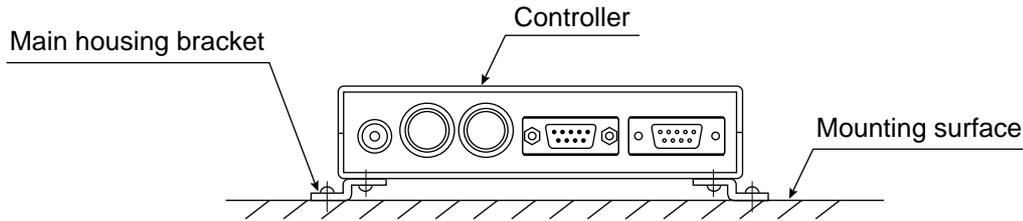
In order to connect camera cables, the remote key pad cable, monitor cable and D-sub connector to the IV-S30J, the following space (min.) is required.



- Do not bend the camera cables repeatedly.
- Make sure the installation location allows enough space for the input/output wires going to the I/O terminal block and the power terminal block on the IV-S30J.

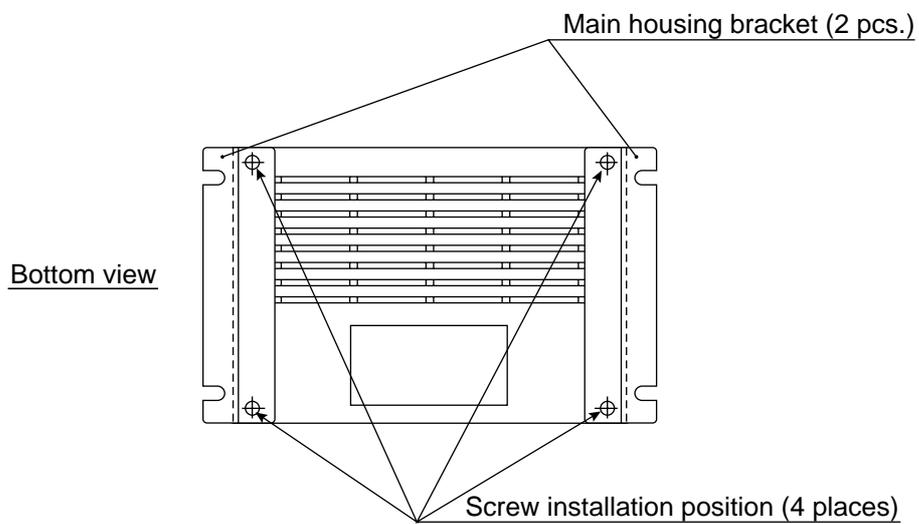
**[2] Installation**

To install the IV-S30J controller, secure the bottom of the housing on the mounting surface with the two main housing brackets (supplied with the controller.)

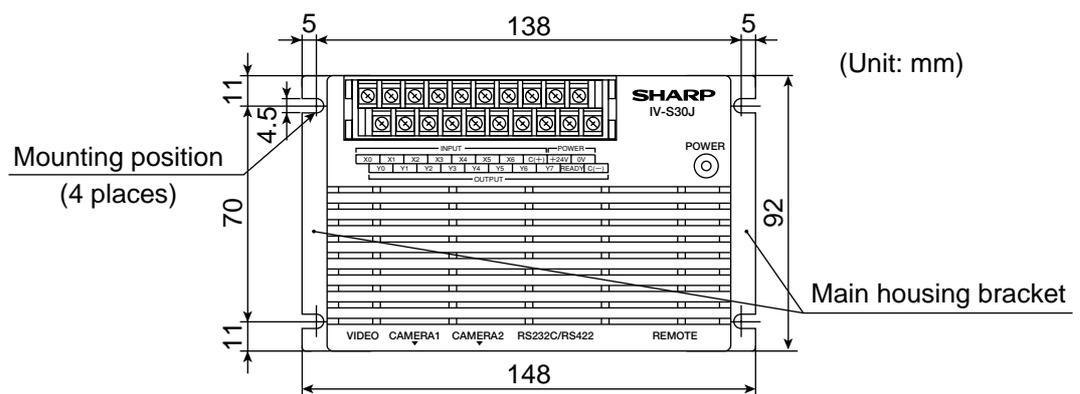


**■ Mounting procedure**

1. Attach the two main housing brackets on the bottom of the IV-S30J. Four screws (M 3 x 6) are supplied to attach the brackets.



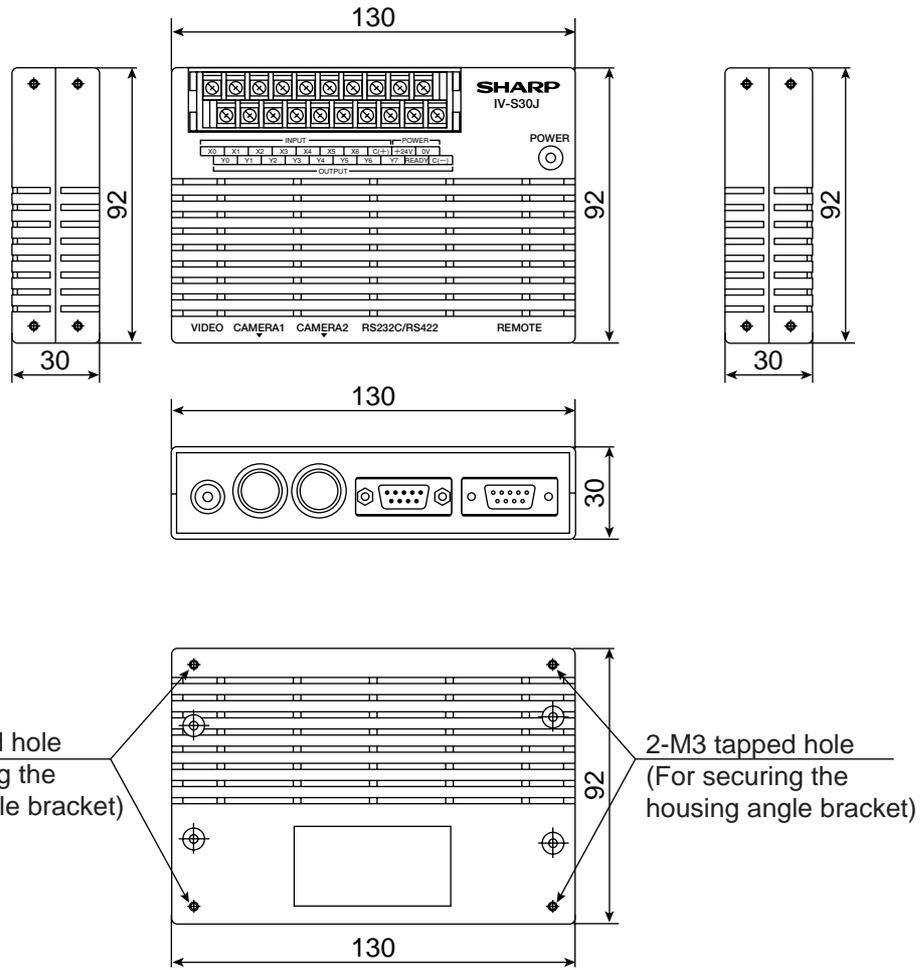
2. Secure the controller on the mounting surface using the main housing brackets.



⇒ The external dimensions of the main housing brackets and the controller are shown on the following page.

- External dimensions of the controller (IV-S30J)

(Unit: mm)

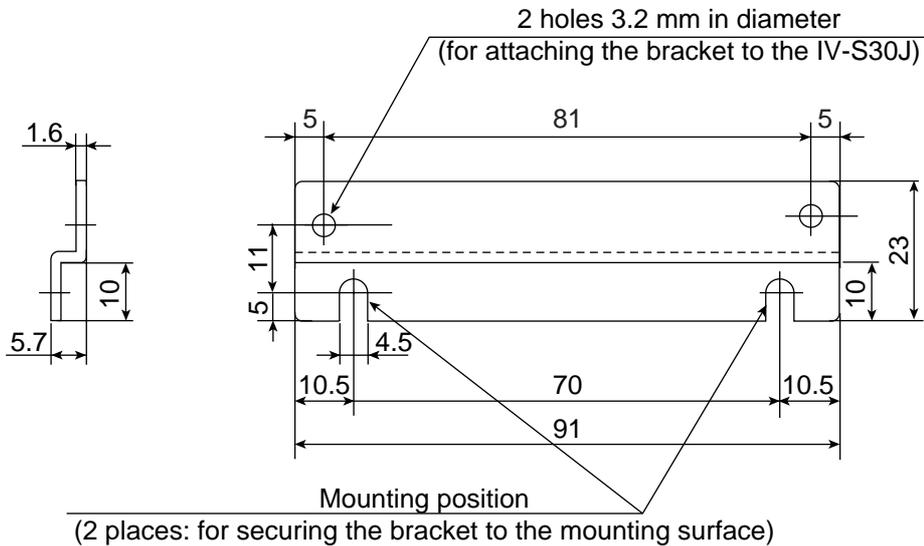


2-M3 tapped hole  
(For securing the  
housing angle bracket)

2-M3 tapped hole  
(For securing the  
housing angle bracket)

- External dimensions of main housing bracket

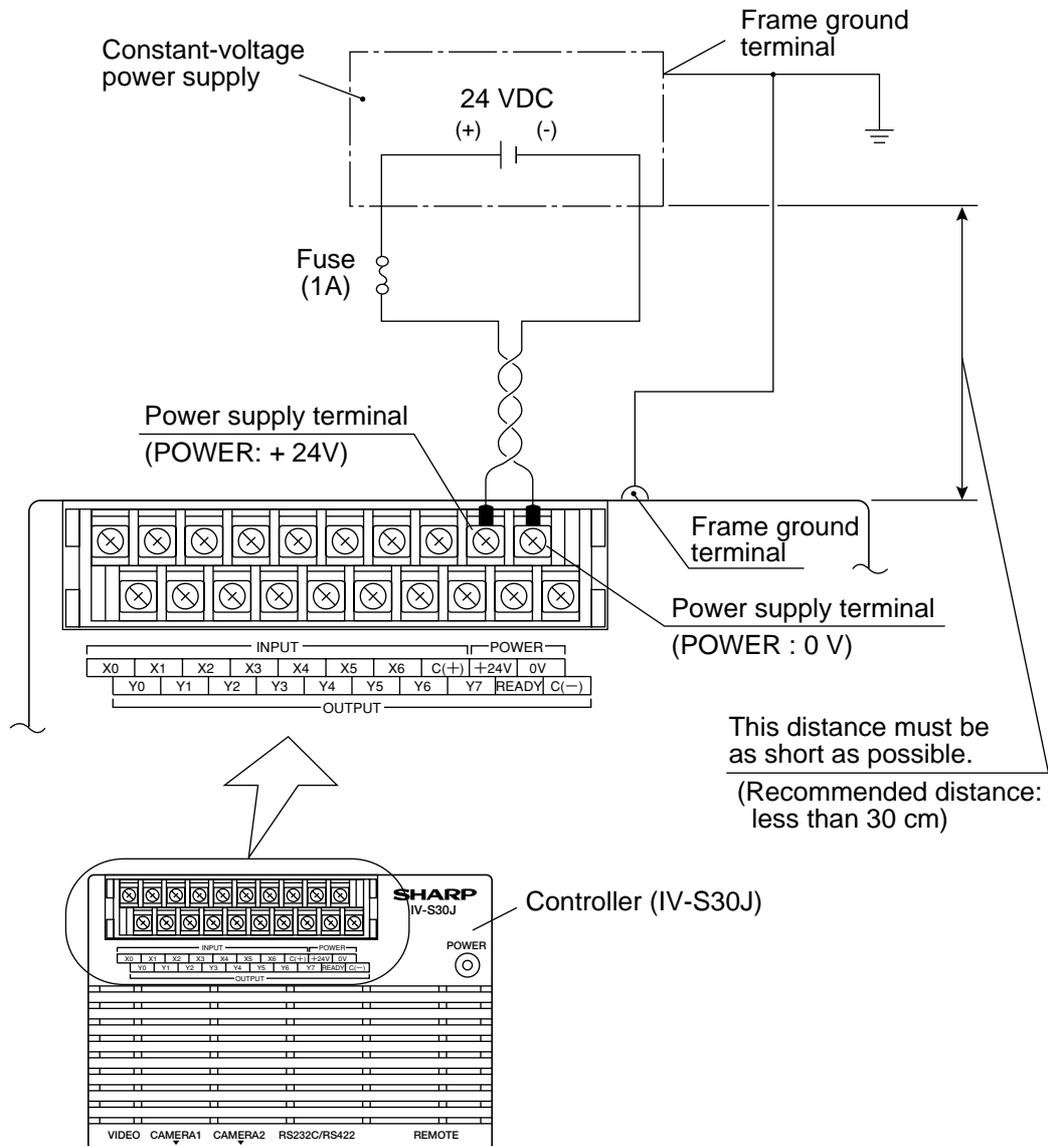
(Unit: mm)



Mounting position  
(2 places: for securing the bracket to the mounting surface)

**[3] Connecting a power supply**

- Connect a commercially available constant-voltage power supply to the power terminals (POWER: +24 V, 0 V) on the controller (IV-S30J). Use a 24 VDC  $\pm 10\%$ , 350 mA or more constant-voltage power supply.
- Use an individual power supply to supply power to the controller. If the power supply is used to power other equipment, measurement errors may occur.
  - Check the polarity of the power supply terminals, +24 V and 0 V. If power is supplied with the polarity inverted, the controller may be damaged.
  - Only connect or disconnect the camera cable and other equipment while the power is OFF.



5

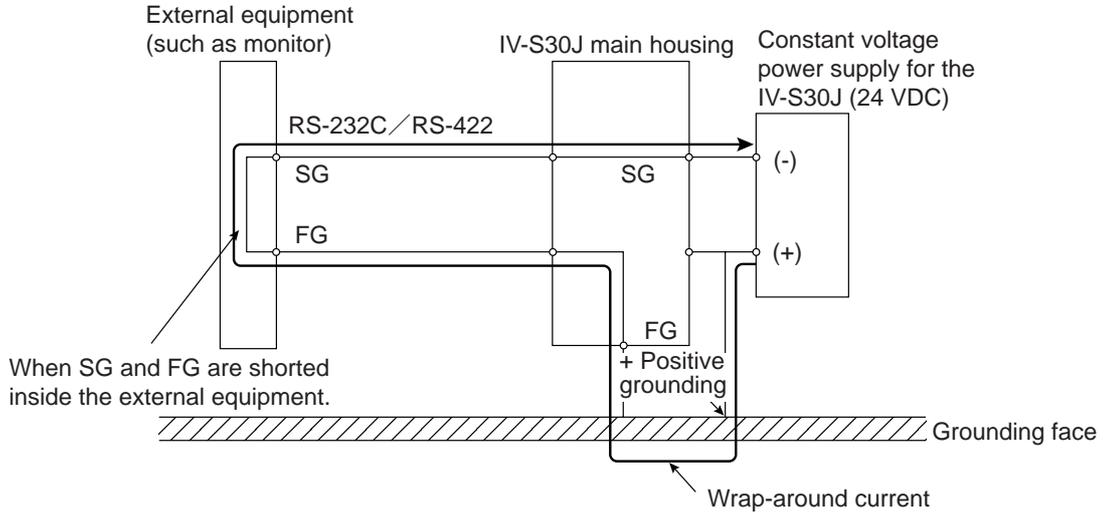
**Note**

- To improve the noise resistance of the constant-voltage power supply connected to the controller (IV-S30J), observe the following precautions.
- Ground the FG terminal of the constant-voltage power supply according to the class D (class 3) grounding.
  - The power line between the controller and the constant-voltage power supply must be as short as possible. (Recommended distance: less than 30 cm)  
Do not run the power supply line near any noise generating sources, such as electric motor lines.
  - Use twisted-pair wire for the power supply line.

Remarks

When connecting a constant voltage power supply (24 VDC) to the IV-S30J main housing, do not ground the positive pole of the power supply.

- When grounding the positive pole of the constant voltage power supply, and if external equipment is used that is connected to SG and FG inside, a short circuit (shown in the figure below) may be created and a large current may flow to the SG circuit inside the IV-S30J. This may damage the circuit, create fumes, or start a fire in the IV-S30J.



- For facility configuration reasons, when grounding positive pole of the 24 VDC power supply, make sure to use a separated power supply (exclusive power supply) that does not ground both the positive and negative terminals.

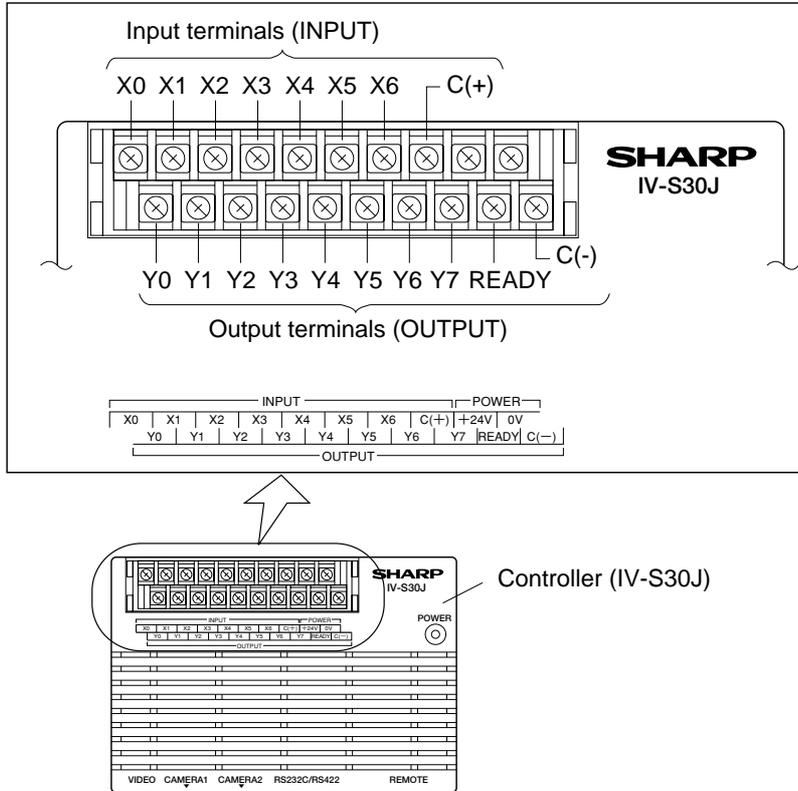
5

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

7 input terminals and 9 output terminals are available on the input/output terminal block on the controller (IV-S30J).

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

**[Input/output terminal block on the IV-S30J]**



**(1) Input terminals (INPUT) X0 to X4**

| X0              | <ul style="list-style-type: none"> <li>- When setting *1 below for measurement start I/O -&gt; External input</li> <li>- When setting *2 below for measurement start I/O -&gt; Measurement start input</li> </ul>  |                 |     |     |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
|-----------------|--|-----------------|-----|-----|----|----|---|-----|-----|-----|-----|---|-----|-----|-----|----|---|-----|-----|----|-----|---|-----|-----|----|----|---|-----|----|-----|-----|---|-----|----|-----|----|---|-----|----|----|-----|---|-----|----|----|----|-----------------|----|----|----|----|---|----|-----|-----|-----|---|----|-----|-----|----|----|----|-----|----|-----|----|----|-----|----|----|----|----|----|-----|-----|----|----|----|-----|----|----|----|----|----|-----|----|----|----|----|----|
| X1 to 4         | <ul style="list-style-type: none"> <li>- When setting *1 below for measurement start I/O -&gt; External input</li> <li>- When setting *2 below for measurement start I/O -&gt; Input object type number (0 to 15)</li> </ul> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Object type No.</th> <th>X4</th> <th>X3</th> <th>X2</th> <th>X1</th> </tr> </thead> <tbody> <tr><td>0</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr> <tr><td>1</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td></tr> <tr><td>2</td><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td></tr> <tr><td>3</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr> <tr><td>4</td><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td></tr> <tr><td>5</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr> <tr><td>6</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td></tr> <tr><td>7</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td></tr> </tbody> </table> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Object type No.</th> <th>X4</th> <th>X3</th> <th>X2</th> <th>X1</th> </tr> </thead> <tbody> <tr><td>8</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr> <tr><td>9</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td></tr> <tr><td>10</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td></tr> <tr><td>11</td><td>ON</td><td>OFF</td><td>ON</td><td>ON</td></tr> <tr><td>12</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr> <tr><td>13</td><td>ON</td><td>ON</td><td>OFF</td><td>ON</td></tr> <tr><td>14</td><td>ON</td><td>ON</td><td>ON</td><td>OFF</td></tr> <tr><td>15</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr> </tbody> </table> | Object type No. | X4  | X3  | X2 | X1 | 0 | OFF | OFF | OFF | OFF | 1 | OFF | OFF | OFF | ON | 2 | OFF | OFF | ON | OFF | 3 | OFF | OFF | ON | ON | 4 | OFF | ON | OFF | OFF | 5 | OFF | ON | OFF | ON | 6 | OFF | ON | ON | OFF | 7 | OFF | ON | ON | ON | Object type No. | X4 | X3 | X2 | X1 | 8 | ON | OFF | OFF | OFF | 9 | ON | OFF | OFF | ON | 10 | ON | OFF | ON | OFF | 11 | ON | OFF | ON | ON | 12 | ON | ON | OFF | OFF | 13 | ON | ON | OFF | ON | 14 | ON | ON | ON | OFF | 15 | ON | ON | ON | ON |
| Object type No. | X4   | X3              | X2  | X1  |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 0               | OFF  | OFF             | OFF | OFF |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 1               | OFF  | OFF             | OFF | ON  |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 2               | OFF  | OFF             | ON  | OFF |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 3               | OFF  | OFF             | ON  | ON  |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 4               | OFF  | ON              | OFF | OFF |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 5               | OFF  | ON              | OFF | ON  |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 6               | OFF  | ON              | ON  | OFF |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 7               | OFF  | ON              | ON  | ON  |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| Object type No. | X4   | X3              | X2  | X1  |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 8               | ON   | OFF             | OFF | OFF |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 9               | ON   | OFF             | OFF | ON  |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 10              | ON   | OFF             | ON  | OFF |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 11              | ON   | OFF             | ON  | ON  |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 12              | ON   | ON              | OFF | OFF |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 13              | ON   | ON              | OFF | ON  |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 14              | ON   | ON              | ON  | OFF |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |
| 15              | ON   | ON              | ON  | ON  |    |    |   |     |     |     |     |   |     |     |     |    |   |     |     |    |     |   |     |     |    |    |   |     |    |     |     |   |     |    |     |    |   |     |    |    |     |   |     |    |    |    |                 |    |    |    |    |   |    |     |     |     |   |    |     |     |    |    |    |     |    |     |    |    |     |    |    |    |    |    |     |     |    |    |    |     |    |    |    |    |    |     |    |    |    |    |    |

| Setting I/O conditions (see Chapter 16 of the Function and Operation) |   |
|---|---|
| *1  | Measurement start input IF = General-purpose serial<br>Measurement start input IF = CCD trigger<br>CCD sampling start = General-purpose serial or auto (edge/level) |
| *2  | Measurement start input IF = Parallel<br>Measurement start input IF = CCD trigger, CCD sampling start = Parallel  |

(2) Input terminals (INPUT) X5, X6

|    |   |   |           |   |
|----|---|---|-----------|---|
| X5 | Parallel selection input<br>(External input, register reference image, and assign measurement number (lower digit))<br>- Select on the "⑤ Parallel input X5" on the "I/O condition" menu. | When selecting "Specify measurement No." for X5 and X6. |           |   |
|    | X6  |   |           | Parallel selection input<br>(External input, change image, and assign measurement number (upper digit))<br>- Select on the "⑥ Parallel input X6" on the "I/O condition" menu. |
|    |   | <b>Execute measurement</b>                              | <b>X6</b> | <b>X5</b>   |
|    |   | Measurement 0   | OFF       | OFF   |
|    |   | Measurement 0&1   | OFF       | ON  |
|    |   | Measurement 0&2   | ON        | OFF   |
|    |   | Measurement 0&3   | ON        | ON  |

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

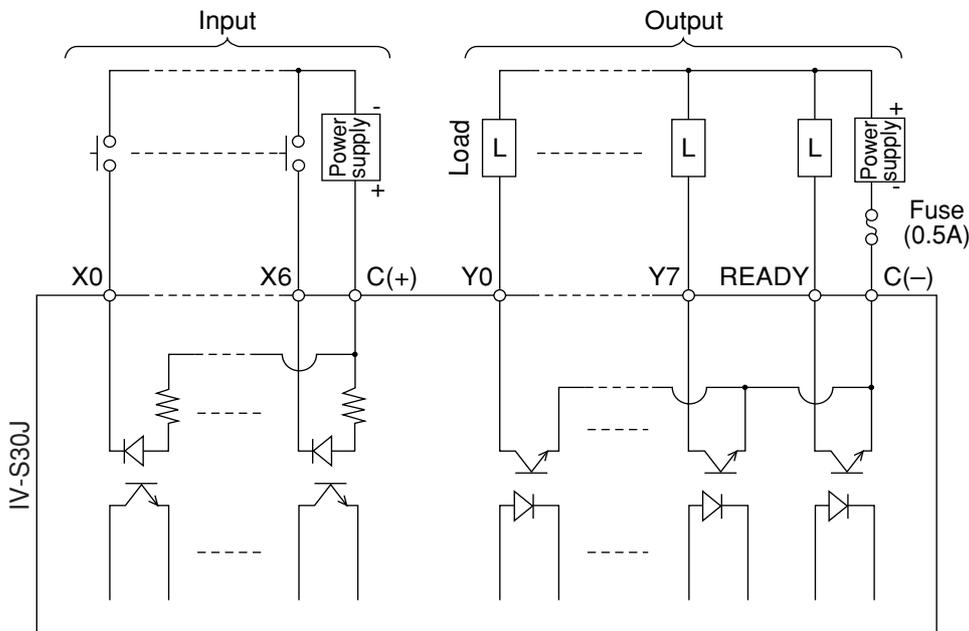
|                 |   |
|-----------------|---|
| <b>Y0 to Y7</b> | Result of logical calculation output<br>- Specify in the "FINAL-OUTPUT COND" on the [OBJECT TYPE COND] menu.  |
| <b>READY</b>    | These signals will turn ON when the measurement start input is enabled.<br>- For information about the timing chart and other details, see "Setting the Input/Output Conditions" in the IV-S30J User's Manual (Function and Operation). |

(4) I/O port

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

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

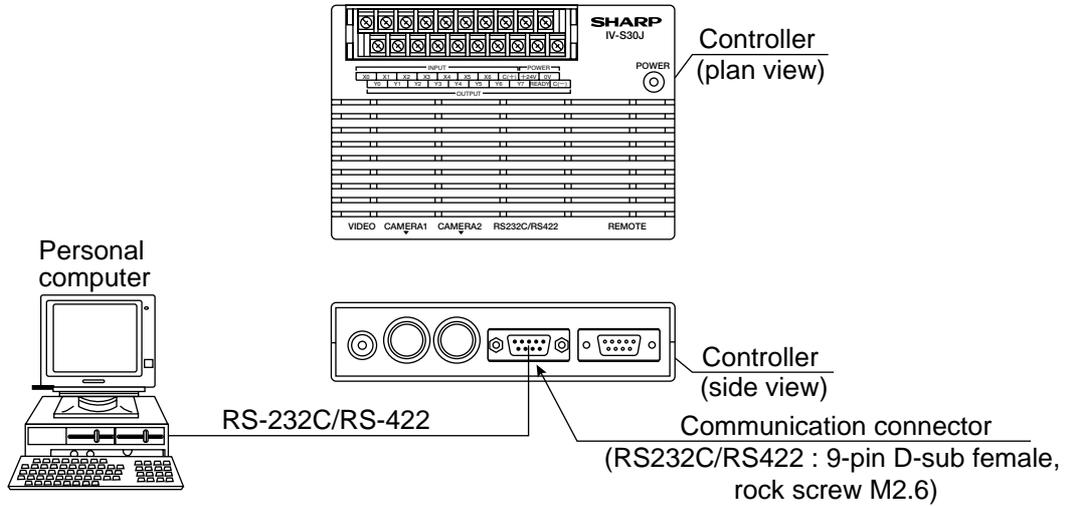
(5) Wiring to the controller (IV-S30J)



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

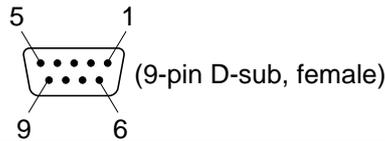
Connect a personal computer to the communication connector (RS232C/RS422) on the controller (IV-S30J).

A 9-pin D-sub, male connector is included with the controller.



5

**(1) When communicating through the RS-232C port**  
 - The controller pin arrangement of the communication connector (for RS-232C)



| Communication standard | Pin No. | Signal name | Details  | Direction |
|------------------------|---------|-------------|--|-----------|
| RS-232C                | 2       | RD          | Received data<br>(Personal computer ⇨ Controller)    | Input     |
|                        | 3       | SD          | Transmitted data<br>(Controller ⇨ Personal computer) | Output    |
|                        | 5       | SG          | Signal ground  | —         |
| Connector case         |         | FG          | Frame ground   | —         |

Personal computer

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

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

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

← \*(RS-232C) →

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

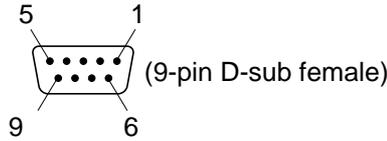
| Communication speed (kbps) | Cable length |
|----------------------------|--------------|
| 9.6, 19.2                  | 15 m or less |
| 38.4, 57.6, 115.2          | 2 to 3 m     |

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

(2) When communicating through the RS-422

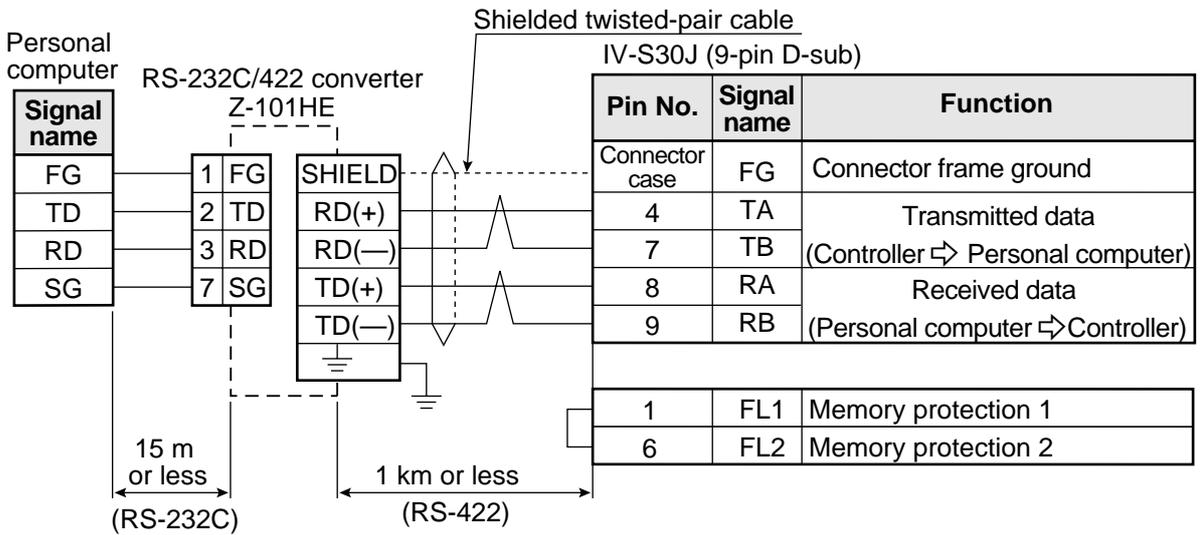
Specify the 4-wire or 2-wire RS-422 system on the [COMM.SET] menu.

- The controller pin arrangement of the communication connector (for RS-422)

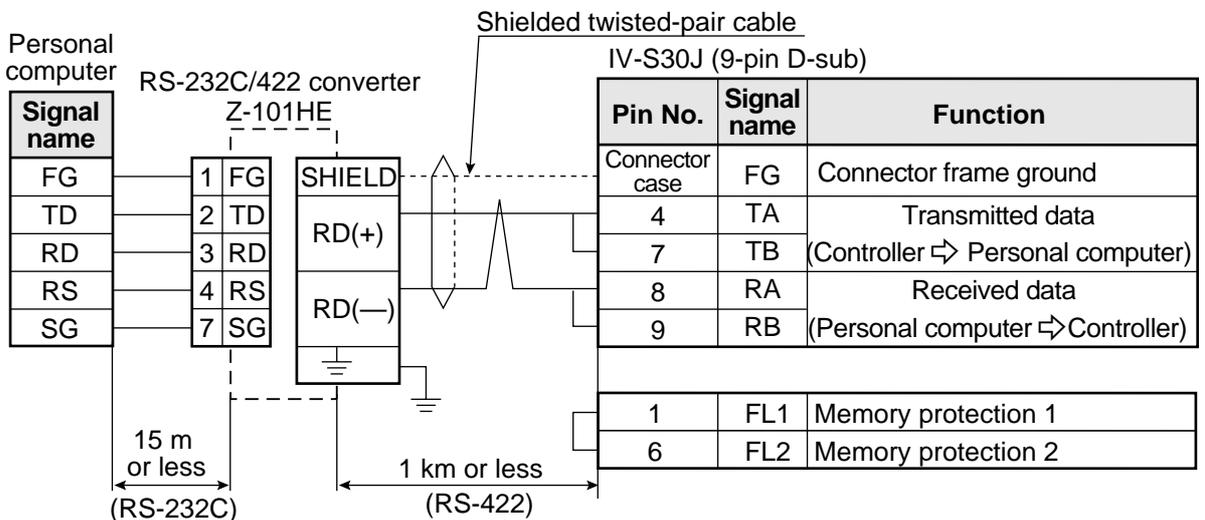


| Communication standard | Pin No. | Signal name | Details  | Direction |
|------------------------|---------|-------------|--|-----------|
| RS-422                 | 4       | TA          | Transmitted data<br>(Controller ⇨ Personal computer) | Output    |
|                        | 7       | TB          |  |           |
|                        | 8       | RA          | Received data<br>(Personal computer ⇨ Controller)    | Input     |
|                        | 9       | RB          |  |           |
| Connector case         |         | FG          | Frame ground   | —         |

• 4-wire system

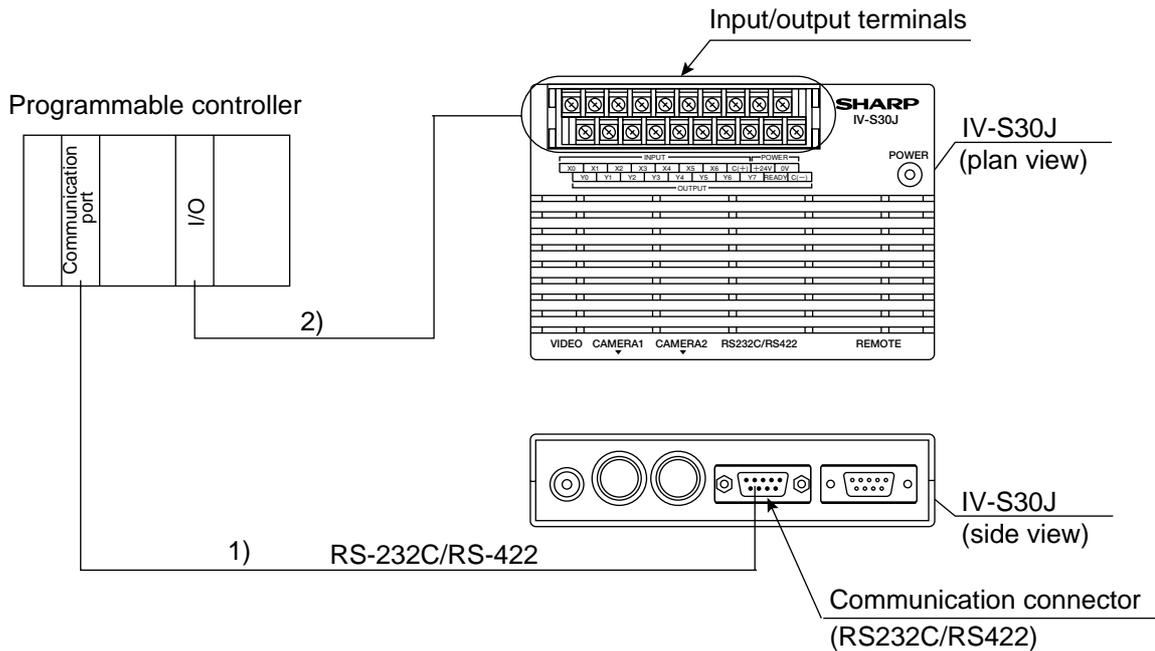


• 2-wire system



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

Connect a programmable controller to the communication connector (RS232C/RS422) and the input/output terminals on the controller (IV-S30J).



- 1) Connect the computer link connector (RS-232C/RS-422) of a programmable controller to the communication connector (RS232C/RS422: 9-pin D-sub, female) on the controller.
  - ⇒ See "Computer Link" in the IV-S30J User's Manual (Function and Operation).  
(The pin arrangement of the communication connector on the controller is shown on page 5-19 to 5-20.)
  - In the case of RS-232C, the maximum communication cable length depends on the communication speed.

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

Conduct a communication test before using the devices for measurements.

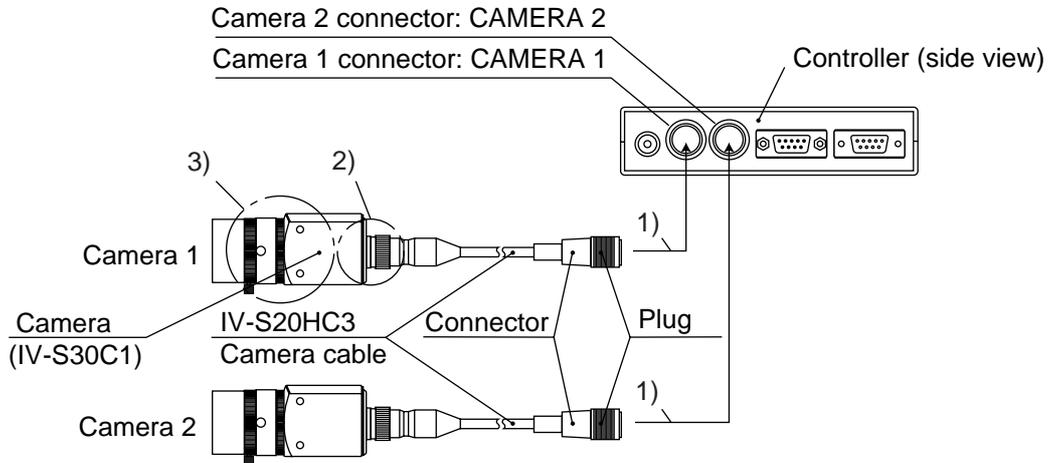
- 2) Connect the input/output terminals of the programmable controller to the input/output terminals on the IV-S30J.
  - ⇒ See item [4] "Connecting to the input/output terminals (parallel I/F)" for details about wiring procedure.

## 5-3 Installing and connecting the IV-S30C1/C2 camera

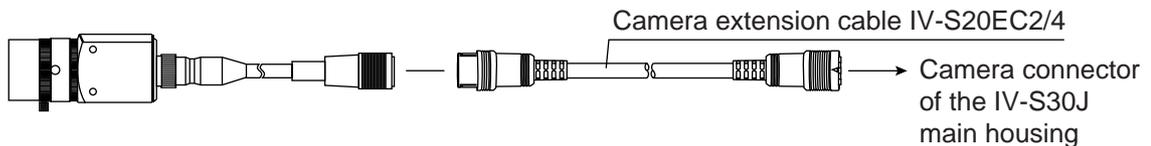
### [1] Installing and connecting the IV-S30C1 standard cameras

#### (1) Connections

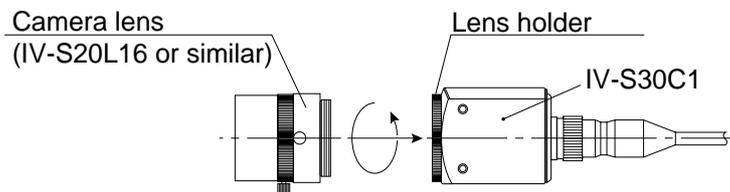
Up to two IV-S30C1 standard cameras can be connected to the IV-S30J using IV-S20HC3 camera conversion cable.



- 1) Connect the IV-S20HC3 to the CAMERA 1 and CAMERA 2 connectors on the IV-S30J.
  - Note: Only connect or disconnect the camera connectors while the power is OFF.
  - To connect them, match the keyed portion of the connectors and press in. When they are firmly connected, you will hear a click.
  - To unplug a connector, hold the plug housing and pull it straight out.
  - Any camera plugged into the CAMERA 1 connector will be system camera 1 and any camera plugged into the CAMERA 2 connector will be system camera 2 in the IV-S30J system.
  - Note: You must have a camera connected to the camera 1 connector.
  - Cable length of the camera cable is 3 m. If you want a longer camera cable than 3 m, please purchase camera extension cable IV-S20EC2 (cable length: 2 m) or IV-S20EC4 (cable length: 4 m).



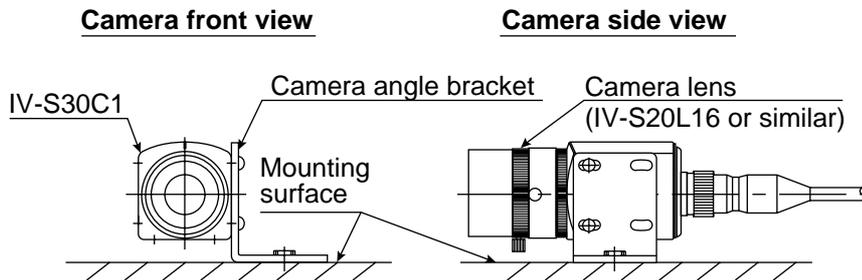
- 2) Plug the other end of the IV-S20HC3 into the IV-S30C1, and tighten the securing ring on the plug housing.
- 3) Screw the IV-S20L16 camera lens (or similar) into the lens holder on the IV-S30C1 until it is secured.



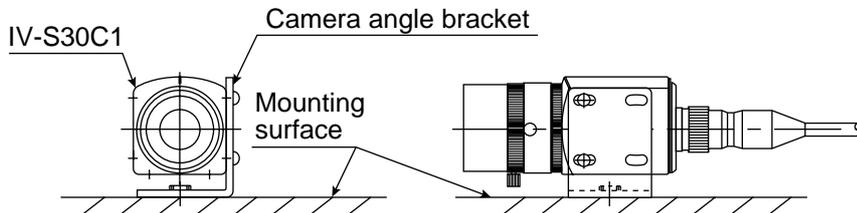
**(2) Installing the camera body**

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

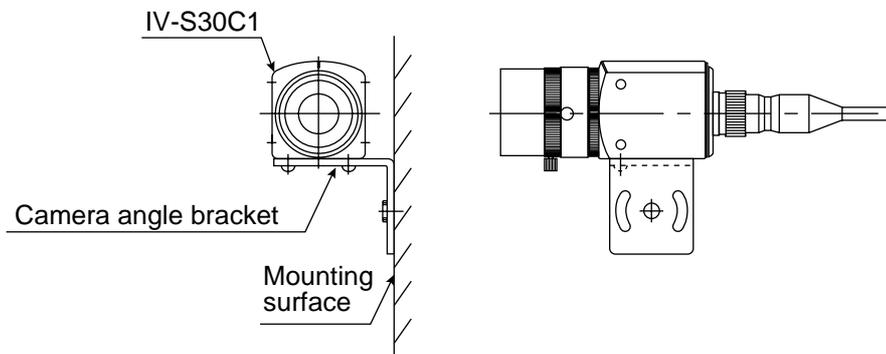
**- Installation example 1**



**- Installation example 2**



**- Installation example 3**

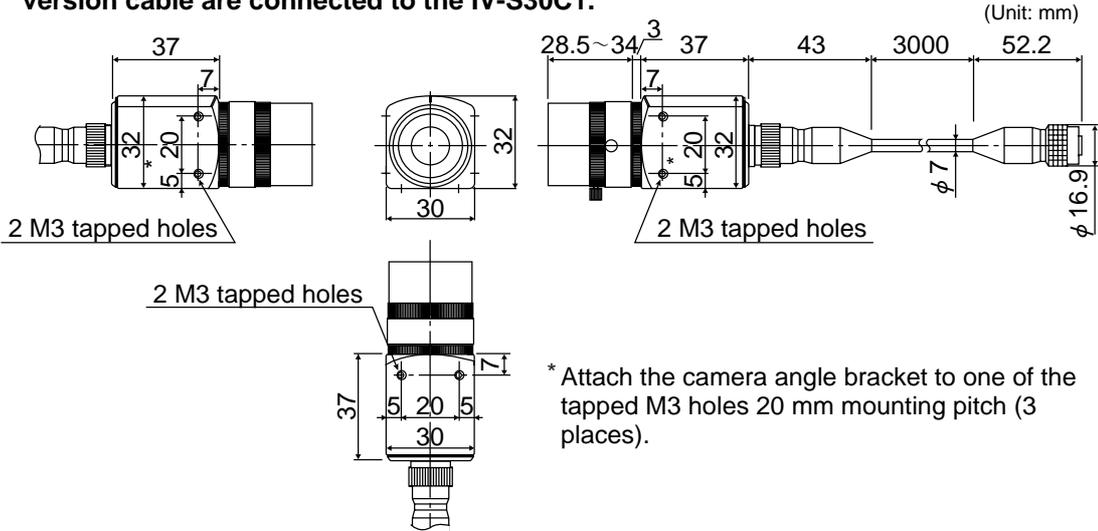


**■ Installation procedure**

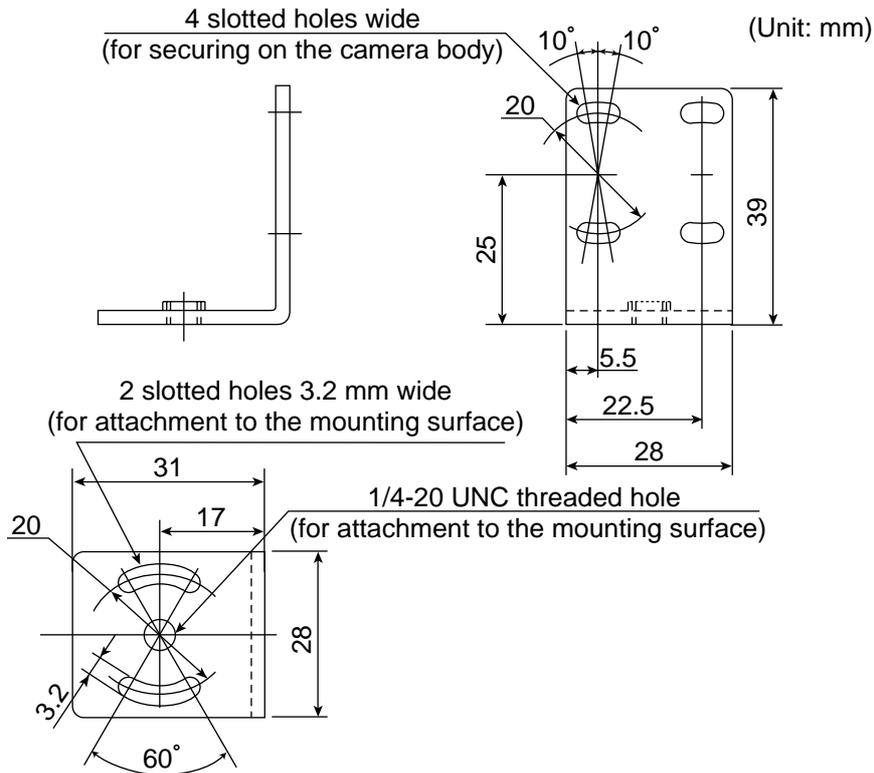
1. Attach the camera angle bracket to the tapped M3 hole on the camera body (20 mm mounting pitch: one of three holes). Two screws (M 3 x 6) are supplied with the camera for attaching the angle.
2. Attach the camera controller angle to the mounting surface with the slotted holes 3.2 mm wide (20 mm mounting pitch) or 1/4-20 UNC threaded hole.

The external dimensions of the camera angle bracket and the IV-S30C1 camera body are shown on the following page.

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

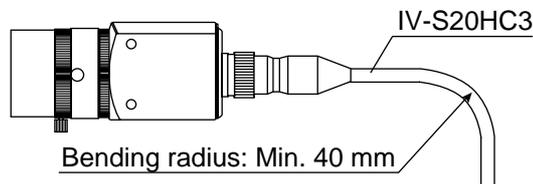


- External dimensions of camera angle bracket



**Note**

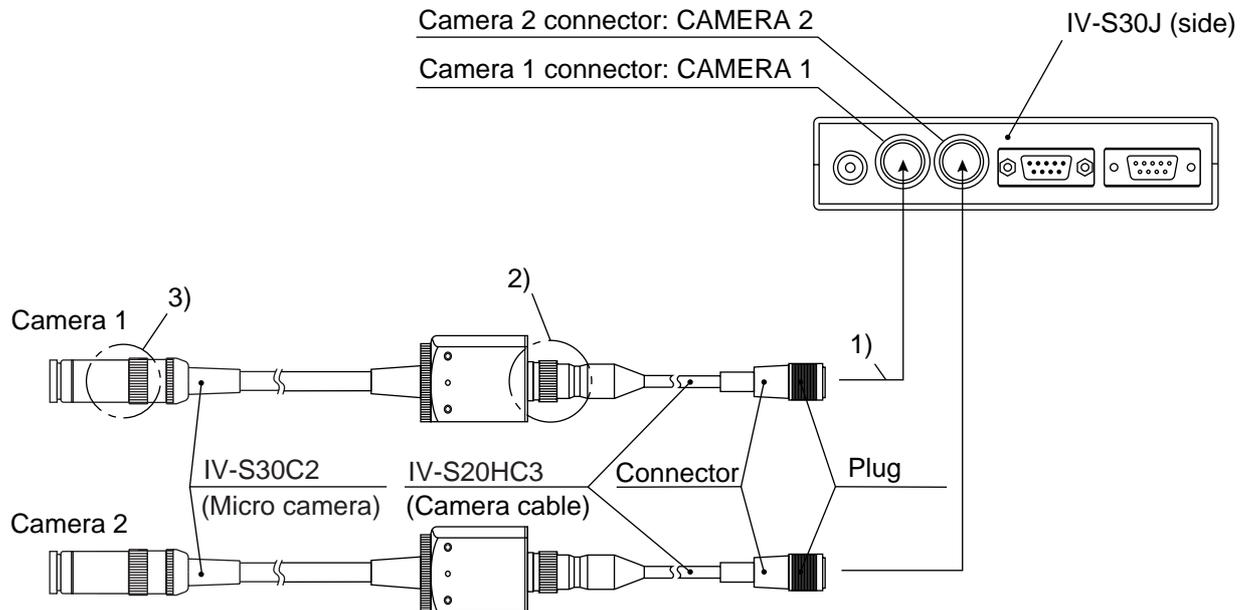
- When the IV-S20HC3 camera conversion cable is bent, its bending radius should be larger than 40 mm.  
If the camera cable will be bent repeatedly during operation, design the cable layout so that the bending radius is 75 mm or more and use components that can be flexed up to 2 million times.



## [2] Installing and connecting the IV-S30C2 micro camera

### (1) Connections

Up to two IV-S30C2 micro cameras can be connected to the following controllers using camera cables.



- 1) Connect the IV-S20HC3 to the CAMERA 1 and CAMERA 2 connectors on the IV-S30J.

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

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

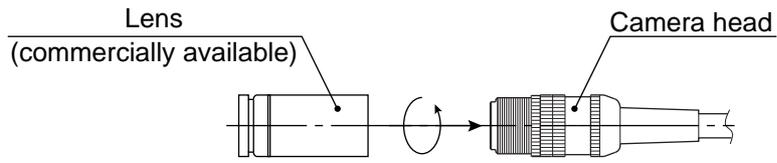
Note: You must have a camera connected to the camera 1 connector.

- Cable length of the camera cable is 3 m. If you want a longer camera cable than 3 m, please purchase camera extension cable IV-S20EC2 (cable length: 2 m) or IV-S20EC4 (cable length: 4 m).

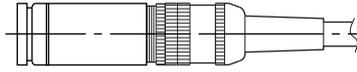
- 2) Plug the camera connector on the IV-S20HC3 (camera conversion cable) into the cable connector on the IV-S30C2 camera and screw it down to secure the connection.

## Connection and Installation Methods

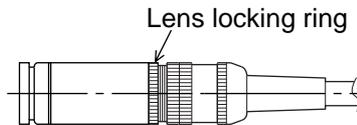
- 3) Screw a commercially available lens into the camera head of the IV-S30C2.



- Step1. Screw the lens in until the camera image is focused.



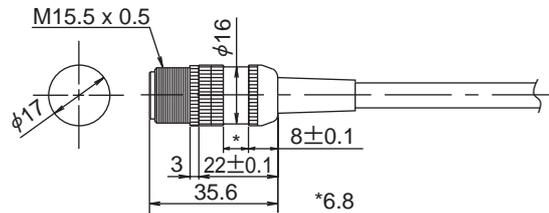
- Step2. Secure the lens using the lens locking ring on the camera head



5

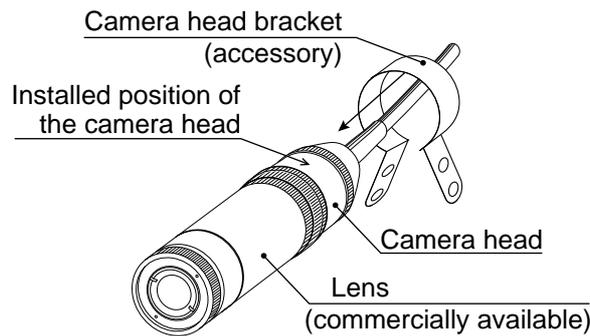
### - External dimensions of the IV-S30C2 camera head

(Unit: mm)

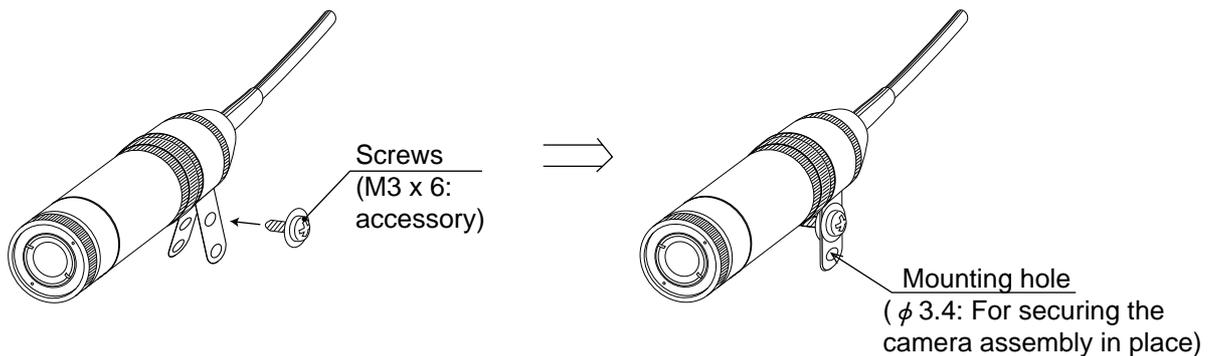


**(2) Installation of the camera head**

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



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

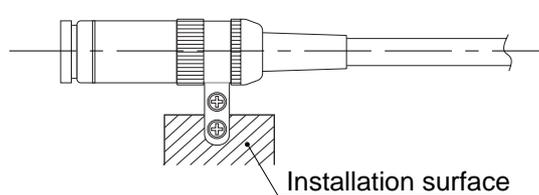


3. Secure the camera head assembly in place using the mounting hole (ø3.4) on the camera head bracket.

**Front view**



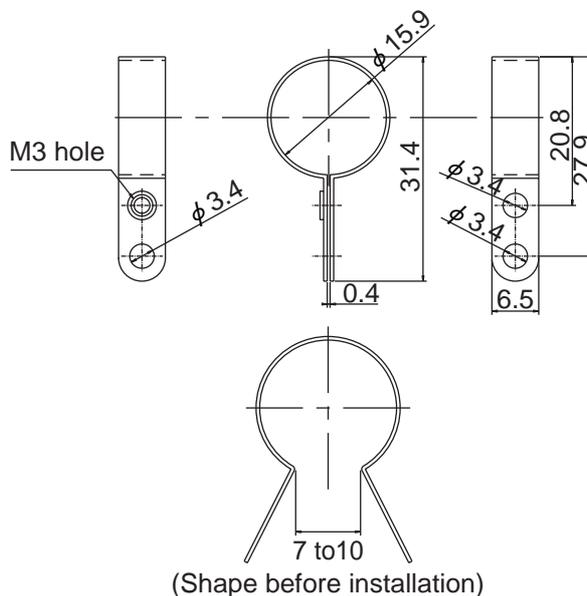
**Side view**



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

**- External dimensions of the camera head bracket**

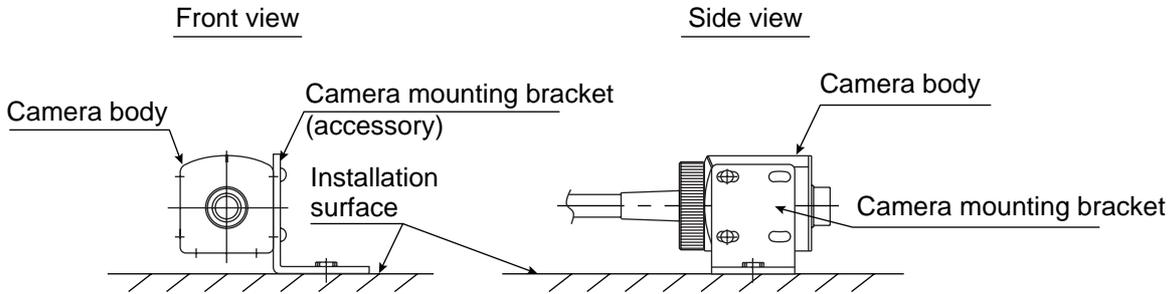
(Unit: mm)



**(3) Installation of the camera body**

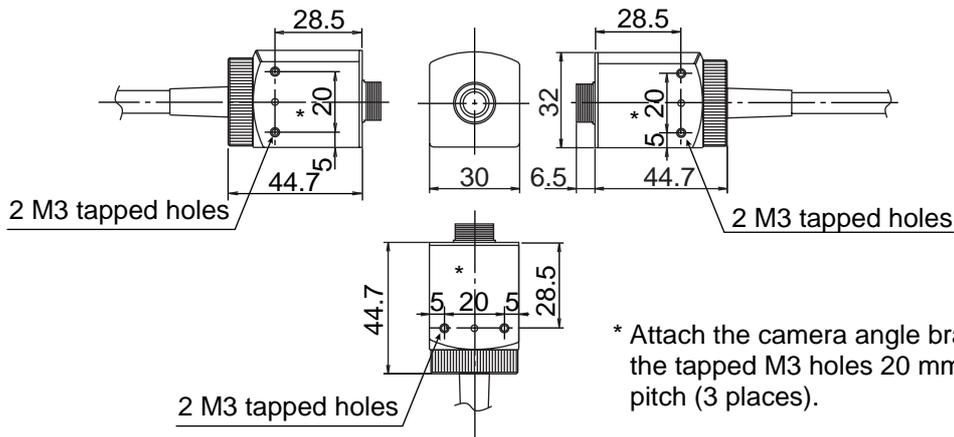
1. Attach the camera mounting bracket (comes with the IV-S30C2) to the three M3 tapped holes (spacing: 20 mm) on the camera body using the M3x6 installation screws that come with the IV-S30C2.
2. Secure the camera mounting bracket on the installation surface using a 3.2mm long, 20 mm difference screw or a 1/4-20 UNC screw hole.

**[Installation example]**



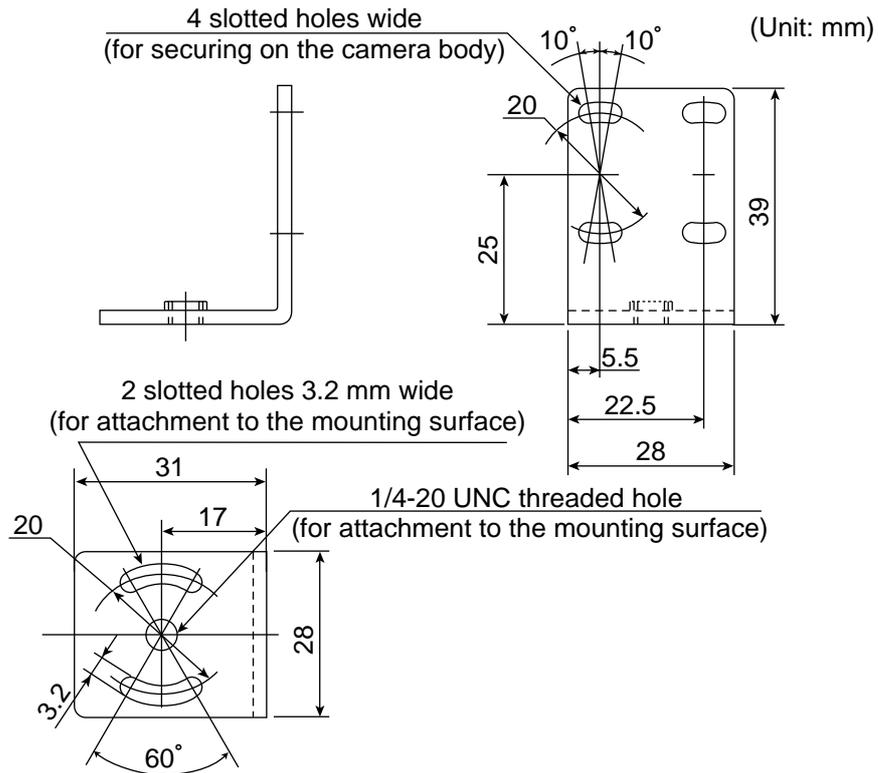
**- External dimensions of the IV-S30C2 camera body**

(Unit: mm)



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

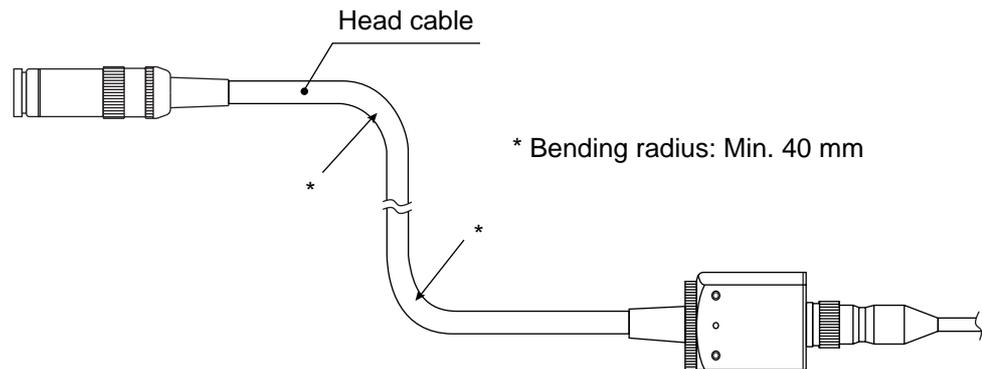
- External dimensions of camera angle bracket



5

**Note**

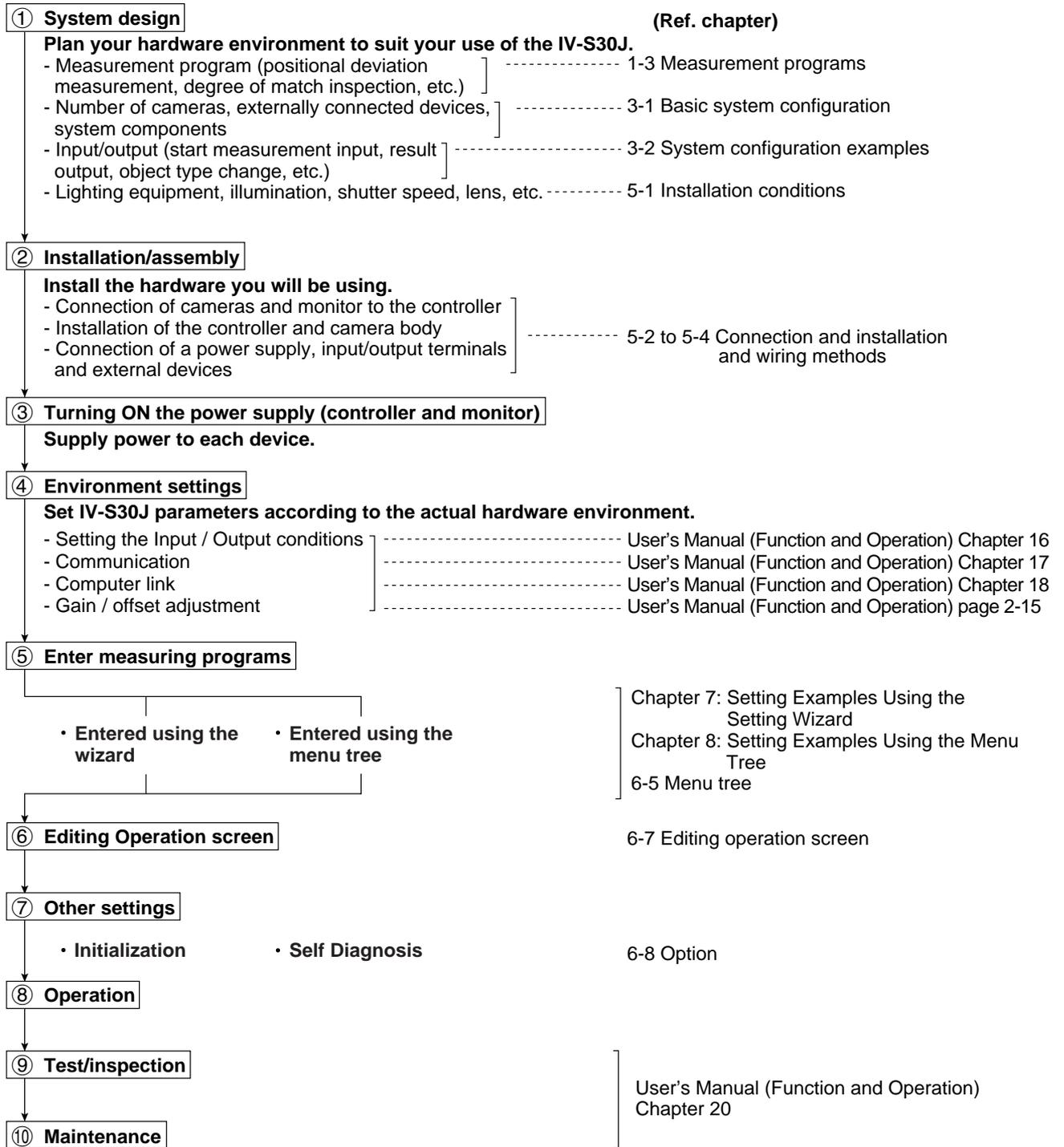
- When the camera head cable is bent, its bending radius should be larger than 40 mm. If the camera cable will be bent repeatedly during operation, design the cable layout so that the bending radius is 75 mm or more and use components that can be flexed up to 2 million times.



# Chapter 6: Setting and Operating Outlines

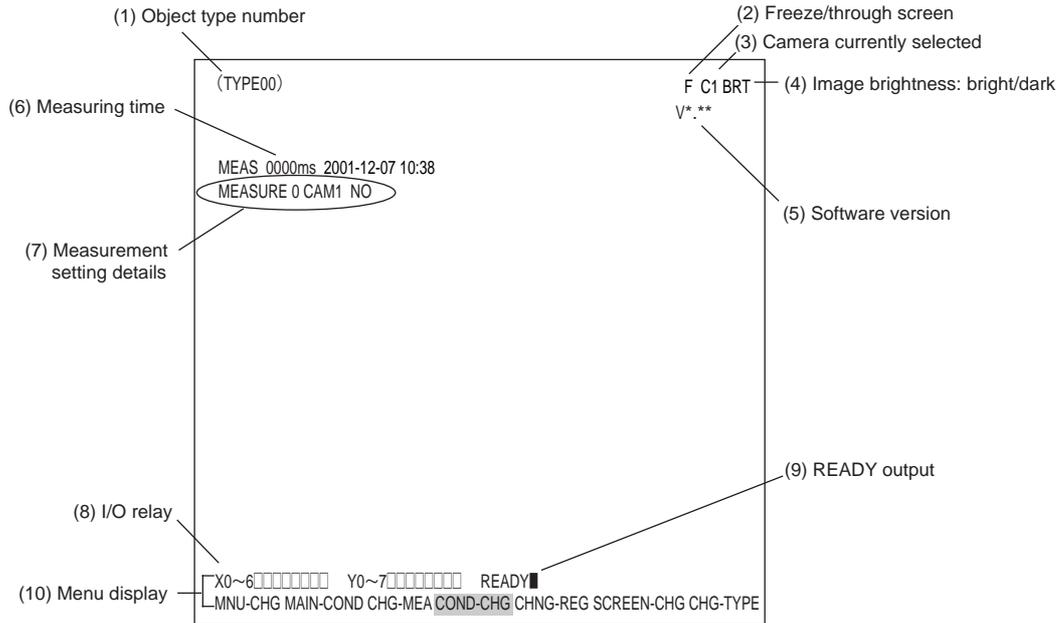
## 6-1 Setting and operating procedures

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



## 6-2 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) 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.<br>- Used for adjusting the camera focus and image properties.                                  |
| Freeze image   | - Displays the single image captured at the start of making measurements.<br>- 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.

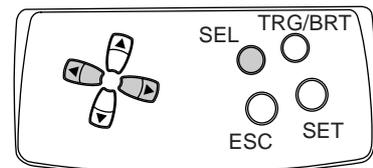
- (3) Indicates which camera is currently selected  
C1: Camera 1 (the camera connected to the "CAMERA1" connector)  
C2: Camera 2 (the camera connected to the "CAMERA2" connector)

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

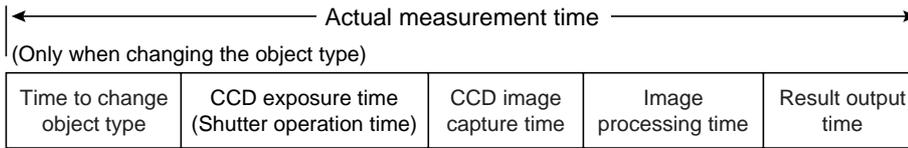
| Screen display | Description   |
|----------------|---|
| Bright         | Display the captured image without changing its brightness. |
| Dark           | Display the captured image at 1/2 the actual brightness     |

### 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.

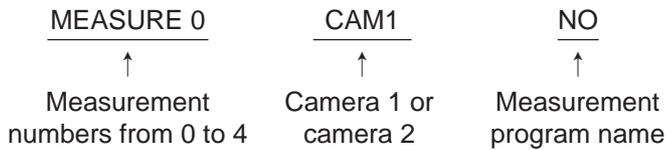


- (5) Displays the software version.
- (6) Displays the measurement time currently assigned.

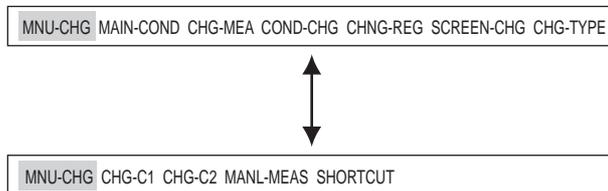


- Serial communication time is not included.
- Set the controller as follows to reduce the measurement time.
  1. Increase the shutter speed.
  2. Select the "partial" image capture feature for the CCD.
  3. Select "NO" for the measurement results display (message display, pattern display, and binary image display).

- (7) Display setting details of each measurement.



- (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.



The details of each item on this menu bar are shown on the next page.

■ Details of each item on the menu bar

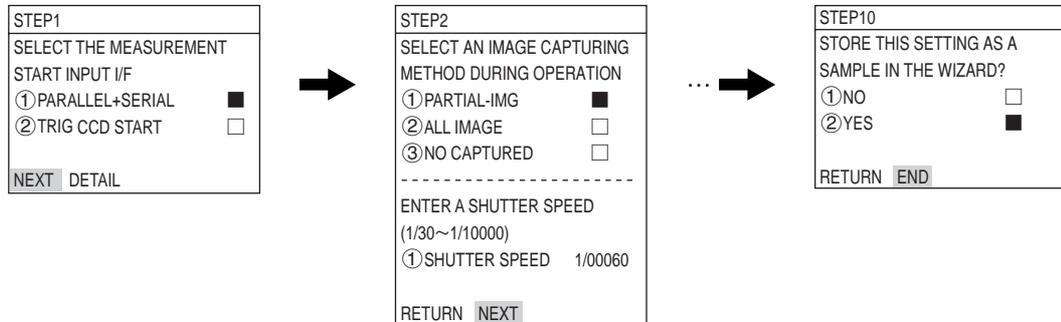
| Item on the menu bar                            | Description  | Display detail on the screen |
|---|--|------------------------------|
| MAIN-COND<br>(main conditions)                  | Displays the MAIN screen.  |                              |
| CHG-MEA<br>(Change measurement)                 | Press the up and down arrow keys to change the display of the evaluation results for each measurement number.<br>(Measurement 0 camera 1 -> measurement 0 camera 2 -> Measurement 1 -> Measurement 2 -> Measurement 3 -> Measurement 4)  |                              |
| COND-CHG<br>(Change the measurement conditions) | Displays the condition change selection list. Change the conditions that get displayed by pressing the up and down arrow keys.<br>For details about the measurement conditions, see pages 8-3 and 8-8 in this manual and Chapter 3: Function and Operation.<br>For details about the distance and angle conditions, see page 14-2 in Function and Operation.<br>For details about the numeric value calculation conditions, see page 15-7 in Function and Operation. |                              |
| CHNG-REG<br>(change registration)               | Change the display of the set of stored details between [A00] - [A07] and [A08] - [A15] using the up and down arrow keys   |                              |
| SCREEN-CHG<br>(change screen)                   | Displays the screen change selection list. Select a screen using the up and down arrow keys.<br>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.   |                              |
| CHG-TYPE<br>(change the object type)            | Displays the object type selection list.<br>Select an object type by pressing the up and down keys.<br>This is enabled when Manual Object Type Change is set to "YES."   |                              |
| CHG-C1<br>(change the Camera 1 image position)  | Moves the image from Camera 1 up and down the screen using the up and down arrow keys.<br>Note: This is enabled when "CAM1&2" is selected in ①MONITOR OUTPUT on the TYPE RUN COND menu (operating conditions).   |                              |
| CHG-C2<br>(change the Camera 2 image position)  | Moves the image from Camera 2 up and down the screen using the up and down arrow keys.<br>Note: This is enabled when "CAM1&2" is selected in ①MONITOR OUTPUT on the TYPE RUN COND (operation conditions).  |                              |
| MANL-MEAS<br>(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.<br>Note: Unless "MANL-MEAS" is selected on the "①EXTENSION FUNC" line in the TYPE RUN COND (operation conditions), this screen cannot be displayed.  |                              |
| SHORTCUT  | Displays a short cut screen.   |                              |

6

### 6-3 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.

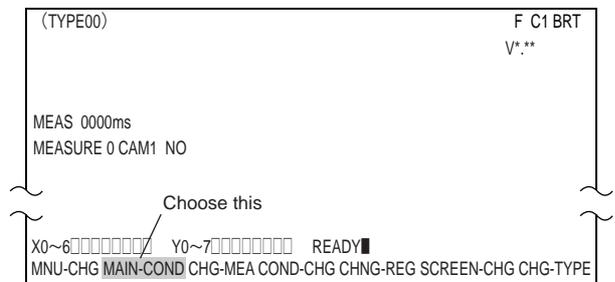
The wizard is convenient for making settings when beginners and inexperienced operators are operating the machine. However, operators who are familiar with the operation may save a lot of time by using other setting methods.



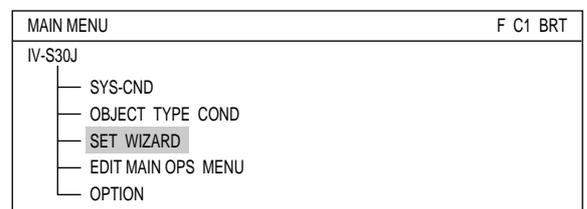
#### [1] How to start the standard wizard

##### Basic operation

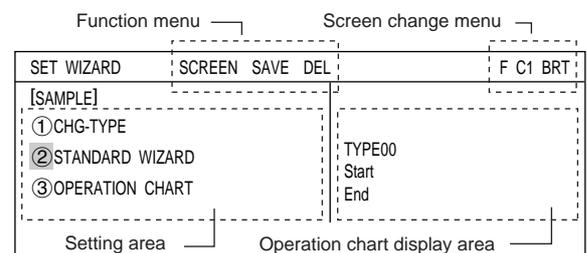
1. Move the cursor to the "MAIN-COND" item on the lower menu using the left and right arrow keys, and press the SET key.



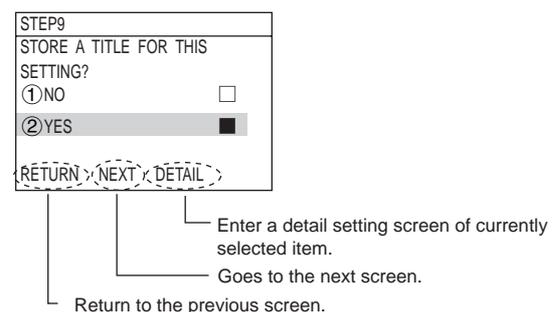
2. The "MAIN MENU" will appear. Move the cursor to the "SET WIZARD" item using the up and down keys and press the SET key.



3. Move the cursor to the "②STANDARD WIZARD" and press the SET key. The SET WIZARD program will start.



4. Answer the questions at each step, from STEP1 to the final step (the step which displays the "End" item")



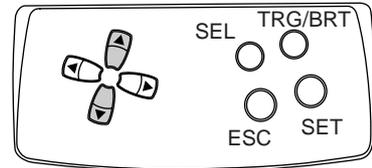
- After storing the sample in the final step, the sample name will appear on the ④ line as shown on the figure right.

| SET WIZARD        | SCREEN | SAVE | DEL |
|-------------------|--------|------|-----|
| [SAMPLE]          |        |      |     |
| ① CHG-TYPE        |        |      |     |
| ② STANDARD WIZARD |        |      |     |
| ③ OPERATION CHART |        |      |     |
| ④ AREA            |        |      |     |

## [2] Other operations in the "Set wizard" program

### 1. Up/down/left/right keys

When the "Set Wizard" program screen appears, the cursor is on the "① OBJECT CHANGE" item. Press the up and down keys and the cursor will move to "② STANDARD WIZARD" or "③ OPERATION CHART." (For the details about the operation chart, see page 6-4.) IN this operation the left and right keys are not used.



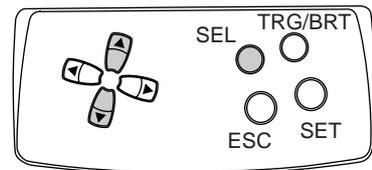
### 2. SEL key

Move the cursor to the "② STANDARD WIZARD" line. Then press the SEL key. The cursor will jump to "F" (freeze) in the upper menu area. Press the up and down key to change between "F" (freeze) and "T" (through) display of images.

| SET WIZARD        | SCREEN | SAVE | DEL | F      | C1 | BRT |
|-------------------|--------|------|-----|--------|----|-----|
| [SAMPLE]          |        |      |     |        |    |     |
| ① CHG-TYPE        |        |      |     |        |    |     |
| ② STANDARD WIZARD |        |      |     |        |    |     |
| ③ OPERATION CHART |        |      |     |        |    |     |
|                   |        |      |     | TYPE00 |    |     |
|                   |        |      |     | Start  |    |     |
|                   |        |      |     | End    |    |     |

"F" (freeze): Static image (Capture an image with the camera and display it on the monitor.)

"T" (through): Dynamic images (display the sequence of images coming from the camera on a real time basis. As the object moves, the display of the object will also move.)

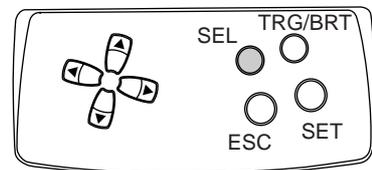


When the cursor is at "F" (or "T") and you press the left or right key, the cursor will move to the "BRT" (bright) (or "DRK" (dark)) position. Now press the up or down key to change the screen between bright and dark.

"BRT": Bright screen  
"DRK": Dark screen

| SET WIZARD        | SCREEN | SAVE | DEL | F      | C1 | BRT |
|-------------------|--------|------|-----|--------|----|-----|
| [SAMPLE]          |        |      |     |        |    |     |
| ① CHG-TYPE        |        |      |     |        |    |     |
| ② STANDARD WIZARD |        |      |     |        |    |     |
| ③ OPERATION CHART |        |      |     |        |    |     |
|                   |        |      |     | TYPE00 |    |     |
|                   |        |      |     | Start  |    |     |
|                   |        |      |     | End    |    |     |

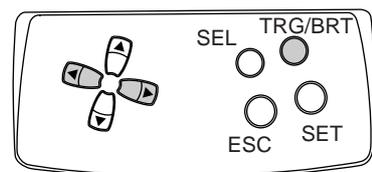
Press the SEL key again and the cursor will jump back to "② STANDARD WIZARD."



### 3. TRG/BRT key

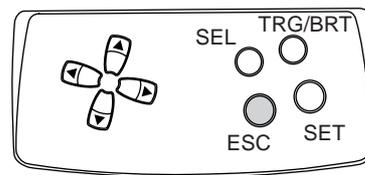
Move the cursor to the "② STANDARD WIZARD" line using the up and down arrow keys. Then press the TRG/BRT key. The cursor will jump to "SCREEN" in the upper menu area. Press the left and right arrow keys to move the cursor between the "SAVE" and "DEL (delete)" items.

Press the TRG/BRT key again to bring the cursor back to the "② STANDARD WIZARD" item.



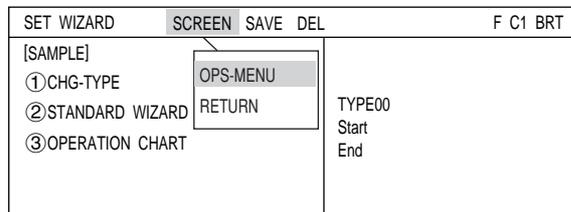
4. ESC key

Press the ESC key to return to the previous screen.



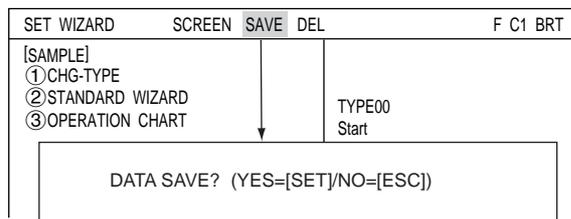
- SCREEN

Move the cursor to "SCREEN" and press the SET key. A pop up menu will appear. Select the desired item using the up and down arrow keys and press the SET key.  
 "OPS-MENU": Return to the operation screen.  
 "RETURN": Return to the MAIN MENU.



- SAVE

Move the cursor to the "SAVE" and press the SET key. The Save Settings screen will appear. Press the SET key and select "YES," the current setting data will be stored in flash memory. If you press the ESC key and select "NO," the controller will close the screen without saving the current setting data.

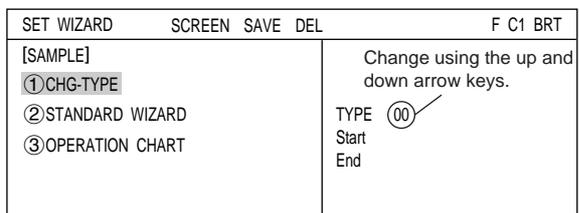


- DEL

Deletes the sample selected.

- ①CHG-TYPE

Move the cursor to "①CHG-TYPE" and press the up or down arrow key. The object number shown on the right side of the monitor will change. Use the number to determine the object type number to set using the standard wizard. (Or, use the number to select an object number operation chart to display. See page 6-8).



For details about the setting measurement conditions using the Set Wizard, see Chapter 7 "Setting Examples Using the Setting Wizard."

## 6-4 Operation chart

As each setting is made using the wizard, the operation chart keeps track of the settings and displays them as an operation chart. You can see all settings you have made so far, or jump back to a specific step on the operation chart.

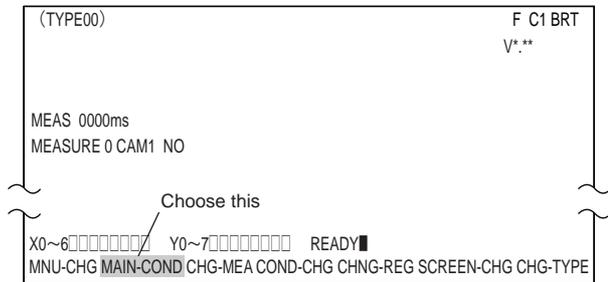
This section describes how to use the operation chart. The operation chart shows the measurement decisions that were made and saved as a chart. You can easily see the major flow of the measurement process and you can determine the execution timing for processes other than image processing (such as numeric and ladder processing). Also, you can change the settings for each step.

TYPE00

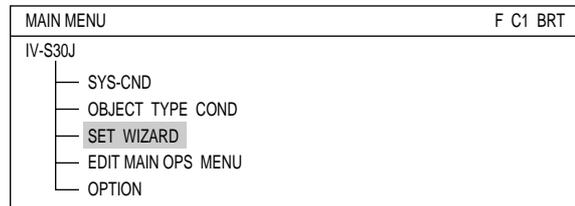
- Start
- STEP1 : PARALLEL+SERIAL
- STEP2 : CAPTURE IMG/PARTIAL-IMG
- STEP3 : MEAS1/CAM1
- STEP4 : MEAS1/BIN-AREA
- STEP5 : MEAS1/WINDOW/MASK,1
- STEP6 : MEAS1/MEAS CND
- STEP7 : MEAS1/EVALUATION
- STEP8 : MEAS1/CALC
- STEP9 : MEAS1/OUT
- STEP10 : FINAL NUMERIC CALC
- STEP11 : FINAL OUTPUT COND
- STEP12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

### [1] Method for displaying the operation chart

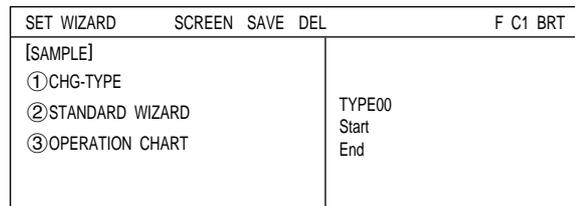
1. Move the cursor to "MAIN-COND" at the bottom of the Operation screen and press the SET key.



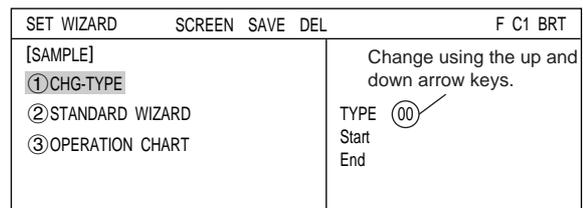
2. The "MAIN MENU" will appear. Move the cursor to "SET WIZARD" using the up and down arrow keys, and press the SET key.



3. The "SET WIZARD" screen will appear.



4. Change the object type number on the operation chart to the desired object type number. Select "①CHG-TYPE" and press the SET key. Then press the up and down arrow keys to change the object type number. After selecting a number, press the ESC key.



- Move the cursor to "③OPERATION CHART" using the up and down arrow keys and press the SET key. The operation chart for the selected object type will be displayed on the right side of the screen.

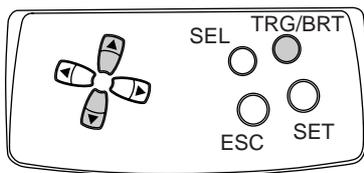
Reference: To use a sample operation chart, move the cursor to the sample number desired and press the SET key. (Ex.: ④)

Note: If no measurement conditions are set, the screen will not display any operation chart when you select "③OPERATION CHART."

| SET WIZARD       | EXIT | F C1 BRT                        |
|------------------|------|---------------------------------|
| [SAMPLE]         |      |                                 |
| ①CHG-TYPE        |      | TYPE00                          |
| ②STANDARD WIZARD |      |                                 |
| ③OPERATION CHART |      | Start                           |
| ④AREA ] Sample   |      | STEP1 : PARALLEL+SERIAL+USB     |
|                  |      | 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                             |

## [2] How to edit an operation chart

- While looking at an open operation chart, select the item you want to edit using the up and down arrow keys. Press the TRG/BRT key, and move the cursor to "EDIT" in the upper function menu. Then, press the SET key.



| SET WIZARD       | SCREEN EDIT SAVE | F C1 BRT                        |
|------------------|------------------|---------------------------------|
| [SAMPLE]         |                  |                                 |
| ①CHG-TYPE        |                  | TYPE00                          |
| ②STANDARD WIZARD |                  |                                 |
| ③OPERATION CHART |                  | Start                           |
|                  |                  | STEP1 : PARALLEL+SERIAL+USB     |
|                  |                  | 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                             |

- A pop up menu will appear and you can chose "CHANGE," "ADD," or "DELETE" from it. Or, while the cursor is in the "③OPERATION CHART," move the cursor to any desired step number and press the SET key. You can then edit that step. (You cannot delete a step using this access method.)

| SET WIZARD       | SCREEN EDIT SAVE | F C1 BRT                        |
|------------------|------------------|---------------------------------|
| [SAMPLE]         |                  |                                 |
| ①CHG-TYPE        |                  | TYPE00                          |
| ②STANDARD WIZARD |                  |                                 |
| ③OPERATION CHART |                  | Start                           |
|                  |                  | STEP1 : PARALLEL+SERIAL+USB     |
|                  |                  | 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                             |

- To quit editing, press the TRG/BRT key and move the cursor to "EXIT" in the upper function menu. Then, press the SET key. (Or, press the ESC key twice.)

| SET WIZARD   | EXIT | F C1 BRT                        |
|--|------|---------------------------------|
| [SAMPLE]   |      |                                 |
| STEP4  |      | TYPE00                          |
| SELECT AN IMAGE PROCESSING METHOD                    |      | Start                           |
| ① GRAY-SRC PROCESS <input type="checkbox"/>          |      | STEP1 : PARALLEL+SERIAL+USB     |
| ② BINARY PROCESS <input checked="" type="checkbox"/> |      | STEP2 : CAPTURE IMG/PARTIAL-IMG |
| -----  |      | STEP3 : MEAS1/CAM1              |
| ① MEASURE AREA <input checked="" type="checkbox"/>   |      | STEP4 : MEAS1/BIN-AREA          |
| ② COUNT QUANTITY <input type="checkbox"/>            |      | STEP5 : MEAS1/WINDOW/MASK,1     |
| ③ CHARACTER(LABELING) <input type="checkbox"/>       |      | STEP6 : MEAS1/MEAS CND          |
| ④ MEASURE POINT EXIST <input type="checkbox"/>       |      | 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              |
| RETURN NEXT  |      | End                             |

- The screen will ask "SAVE OK?." Move the cursor to "OPERATION CHART" or "NEW SAMPLE" using the up and down arrow keys, and press the SET key.

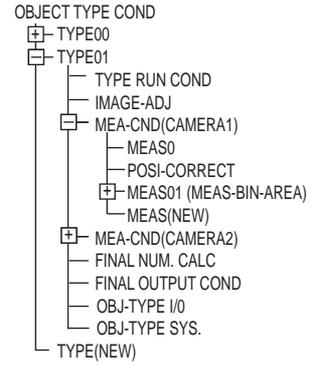
- The changes will be written into the current operation chart.
- Save as new sample (The original operation chart will not be changed.)

Note: To change the sample, you can select "NOW SAMPLE" or "NEW SAMPLE."

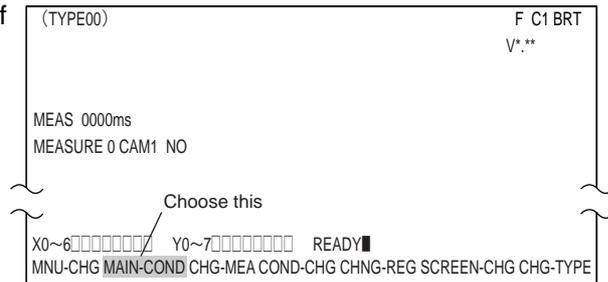
| SET WIZARD  | EXIT |
|---|------|
| [SAMPLE]  |      |
| SAVE OK?  |      |
| <input checked="" type="checkbox"/> OPERATION CHART |      |
| <input type="checkbox"/> NEW SAMPLE                 |      |
| YES=SET, NO=ESC                                     |      |

## 6-5 Menu tree

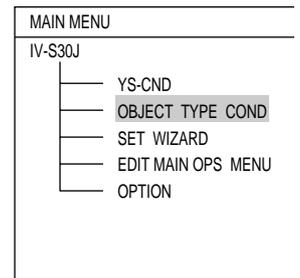
This section describes each of the settings using the menu tree.



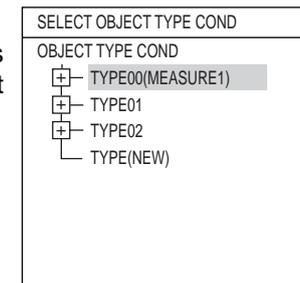
1. Move the cursor to "MAIN-COND" at the bottom of the Operation screen and press the SET key.



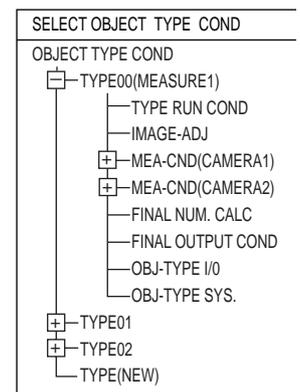
2. The "MAIN MENU" will appear. Move the cursor to "OBJECT TYPE COND" using the up and down arrow keys, and press the SET key.



3. A menu tree is displayed for each setting or registered object type. To create a new object type, move the cursor to "TYPE(NEW)" and press the SET key. The lowest, not yet assigned number will be selected. (Default value is TYPE00.)



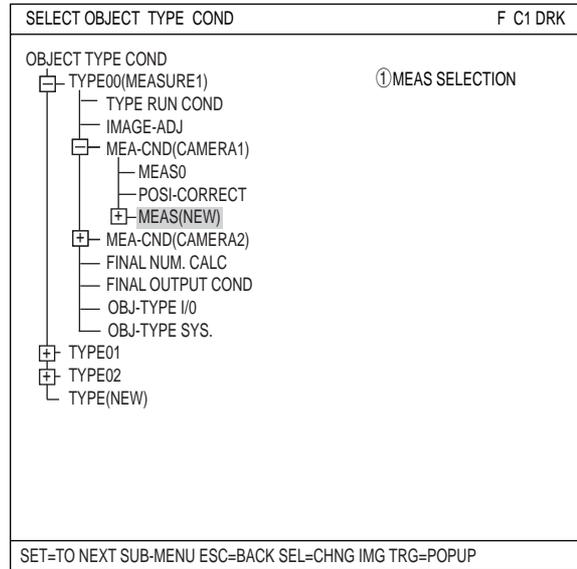
4. Move the cursor to the object type number you want to change using the up and down keys. Press the right arrow key and the sub menu will be displayed. A plus sign "+" means that there are other sub-menus below the marked menu. A minus sign "-" means that the sub menus are already displayed. By pressing the left arrow key on the "-" sign, the sub menu display will be closed.



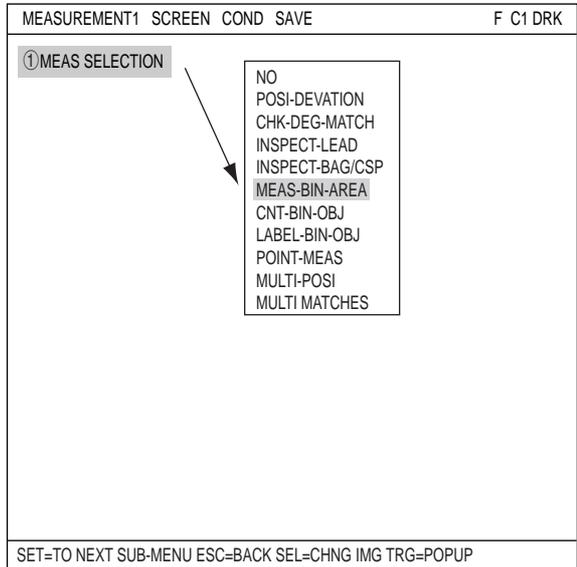
## Setting and Operating Outlines

- Move the cursor to the item on the menu that you want to set using the up and down arrow keys. Press the SET key to begin setting this item.

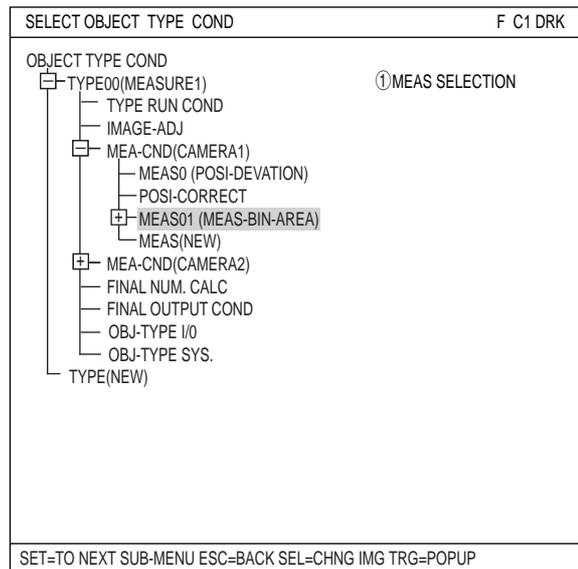
Ex.: To select binary area measurement using camera 1, move the cursor to "MEA-CND (CAMERA1)" and press the SET key. Next, select "MEAS(NEW)" in the sub menu and then press the SET key.



- Press the SET key on "① MEAS SELECTION" on the measurement setting screen and then select "MEAS-BIN-AREA" on the pop up menu. Finally, press the SET key.



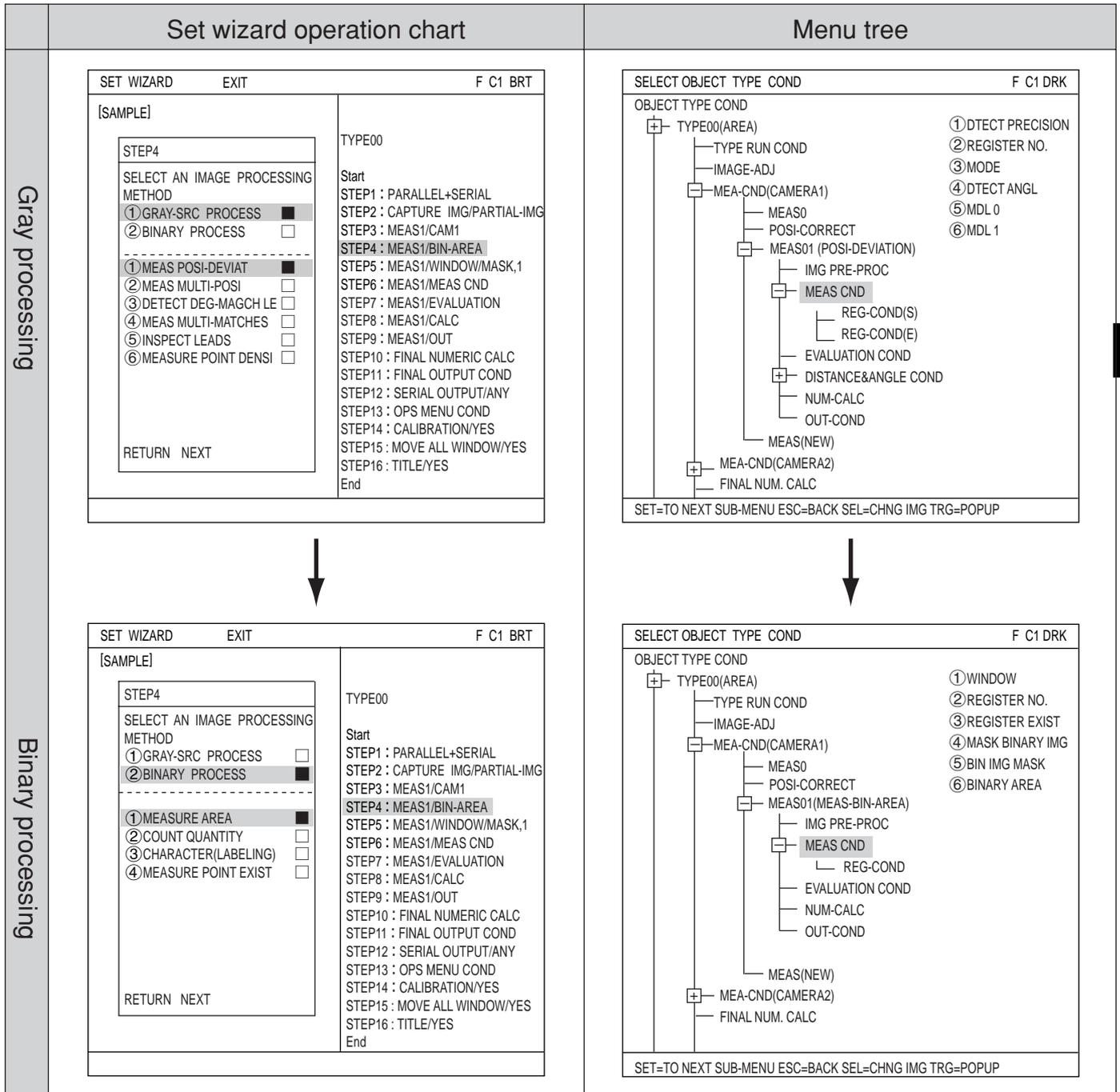
- After making your selection, press the ESC key to return the cursor to the menu tree. Item "MEAS01 (MEAS-BIN-AREA)" will be given a "⊕" sign on the menu tree.
- Move the cursor to "MEAS01 (MEAS-BIN-AREA)" and press the right arrow key. Now the sub menu will appear and you can set each item used for binary area measurement.



## 6-6 Relationship between the set wizard program, the operation chart, and the menu tree

If you change the operation chart using the set wizard, the menu tree will also change. If you change a setting on the menu tree, the operation chart in the set wizard will also be changed.

Ex.: When you want to change the image-processing method from gray search to binary processing.

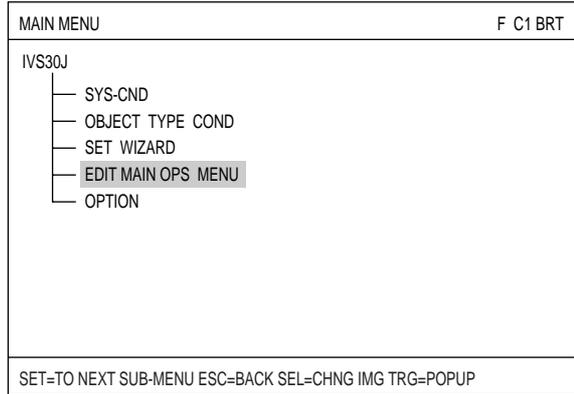


If you change the gray search to area measurement by binary processing using the set wizard program, the corresponding item on the menu tree will also change.

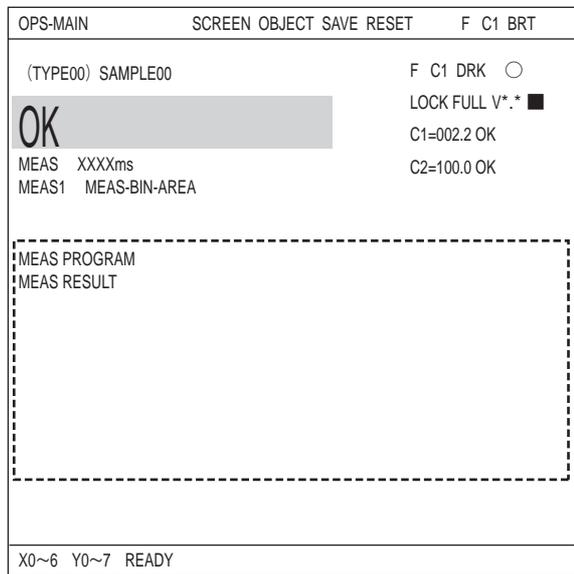
## 6-7 Editing operation screen

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

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



- (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**

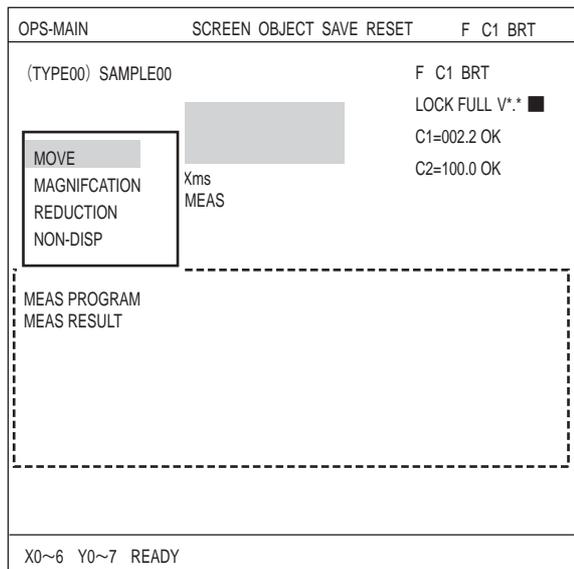
Select "MOVE" using the SET key. Now the highlighted block of text can be moved using the up, down, left, and right arrow keys. When the text is in the desired new position, press the SET key again.

**- MAGNIFICATION/REDUCTION**

Move the cursor to the "ENLARGE, REDUCE" line and press the SET key. The highlighted block of text can be enlarged or reduced.

**- NON-DISP**

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



## 6-8 Option

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

### Setting method

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

|                      |          |
|----------------------|----------|
| MAIN MENU            | F C1 BRT |
| IVS30J               |          |
| — SYS-CND            |          |
| — OBJECT TYPE COND   |          |
| — SET WIZARD         |          |
| — EDIT MAIN OPS MENU |          |
| — <b>OPTION</b>      |          |

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 "ALL-INT" or "INT-RAM" and the following message will appear.

#### MEM. 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 MENU."

### 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." Press ESC key to return to the "MAIN MENU."

|   |             |          |
|---|-------------|----------|
| OPTION                                  | SCREEN SAVE | F C1 BRT |
| ①INITIALIZATION                         | ALL-INIT    | INIT-RAM |
| ②SELF DIAGNOSIS                         | EXEC        |          |
|   | DIAGNOSING  |          |
| VRAM                                    | OK          |          |
| SDRAM                                   | OK          |          |
| TYPE COND                               | OK          |          |
| REFERENCE IMG                           | OK          |          |
| BOOT-PROG                               | OK          |          |
| SYSTEM-PROG                             | OK          |          |
| SET=EXEC ESC=BACK SEL=CHNG IMG TRG=FUNC |             |          |

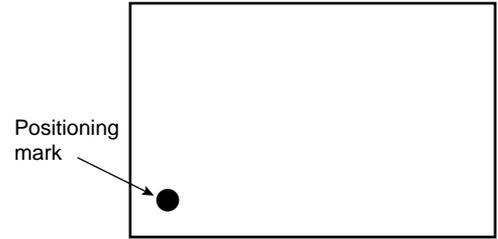
# Chapter 7: Setting Examples Using the Setting Wizard

## 7-1 Position deviation measurement

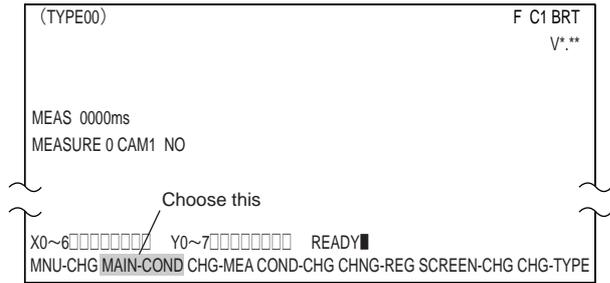
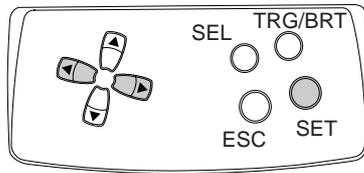
This paragraph describes an example of how to set the measurement positional deviation amount for the positioning mark shown on the right.

Use the remote keypad for this operation.

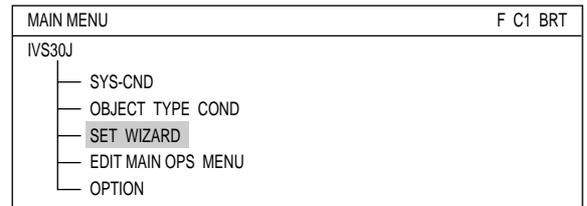
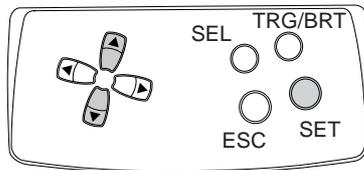
⇒ See page 6-6 for detail of the operation of each key on the remote keypad.



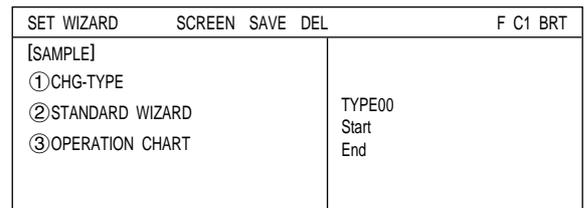
- (1) Move the cursor to "MAIN COND" using the left and right arrow keys and press the SET key.



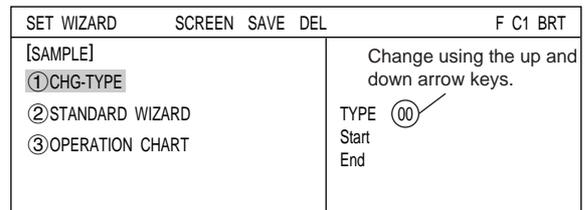
- (2) The "MAIN MENU" will appear. Move the cursor to the "SET WIZARD" item using the up and down arrow keys, and press the SET key.



- (3) The "SET WIZARD" screen will appear.



- (4) Enter an object type number. Move the cursor to "①CHG-TYPE," using the up and down arrow keys, and press the SET key. "①CHG-TYPE" will be highlighted. Next, press the up and down arrow keys and the "TYPE00" display on the right will change. Each time you press the up key, the type number will increase by one, from 00 to 15 and then back to 00. Each time you press the down key, the type number will decrease by one, first from 00 to 15 and then from 15 down to 00. Holding down either of these keys advances the number rapidly. Finally, press the ESC key to confirm the selected number.



## Setting Examples Using the Setting Wizard

(5) Move the cursor to "②STANDARD WIZARD" and press the SET key. The set wizard will start.

= In this example, the settings on the screens from the STEP1 to STEP 3 (CORRECT POSITION) are not changed. Select "NEXT" on each of these screens to go to the next screen. =

### How to go to next step while leaving the current step in the Set Wizard unchanged.

(1) Press the up or down arrow key several times to move the cursor to the "NEXT" item.

(2) Press the SET key.

|   |                                     |
|---|-------------------------------------|
| STEP1                                     |                                     |
| SELECT THE MEASUREMENT<br>START INPUT I/F |                                     |
| ① PARALLEL+SERIAL                         | <input checked="" type="checkbox"/> |
| ② TRIG CCD START                          | <input type="checkbox"/>            |
| NEXT    DETAIL                            |                                     |

|   |                                     |
|---|-------------------------------------|
| STEP1                                     |                                     |
| SELECT THE MEASUREMENT<br>START INPUT I/F |                                     |
| ① PARALLEL+SERIAL                         | <input checked="" type="checkbox"/> |
| ② TRIG CCD START                          | <input type="checkbox"/>            |
| NEXT    DETAIL                            |                                     |

This screen is used to select the signal that the system will use to start making a measurement.  
The default is "①PARARELL+SERIAL."  
⇒ For details, see page 16-5 in Function and Operation.  
CCD trigger  
⇒ For details, see page G-2.

|  |                                     |
|--|-------------------------------------|
| STEP2  |                                     |
| SELECT AN IMAGE CAPTURING<br>METHOD DURING OPERATION |                                     |
| ① PARTIAL-IMG  | <input checked="" type="checkbox"/> |
| ② ALL IMAGE  | <input type="checkbox"/>            |
| ③ NO CAPTURED  | <input type="checkbox"/>            |
| -----  |                                     |
| ENTER A SHUTTER SPEED<br>(1/30~1/10000)              |                                     |
| ① SHUTTER SPEED                                      | 1/00060                             |
| RETURN    NEXT                                       |                                     |

Select a method to capture image.  
The default is "①PARTIAL-IMG."

|                   |                                     |
|-------------------|-------------------------------------|
| STEP3             |                                     |
| CORRECT POSITION? |                                     |
| ① NO              | <input checked="" type="checkbox"/> |
| ② CAM1            | <input type="checkbox"/>            |
| ③ CAM2            | <input type="checkbox"/>            |
| RETURN    NEXT    |                                     |

Specify whether or not to correct the captured image.  
⇒ For details, see page 3-30 in Function and Operation.

(6) Select a camera in order to specify measurement conditions

Move the cursor to "②CAM1" or "③CAM2" using the up and down arrow keys, and press the SET key.

Note:If you select "NO REGISTRATION", you cannot set the measurement conditions.

Press "NEXT" and go to the next screen.

|  |                                     |                                 |          |
|--|-------------------------------------|---------------------------------|----------|
| SET WIZARD   |                                     | EXIT                            | F C1 BRT |
| STEP3  |                                     | TYPE00                          |          |
| SELECT A CAMERA TO SPECIFY<br>MEASUREMENT CONDITIONS |                                     | Start                           |          |
| ① NO REGISTRATION                                    | <input type="checkbox"/>            | STEP1 : PARALLEL+SERIAL         |          |
| ② CAM1   | <input checked="" type="checkbox"/> | STEP2 : CAPTURE IMG/PARTIAL-IMG |          |
| ③ CAM2   | <input type="checkbox"/>            | STEP3 : MEAS1/CAM1              |          |
| RETURN    NEXT                                       |                                     | End                             |          |

(7) Select an image-processing method  
 Move the cursor to "①GRAY-SRC PROCESS" and press the SET key.

Next move the cursor to "①MEAS POSI-DEVIAT" using the up and down arrow keys and press the SET key.  
 Press "NEXT" and go to the next screen.

| SET WIZARD                        | EXIT                                | F C1 BRT   |
|-----------------------------------|-------------------------------------|--|
| [SAMPLE]                          |                                     |  |
| STEP4                             |                                     |  |
| SELECT AN IMAGE PROCESSING METHOD |                                     |  |
| ① GRAY-SRC PROCESS                | <input checked="" type="checkbox"/> |  |
| ② BINARY PROCESS                  | <input type="checkbox"/>            |  |
| -----                             |                                     |  |
| ① MEAS POSI-DEVIAT                | <input checked="" type="checkbox"/> |  |
| ② MEAS MULTI-POSI                 | <input type="checkbox"/>            |  |
| ③ DETECT DEG-MAGCH LE             | <input type="checkbox"/>            |  |
| ④ MEAS MULTI-MATCHES              | <input type="checkbox"/>            |  |
| ⑤ INSPECT LEADS                   | <input type="checkbox"/>            |  |
| ⑥ MEASURE POINT DENS              | <input type="checkbox"/>            |  |
| RETURN NEXT                       |                                     |  |
|                                   |                                     | TYPE00<br>Start<br>STEP1 : PARALLEL+SERIAL<br>STEP2 : CAPTURE IMG/PARTIAL-IMG<br>STEP3 : MEAS1/CAM1<br>STEP4 : MEAS1/POS DEVIAT<br>End |

= In this example, the settings on the screens are not changed. Select "NEXT" on each of these screens to go to the next screen. =

| STEP4  |    |
|--|----|
| SELECT TYPE OF CALCULATION BETWEEN IMAGES      |    |
| ① COMPARE IMG                                  | NO |
| -----  |    |
| SELECT WHETHER OR NOT TO CONVERT IMAGE DENSITY |    |
| ① CHING GRAY LEVEL                             | NO |
| -----  |    |
| SELECT FILTER TYPE FOR IMAGE DATA              |    |
| ① SPACE FILTER                                 | NO |
| RETURN NEXT                                    |    |



Select whether or not to process the captured image.  
 Calculation between images ⇨ See page 3-19 in Function and Operation  
 Density conversion ⇨ See page 3-22 in Function and Operation  
 Space filter ⇨ See page 3-23 in Function and Operation

## Setting Examples Using the Setting Wizard

### (8) Select a registration number

Move the cursor to "①REGISTER NO. (0 ~ 7)" and press the SET key. While this item is highlighted, press the up and down arrow keys and press the SET key when the number you want appears.

Next, move the cursor to "②GRAY-SRC" on the "SELECT AN IMAGE PROCESSING" line and press the SET key.

Move the cursor to "①NUM. OF DTECT" and press the SET key. Select the "1P" on the popup menu and press the SET key.

Move the cursor to "①DTECT ANGLE" on the "ENTER A RANGE AND UNITS FOR ROTATION ANGLE DETECTION" line and select an angle ("NO," "±15°," "±30°," "±45°" or "360°") on the pop up menu. When an angle other than "NO" is selected, "10" is displayed for the "②UNIT."

| SET WEZARD                                    | EXIT | F C1 BRT                        |
|---|------|---------------------------------|
| [SAMPLE]                                      |      |                                 |
| STEP5   |      | TYPE00                          |
| ①REGISTER NO. (0~7) 0                         |      | Start                           |
| -----   |      | STEP1 : PARALLEL+SERIAL         |
| SELECT AN IMAGE PROCESSING                    |      | STEP2 : CAPTURE IMG/PARTIAL-IMG |
| ①NO <input type="checkbox"/>                  |      | STEP3 : MEAS1/POS CAM1          |
| ②GRAY-SRC <input checked="" type="checkbox"/> |      | STEP4 : MEAS1/POS DEVIAT        |
| ③EDGE DTECT <input type="checkbox"/>          |      | STEP5 : MEAS1/MEAS CND          |
| ④SCH+EDGE <input type="checkbox"/>            |      | -----                           |
| ①NUM. OF DTECT 1P                             |      | End                             |
| -----   |      | 1P                              |
| ENTER A RANGE AND UNITS FOR                   |      | 2P                              |
| ROTATION ANGLE DETECTION                      |      | NO                              |
| ①DTECT ANGLE NO                               |      | ±15°                            |
| -----   |      | ±30°                            |
| RETURN NEXT <b>DETAIL</b>                     |      | ±45°                            |
|   |      | 360°                            |

In this example, select "NO."

The "DETAIL" item will appear in the lower menu. Move the cursor to "DETAIL" and press the SET key.

Now "REG COND" screen will appear.

■ **Setting the registration conditions**

① **REGISTER NUMBER**

The previously specified register number is displayed. To change the register number, press the SET key. While the number is highlighted, press the up and down arrow keys to change it.

Next, adjust the image you want to measure.

1. Press the SEL key to move the cursor to the "F" position in the upper function menu. Press the up and down arrow keys to change the "F" to "T." Now the image from "CAM1" will be displayed as a through image on the monitor.

Note: When the image is difficult to see, change the image setting between "BRT" and "DRK." After changing from the "Freeze" to the "Through" image display, press the left key once and then press the up key once. The "Dark" image setting can be selected.

2. Adjust the focus and aperture of the camera lens to obtain a clear image of the object.
  - ⇒ See pages 4-2 and 4-3.

3. After the measurement object image is clearly visible, change the image mode back to "F" (Freeze) using the up and down arrow keys. By switching the image display mode from "T" to "F," the image will be captured by the IV-S30 controller.

Note: Whenever you want to register a reference image, the image display mode should be changed to "F."

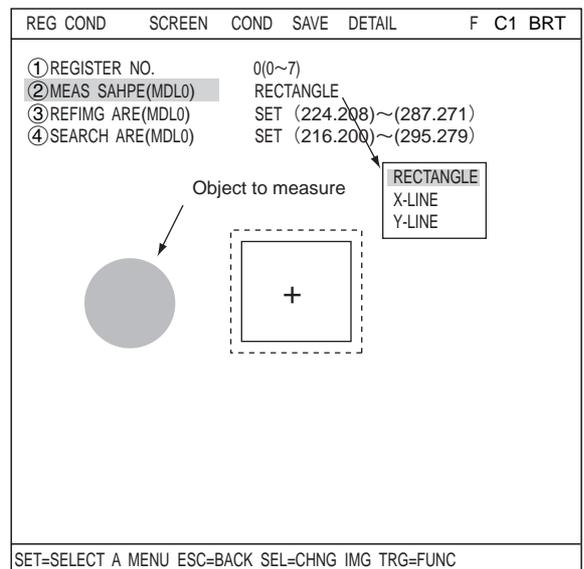
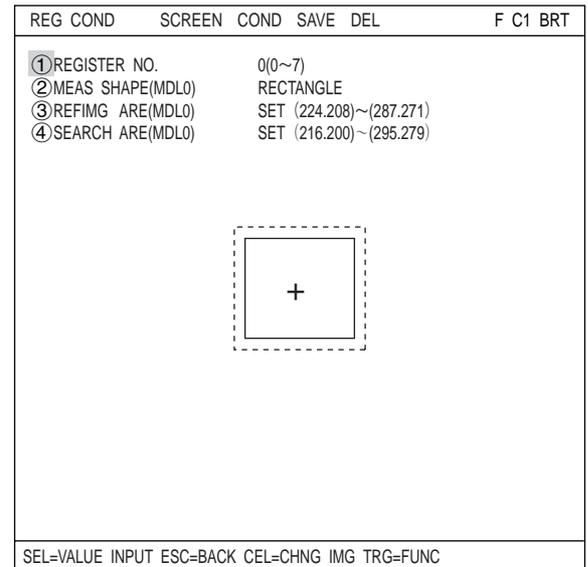
4. Press the SEL key and move the cursor from the upper function menu to the "REG COND" screen.

② **MEAS SHAPE (MDL0)**

Move the cursor to this line and press the SET key. A popup menu will appear.

Move the cursor to "RECTANGLE", "X- LINE" or "Y- LINE" and press the SET key. In this example, select "RECTANGLE."

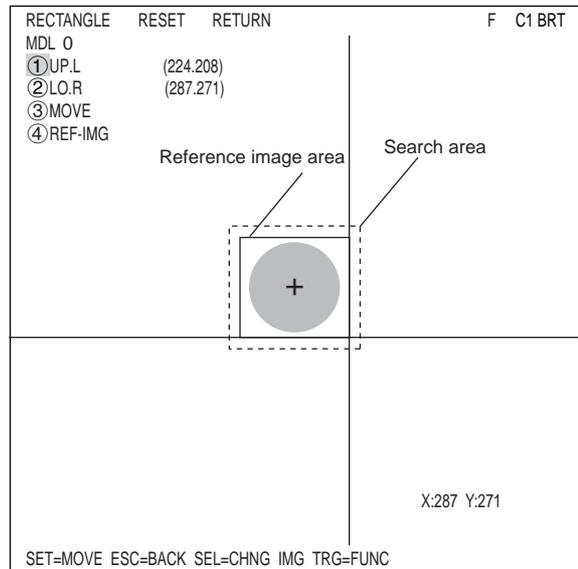
⇒ For details, see page 3-4 in Function and Operation.



### ③ REFIMG ARE (MDL0)

Move the cursor to this line and press the SET key. The "SET" line will be highlighted. Press the SET key again and the "RECTANGLE" setting screen will appear.

Adjust the size of the rectangle by setting "①UP.L" and "②LO.R" (upper left and lower right corners) in order to establish the reference image area.



|             |  |
|-------------|--|
| <b>UP.L</b> | The upper left corner of the rectangle can be moved up, down, left, and right.   |
| <b>LO.R</b> | The lower right corner of the rectangle can be moved up, down, left, and right.  |
| <b>MOVE</b> | The rectangle can be moved up, down, left, and right. Select "MOVE" using the up and down arrow keys. Press the SET key to display a cross hair cursor on the screen. Now, move the rectangle by pressing the up, down, left, and right arrow keys. When it is in position, press the SET key to confirm it. |

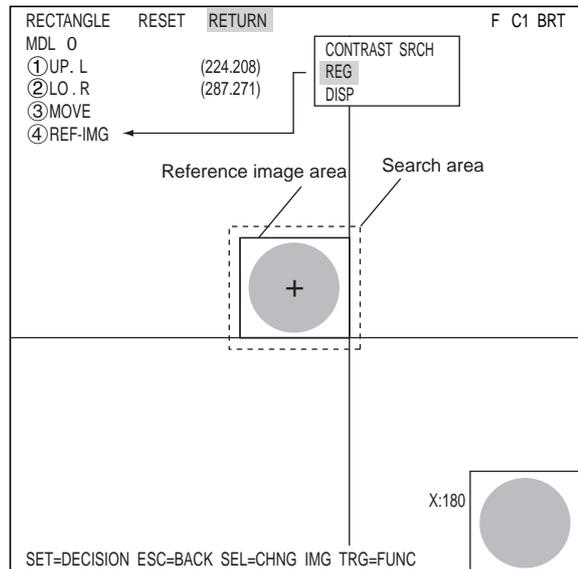
Move the cursor to "①UP.L" or "②LO.R." After the position of the rectangle is correct, press the SET key.

### Register a reference image

Move the cursor to "④REF-IMG" using the up and down arrow keys and press the SET key. Then, select "REG" from the popup menu. The reference image that you registered is shown in the lower right corner of the screen.

After the setting is complete, press the ESC key to return to the "REG COND" screen.

Note: If a reference image is not registered, you cannot make measurements.



### ④ SEARCH ARE (MDL0)

Move the cursor to this line and press the SET key. "SET" will be highlighted. Press the SET key again and the "RECTANGLE" screen will appear.

Use the same procedures as you used for "③REFIMG ARE(MDL0)" to adjust the size and position of the rectangle defining the search area.

After the setting is complete, press the ESC key and return to the "SET WIZARD" screen. Move the cursor to "NEXT" and press the SET key.

= In this example, the settings on the screens are not changed. Select "NEXT" on each of these screens to go to the next screen. =

|   |
|---|
| STEP6   |
| SELECT INSPECTION PRECISION                           |
| ① STANDARD(PIXEL) <input checked="" type="checkbox"/> |
| ② HIGH(SUB-PIXEL) <input type="checkbox"/>            |
| RETURN NEXT   |



Setting the detection precision.  
 ⇒ For details, see page 3-9 in Function and Operation.

- (9) Select whether or not to set the evaluation conditions for measured results.  
 Select "②YES" and press the SET key.

The "DETAIL" item will appear on the lower part of the screen. Move the cursor to "DETAIL" and press the SET key.

|   |        |                                 |
|---|--------|---------------------------------|
| SET WIZARD                                | EXIT   | F C1 BRT                        |
| [SAMPLE]                                  |        |                                 |
| STEP7                                     |        | TYPE00                          |
| COMPARE EVALUATION                        |        | Start                           |
| CONDITIONS TO MEASUREMENT                 |        | STEP1 : PARALLEL+SERIAL         |
| RESULTS (YES/NO)                          |        | STEP2 : CAPTURE IMG/PARTIAL-IMG |
| ① NO <input type="checkbox"/>             |        | STEP3 : MEAS1/CAM1              |
| ② YES <input checked="" type="checkbox"/> |        | STEP4 : MEAS1/POS DEVIAT        |
| RETURN                                    | NEXT   | STEP5 : MEAS1/MEAS CND          |
|   | DETAIL | STEP6 : MEAS1/DTECT PRECISION   |
|   |        | STEP7 : MEAS1/EVALUATION        |
|   |        | End                             |

7

The "EVALUAT COND" screen will appear. Select "①REGISTER NO." using the up and down arrow keys. Change the number to "0" using the up and down arrow keys. Then press the SET key.

|  |                    |                   |               |      |          |   |    |     |
|--|--------------------|-------------------|---------------|------|----------|---|----|-----|
| EVALUAT COND                                   | SCREEN             | COND              | SAVE          | EDIT | SEL      | F | C1 | BRT |
| ① REGISTER NO.                                 | 0(0~7)             |                   | [TEST RESULT] |      | [OUTPUT] |   |    |     |
| ② CONDITION SET                                | AUTO(-10%)         |                   |               |      |          |   |    |     |
| ③ X COORD. (MDL0)                              | 000.0~511.0        | X0=               |               |      | NO       |   |    |     |
| ④ Y COORD. (MDL0)                              | 000.0~479.0        | Y0=               |               |      | NO       |   |    |     |
| ⑤ x DEVIATE (MDL0)                             | -511.0~+511.0      | x0=               |               |      | NO       |   |    |     |
| ⑥ y DEVIATE (MDL0)                             | -479.0~+479.0      | y0=               |               |      | NO       |   |    |     |
| ⑦ MATCH LVL (MDL0)                             | -10000~+10000      | M0=               |               |      | NO       |   |    |     |
| ⑧ TEST   | EXEC(WITH-POSI.ADJ | WITHOUT-POSI.ADJ) |               |      |          |   |    |     |
| SEL=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC |                    |                   |               |      |          |   |    |     |

## Setting Examples Using the Setting Wizard

Select "⑦MATCH LVL (MDL0)" using the up and down arrow keys and set the upper and lower limit values.

Select a digit using the left and right arrow keys. Select a number using the up and down arrow keys. After the value is correct, press the SET key. Then press the left and right keys to move the cursor to "OUTPUT." Now press the SET key. A popup menu will appear and you can choose "NO," "Y," or "C."

Move the cursor to "Y" and press the SET key. Then select the Y0 and press the SET key. Now the evaluation results will be output to the Y0 terminal.

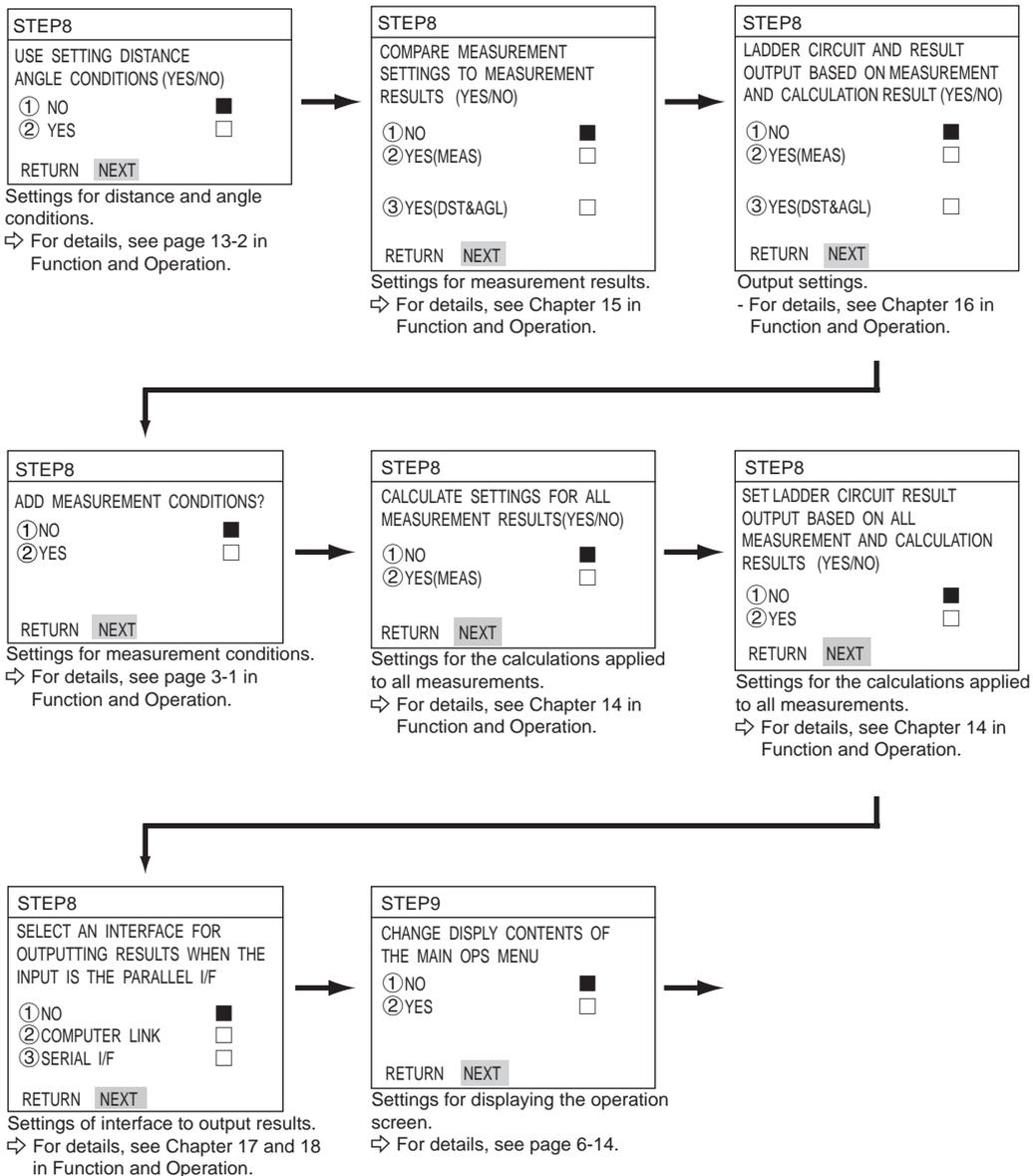
⇒ For details about the evaluation conditions, see page 3-18 in Function and Operation.

| EVALUAT | COND          | SCREEN               | COND          | SAVE     | EDIT | SEL | F | C1 | BRT          |
|---------|---------------|----------------------|---------------|----------|------|-----|---|----|--------------|
| ①       | REGISTER NO.  | 0(0-7)               | [TEST RESULT] | [OUTPUT] |      |     |   |    |              |
| ②       | CONDITION SET | AUTO(~10%)           |               |          |      |     |   |    |              |
| ③       | X COORD.      | (MDL0) 000.0~511.0   | X0=           |          |      |     |   |    | NO           |
| ④       | Y COORD.      | (MDL0) 000.0~479.0   | Y0=           |          |      |     |   |    | NO           |
| ⑤       | x DEVIATE     | (MDL0) -511.0~+511.0 | x0=           |          |      |     |   |    | NO           |
| ⑥       | y DEVIARTE    | -----                |               |          |      |     |   |    | NO           |
| ⑦       | MATCH LVL     | Y OUTPUT             | Use place     |          |      |     |   |    | NO<br>Y<br>C |
|         |               | -----                |               |          |      |     |   |    |              |
|         |               | Y0                   | NO            |          |      |     |   |    |              |
|         |               | Y1                   | NO            |          |      |     |   |    |              |
|         |               | Y2                   | NO            |          |      |     |   |    |              |
|         |               | Y3                   | NO            |          |      |     |   |    |              |
| ⑧       | TEST          | Y4                   | NO            |          |      |     |   |    |              |
|         |               | Y5                   | NO            |          |      |     |   |    |              |
|         |               | Y6                   | NO            |          |      |     |   |    |              |
|         |               | Y7                   | NO            |          |      |     |   |    |              |
|         |               | -----                |               |          |      |     |   |    |              |

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

After the settings are complete, press the ESC key to return to the "SET WIZARD" screen.

= In this example, the settings on the STEP8 to STEP9 (MAIN OPS MENU) are not changed. Select "NEXT" on each of these screens to go to the next screen. =



- (10) STORE A TITLE FOR THIS SETTING?  
 After making this series of settings, select "②YES" to save the settings as a group. By selecting "② YES," "DETAIL" will appear in the lower menu. Select "DETAIL" and press the SET key.

|                                 |                                     |                                 |
|---------------------------------|-------------------------------------|---------------------------------|
| SET WIZARD                      | EXIT                                | F C1 BRT                        |
| [SAMPLE]                        |                                     |                                 |
| STEP9                           |                                     | TYPE00                          |
| STORE A TITLE FOR THIS SETTING? |                                     | Start                           |
| ① NO                            | <input type="checkbox"/>            | STEP1 : PARALLEL+SERIAL         |
| ② YES                           | <input checked="" type="checkbox"/> | STEP2 : CAPTURE IMG/PARTIAL-IMG |
| RETURN NEXT <b>DETAIL</b>       |                                     | STEP3 : MEAS1/CAM1              |
|                                 |                                     | STEP4 : MEAS1/POS DEVIAT        |
|                                 |                                     | STEP5 : MEAS1/MEAS CND          |
|                                 |                                     | STEP6 : MEAS1/DTECT PRECISION   |
|                                 |                                     | STEP7 : MEAS1/EVALUATION        |
|                                 |                                     | STEP8 : TITLE/YES               |
|                                 |                                     | End                             |

The "STR OBJ TITLE" screen will appear. Enter a name using the up, down, left, and right arrow keys. Then, select "END" and press the SET key. The monitor will return to the "SET WIZARD" screen. Select "NEXT" and press the SET key to go to the next screen.

|                           |      |          |
|---------------------------|------|----------|
| STR OBJ TITLE SCREEN      | SAVE | F C1 BRT |
| AREA_                     |      |          |
| 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 |      |          |
| 0 1 2 3 4 5 6 7 8 9       |      |          |
| - - ( ) < > SP            |      |          |
| ← → DEL <b>END</b>        |      |          |

- (11) STORE THIS SETTING AS A SAMPLE IN THE WIZARD?  
 Select "①NO" or "②YES" and then "END." Finally, press the SET key.

If you selected "②YES" to store the settings, move the cursor to "END" and press the SET key. The wizard will shut down.

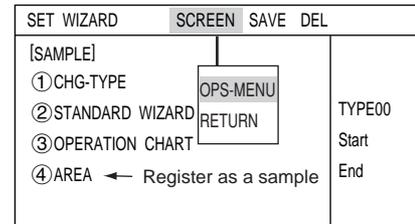
|   |                                     |                                 |
|---|-------------------------------------|---------------------------------|
| SET WIZARD                                    | EXIT                                | F C1 BRT                        |
| [SAMPLE]                                      |                                     |                                 |
| STEP9   |                                     | TYPE00                          |
| STORE THIS SETTING AS A SAMPLE IN THE WIZARD? |                                     | Start                           |
| ① NO  | <input type="checkbox"/>            | STEP1 : PARALLEL+SERIAL         |
| ② YES   | <input checked="" type="checkbox"/> | STEP2 : CAPTURE IMG/PARTIAL-IMG |
| RETURN <b>END</b>                             |                                     | STEP3 : MEAS1/CAM1              |
|   |                                     | STEP4 : MEAS1/POS DEVIAT        |
|   |                                     | STEP5 : MEAS1/MEAS CND          |
|   |                                     | STEP6 : MEAS1/DTECT PRECISION   |
|   |                                     | STEP7 : MEAS1/EVALUATION        |
|   |                                     | STEP8 : TITLE/YES               |
|   |                                     | End                             |

## Setting Examples Using the Setting Wizard

(12) The sample is registered with the title you assigned to on the "SET WIZARD" screen.

Note 1: If no title was assigned, the sample settings are simply listed as "Sample \*"

Note 2: A maximum of eight sample settings can be assigned.

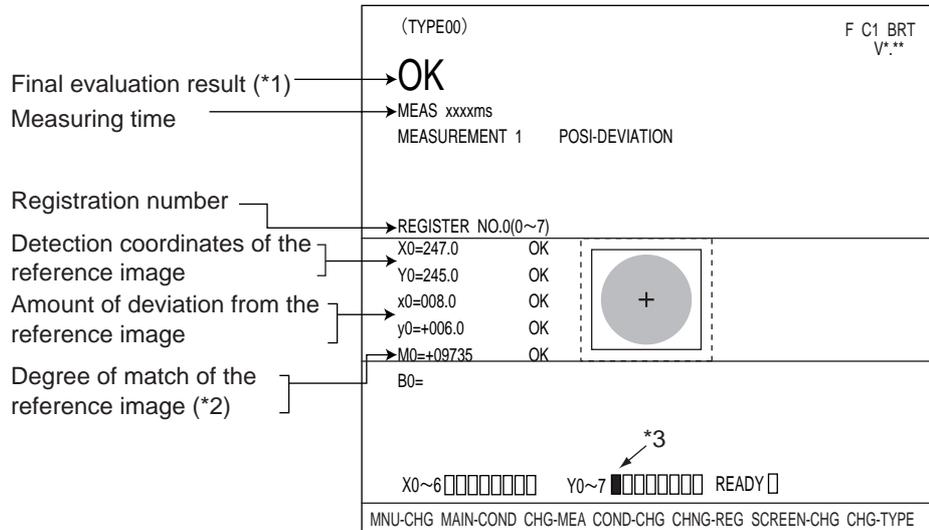


(13) The monitor will return to display the operation screen.

To return to the operation screen, press the ESC key twice, or move the cursor to "SCREEN" in the upper menu area and select "OPS-MENU" from the popup menu.

(14) Execute a measurement.

While the operation screen is displayed, press the TRG/BRT key. The measurement results will be displayed on the screen.



\*1 The final evaluation result will be displayed as "OK" in the upper left corner of the screen when all of the items have been evaluated acceptable.

If there is a single unacceptable item, "NG" will be displayed.

\*2 "M0 +09735" means that the degree of match (percentage of pixels that match) between pixels in the stored image and the measured image is 97.35%.

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

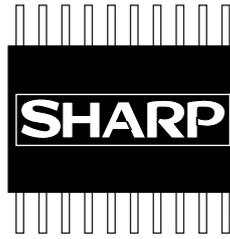
In order to evaluate acceptability based on the degree of match, first an image of a good specimen is stored for reference. Then, an image of defective specimen is compared for degree of match. Finally an image of another good specimen is compared. These comparisons establish the degree of match to be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

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

\*3 When the final evaluation result is OK, Y0 is turned ON, and a filled box ■ is displayed. (When the result is NG, an empty box □ is displayed.)

## 7-2 Area measurement by binary conversion

This section describes the setting procedures for the binary area measurement of the object below. The area will be measured by counting the number of pixels after binarization.



Object to be measured  
(Measure the white area  
in the "SHARP" logo.)

This section describes only the minimum required settings.  
Use the remote keypad for the operation.

⇒ See page 6-6 for detail of the operation of each key on the remote keypad.

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

(2) The "MAIN MENU" will appear.  
Move the cursor to the "SET WIZARD" item 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) The "SET WIZARD" screen will appear.

|                  |                 |          |
|------------------|-----------------|----------|
| SET WIZARD       | SCREEN SAVE DEL | F C1 BRT |
| [SAMPLE]         |                 |          |
| ①CHG-TYPE        |                 |          |
| ②STANDARD WIZARD | TYPE00          |          |
| ③OPERATION CHART | Start           |          |
|                  | End             |          |

(4) Enter an object type number.

Move the cursor to "①CHG-TYPE," using the up and down arrow keys, and press the SET key. "①CHG-TYPE" will be highlighted. Next, press the up and down arrow keys and the "TYPE00" display on the right will change. Each time you press the up key, the type number will increase by one, from 00 to 15 and then back to 00. Each time you press the down key, the type number will decrease by one, first from 00 to 15 and then from 15 down to 00. Holding down either of these keys advances the number rapidly. Finally, press the ESC key to confirm the selected number.

|                  |   |          |
|------------------|---|----------|
| SET WIZARD       | SCREEN SAVE DEL                           | F C1 BRT |
| [SAMPLE]         |   |          |
| ①CHG-TYPE        | Change by pressing up and down arrow keys |          |
| ②STANDARD WIZARD | TYPE 01                                   |          |
| ③OPERATION CHART | Start                                     |          |
|                  | End                                       |          |

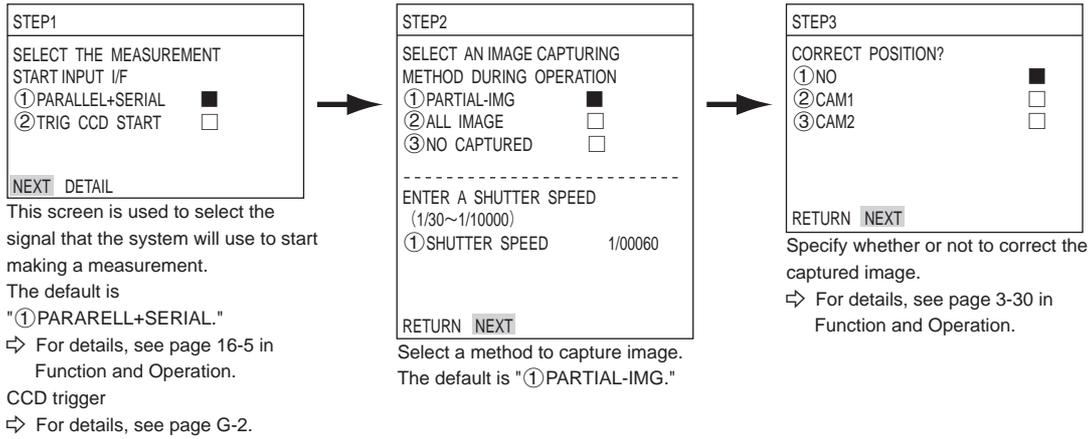
(5) Move the cursor to "②STANDARD WIZARD" and press the SET key. The set wizard will start.

|                        |                                     |          |
|------------------------|-------------------------------------|----------|
| SET WIZARD             | SCREEN SAVE DEL                     | F C1 BRT |
| [SAMPLE]               |                                     |          |
| STEP1                  |                                     |          |
| SELECT THE MEASUREMENT |                                     |          |
| START INPUT I/F        |                                     |          |
| ①PARALLEL+SERIAL       | <input checked="" type="checkbox"/> |          |
| ②TRIG CCD START        | <input type="checkbox"/>            |          |
| NEXT                   | DETAIL                              |          |
|                        | TYPE 00                             |          |
|                        | Start                               |          |
|                        | STEP1: PARALLEL+SERIAL+USB          |          |
|                        | End                                 |          |

Move to the next setting screen

## Setting Examples Using the Setting Wizard

= In this example, the settings on the screens from the STEP1 to STEP 3 (CORRECT POSITION) are not changed. Select "NEXT" on each of these screens to go to the next screen. =



(6) Select a camera in order to specify measurement conditions.

Move the cursor to "②CAM1" or "③CAM2" using the up and down arrow keys, and press the SET key.

Note: If you select "NO REGISTRATION" you cannot set the measurement conditions.

Press "NEXT" and go to the next screen.

| SET WIZARD  | EXIT                                | F C1 BRT   |
|---|-------------------------------------|--|
| STEP3   |                                     |  |
| SELECT A CAMERA TO SPECIFY MEASUREMENT CONDITIONS |                                     |  |
| ① NO REGISTRATION                                 | <input type="checkbox"/>            |  |
| ② CAM1  | <input checked="" type="checkbox"/> |  |
| ③ CAM2  | <input type="checkbox"/>            |  |
| RETURN <b>NEXT</b>                                |                                     |  |
|   |                                     | TYPE00<br>Start<br>STEP1 : PARALLEL+SERIAL<br>STEP2 : CAPTURE IMG/PARTIAL-IMG<br>STEP3 : MEAS1/CAM1<br>End |

(7) Select an image-processing method  
 Move the cursor to "②BINARY PROCESS" and press the SET key.

Next move the cursor to "①MEASURE AREA" using the up and down arrow keys and press the SET key.

Press "NEXT" and go to the next screen.

| SET WIZARD                        | EXIT                                | F C1 BRT   |
|-----------------------------------|-------------------------------------|--|
| [SAMPLE]                          |                                     |  |
| STEP4                             |                                     |  |
| SELECT AN IMAGE PROCESSING METHOD |                                     |  |
| ① GRAY-SRC PROCESS                | <input type="checkbox"/>            |  |
| ② BINARY PROCESS                  | <input checked="" type="checkbox"/> |  |
| -----                             |                                     |  |
| ① MEASURE AREA                    | <input checked="" type="checkbox"/> |  |
| ② COUNT QUANTITY                  | <input type="checkbox"/>            |  |
| ③ CHARACTER(LABELING)             | <input type="checkbox"/>            |  |
| ④ MEASURE POINT EXIST             | <input type="checkbox"/>            |  |
| RETURN <b>NEXT</b>                |                                     |  |
|                                   |                                     | TYPE00<br>Start<br>STEP1 : PARALLEL+SERIAL<br>STEP2 : CAPTURE IMG/PARTIAL-IMG<br>STEP3 : MEAS1/CAM1<br>STEP4 : MEAS1/BIN-AREA<br>End |

= In this example, the settings on the screens are not changed. Select "NEXT" on each of these screens to go to the next screen. =

|  |    |
|--|----|
| STEP5  |    |
| SELECT TYPE OF CALCULATION BETWEEN IMAGES      |    |
| ① COMPARE IMG                                  | NO |
| -----  |    |
| SELECT WHETHER OR NOT TO CONVERT IMAGE DENSITY |    |
| ① CHNG CRAY LEVEL                              | NO |
| -----  |    |
| SELECT FILTER TYPE FOR IMAGE DATA              |    |
| ① SPACE FILTER                                 | NO |
| RETURN NEXT                                    |    |

Detailed settings of the compare images.  
 ⇨ See page 3-20 in Function and Operation



|                    |                                     |
|--------------------|-------------------------------------|
| STEP5              |                                     |
| SELECT WINDOW TYPE |                                     |
| ① NUM-OF-MASK 1    | <input checked="" type="checkbox"/> |
| ② NUM-OF-MASK 2    | <input type="checkbox"/>            |
| ③ NUM-OF-MASK 4    | <input type="checkbox"/>            |
| ④ BINARY-IMG-MASK  | <input type="checkbox"/>            |
| ⑤ POLYGON          | <input type="checkbox"/>            |
| RETURN NEXT        |                                     |

Select measuring window type.  
 ⇨ See page 7-3 in Function and Operation



- (8) Select a registration number  
 Move the cursor to "① REGISTER NO. (0 ~ 15)" and press the SET key. While this item is highlighted, press the up and down arrow keys and press the SET key twice when the number you want appears.

|                             |                                     |   |
|-----------------------------|-------------------------------------|---|
| SET WIZARD                  | EXIT                                | F C1 BRT  |
| [SAMPLE]                    |                                     |   |
| STEP6                       |                                     | TYPE00<br>Start<br>STEP1 : PARALLEL+SERIAL<br>STEP2 : CAPTURE IMG/PARTIAL-IMG<br>STEP3 : MEAS1/CAM1<br>STEP4 : MEAS1/BIN-AREA<br>STEP5 : MEAS1/WINDOW/MASK,1<br>STEP6 : MEAS1/MEAS CND<br>End |
| ① REGISTER NO. (0-15) 00    |                                     |   |
| -----                       |                                     |   |
| SELECT REGISTRATION(YES/NO) |                                     |   |
| ① NO                        | <input checked="" type="checkbox"/> |   |
| ② YES                       | <input type="checkbox"/>            |   |
| RETURN NEXT                 |                                     |   |

7

Next, move the cursor to "② YES" on the "SELECT REGISTRATION (YES/NO)" line and press the SET key.

The "DETAIL" item will appear in the lower menu. Move the cursor to "DETAIL" and press the SET key.

Now the "REG COND" menu will appear.

|                             |                                     |   |
|-----------------------------|-------------------------------------|---|
| SET WIZARD                  | EXIT                                | F C1 BRT  |
| [SAMPLE]                    |                                     |   |
| STEP6                       |                                     | TYPE00<br>Start<br>STEP1 : PARALLEL+SERIAL<br>STEP2 : CAPTURE IMG/PARTIAL-IMG<br>STEP3 : MEAS1/CAM1<br>STEP4 : MEAS1/BIN-AREA<br>STEP5 : MEAS1/WINDOW/MASK,1<br>STEP6 : MEAS1/MEAS CND<br>End |
| ① REGISTER NO. (0-15) 00    |                                     |   |
| -----                       |                                     |   |
| SELECT REGISTRATION(YES/NO) |                                     |   |
| ① NO                        | <input type="checkbox"/>            |   |
| ② YES                       | <input checked="" type="checkbox"/> |   |
| RETURN NEXT <b>DETAIL</b>   |                                     |   |

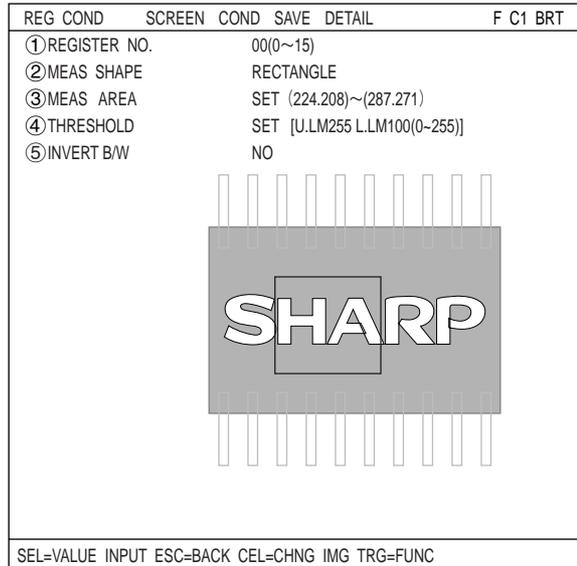
■ Setting the registration conditions

• Adjust the image

On the "REG COND" menu, adjust the image to be measured.

1. Press the SEL key to move the cursor to the "F" position in the upper function menu. Press the up and down arrow keys to change the "F" to "T." Now the image from "CAM1" will be displayed as a through image on the monitor.

Note: When the image is difficult to see, change the image setting between "BRT" and "DRK." After changing from the "Freeze" to the "Through" image display, press the left key once and then press the up key once. The "DRK" image setting can be selected.



2. Adjust the focus and aperture of the camera lens to obtain a clear image of the object.  
⇒ See pages 4-2 and 4-3.
3. After the measurement object image is clearly visible, change the image mode back to "F" (Freeze) using the up and down arrow keys.

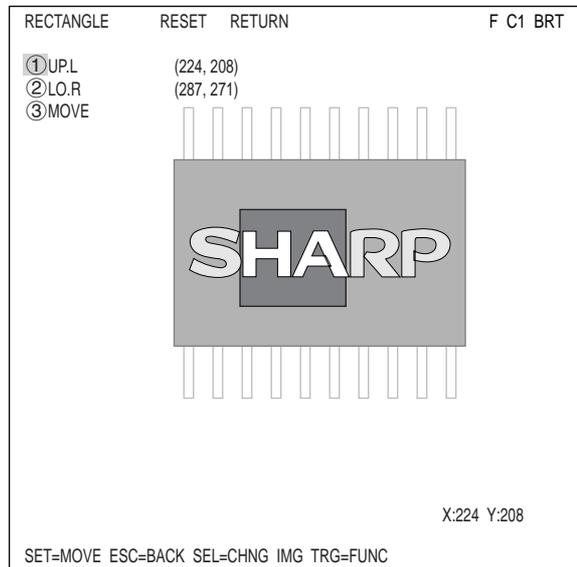
Note: Whenever you want to set threshold value, the image display mode should be changed to "F."

4. Press the SEL key and move the cursor from the upper function menu to the "REG COND" screen.

• Specify the measurement area

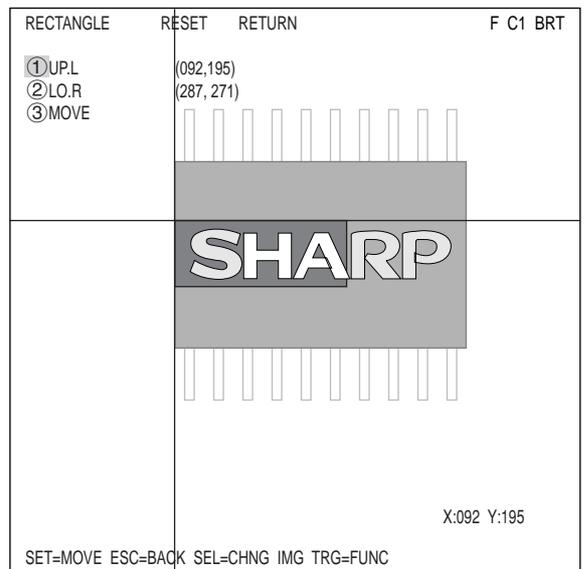
Move the cursor to "③ MEAS AREA" and press the SET key. "SET" will be highlighted.

Press the SET key again and the "RECTANGLE" screen will appear.



Move the cursor to "①UP.L" and press the SET key. The X and Y coordinates of the rectangle are displayed on the screen. Identify the coordinates of the upper left corner of the measurement area using the up, down, left, and right arrow keys. After the coordinates of the upper left corner are correct, press the SET key.

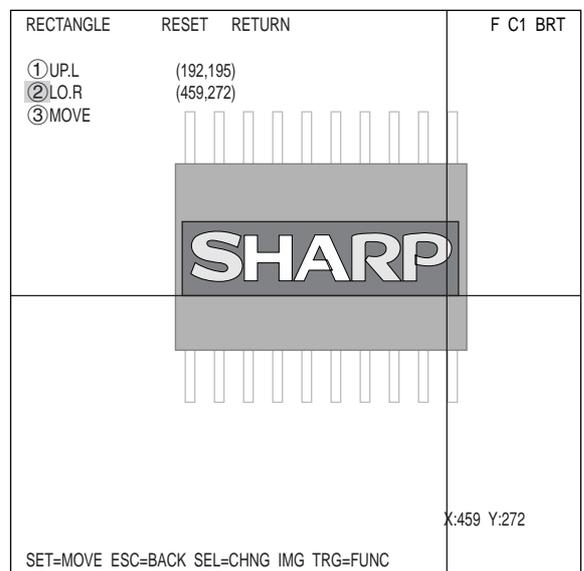
Note: If you press the ESC key, the setting will be canceled.



Next, move the cursor to the "②LO.R" line and press the SET key. Then set the coordinates of the lower right corner of the measurement area, the same as done for the upper left corner.

After the setting is complete, press the ESC key and the monitor will return to the "MEAS COND" screen.

If "③MEAS AREA" setting is highlighted, press the ESC key again to remove the highlighting.



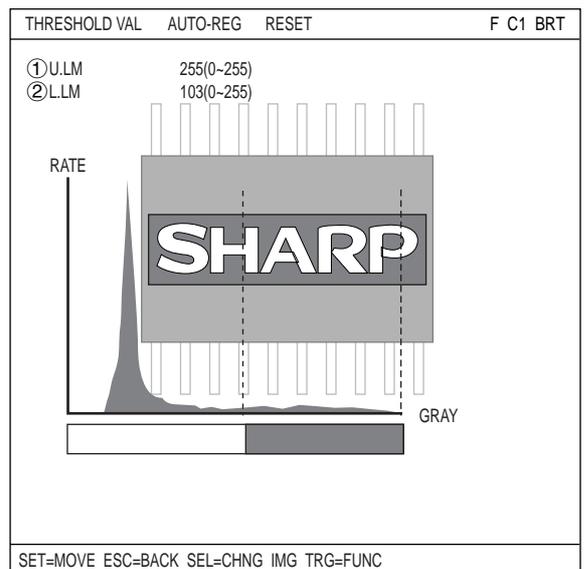
- **Setting the threshold value**

Move the cursor to "④THRESHOLD" and press the SET key. The "SET" will be highlighted, press the SET key again. The "THRESHOLD (graphic)" screen will appear.

Move the cursor to "①U.LM" or "②L.LM" and press the SET key. The number will be highlighted. Next, press the up and down arrow keys. The bar on the graph will move left and right and you can adjust the upper and lower limit values.

- **Auto setting**

On the "THRESHOLD VAL (graphic)" screen, press the TRG/BRT key to move the cursor to the upper function menu. Move the cursor to "AUTO-REG" and press the SET key. A popup menu will appear. The controller will set the threshold to the optimum values automatically when you select the "L LIMIT ONLY" or "U&L LIMITS."



After the settings are complete, press the ESC key twice to return to the "SET WIZARD" screen. Select "NEXT" to go to the next screen.

## Setting Examples Using the Setting Wizard

- (9) Select whether or not to set the evaluation conditions for measured results.  
 Select "②YES" using the up and down arrow keys and press the SET key. The "DETAIL" item will appear on the lower part of the screen. Move the cursor to "DETAIL" and press the SET key.

| SET WIZARD  | EXIT | F C1 BRT                       |
|---|------|--------------------------------|
| [SAMPLE]  |      |                                |
| STEP7   |      |                                |
| COMPARE EVALUATION<br>CONDITIONS TO MEASUREMENT<br>RESULTS (YES/NO) |      | TYPE00                         |
| ① NO <input type="checkbox"/>                                       |      | Start                          |
| ② YES <input checked="" type="checkbox"/>                           |      | STEP1 :PARALLEL+SERIAL         |
| RETURN NEXT <b>DETAIL</b>   |      | STEP2 :CAPTURE IMG/PARTIAL-IMG |
|   |      | STEP3 :MEAS1/CAM1              |
|   |      | STEP4 :MEAS1/POS DEVIAT        |
|   |      | STEP5 :MEAS1/MEAS CND          |
|   |      | STEP6 :MEAS1/DTECT PRECISION   |
|   |      | <b>STEP7 :MEAS1/EVALUATION</b> |
|   |      | End                            |

The "EVALUAT COND" screen will appear.

Select "③REGISTER 00" using the up and down arrow keys and press the SET key twice. The cursor will move to the leftmost digit of the lower limit value.

Select a digit using the left and right arrow keys. Set the value of the digit using the up and down arrow keys.

After the value is correct, press the SET key.

| EVALUAT COND                            | SCREEN             | COND              | SAVE | EDIT | SEL                    | F C1 BRT |
|---|--------------------|-------------------|------|------|------------------------|----------|
| ①CHNG REG                               |                    |                   |      |      | [TEST RESULT] [OUTPUT] |          |
| ②CONDITION SET                          | AUTO(-10%)         |                   |      |      |                        |          |
| ③REGTSTER 00                            | 000000-245760      | A00=              |      |      | NO                     |          |
| ④REGTSTER 01                            | 000000-245760      |                   |      |      |                        |          |
| ⑤REGTSTER 02                            | 000000-245760      |                   |      |      |                        |          |
| ⑥REGTSTER 03                            | 000000-245760      |                   |      |      |                        |          |
| ⑦REGTSTER 04                            | 000000-245760      |                   |      |      |                        |          |
| ⑧REGTSTER 05                            | 000000-245760      |                   |      |      |                        |          |
| ⑨REGTSTER 06                            | 000000-245760      |                   |      |      |                        |          |
| ⑩REGTSTER 07                            | 000000-245760      |                   |      |      |                        |          |
| ⑪TEST                                   | EXEC(WITH-POSI.ADJ | WITHOUT-POSI.ADJ) |      |      |                        |          |
| SET=EXEC ESC=BACK SEL=CHNG IMG TRG=FUNC |                    |                   |      |      |                        |          |

Press the left and right keys to move the cursor to "OUTPUT." Now press the SET key. A popup menu will appear and you can choose "NO," "Y," or "C."

Move the cursor to "Y" and press the SET key. Then select the Y0 and press the SET key. Now the evaluation results will be output to the Y0 terminal.

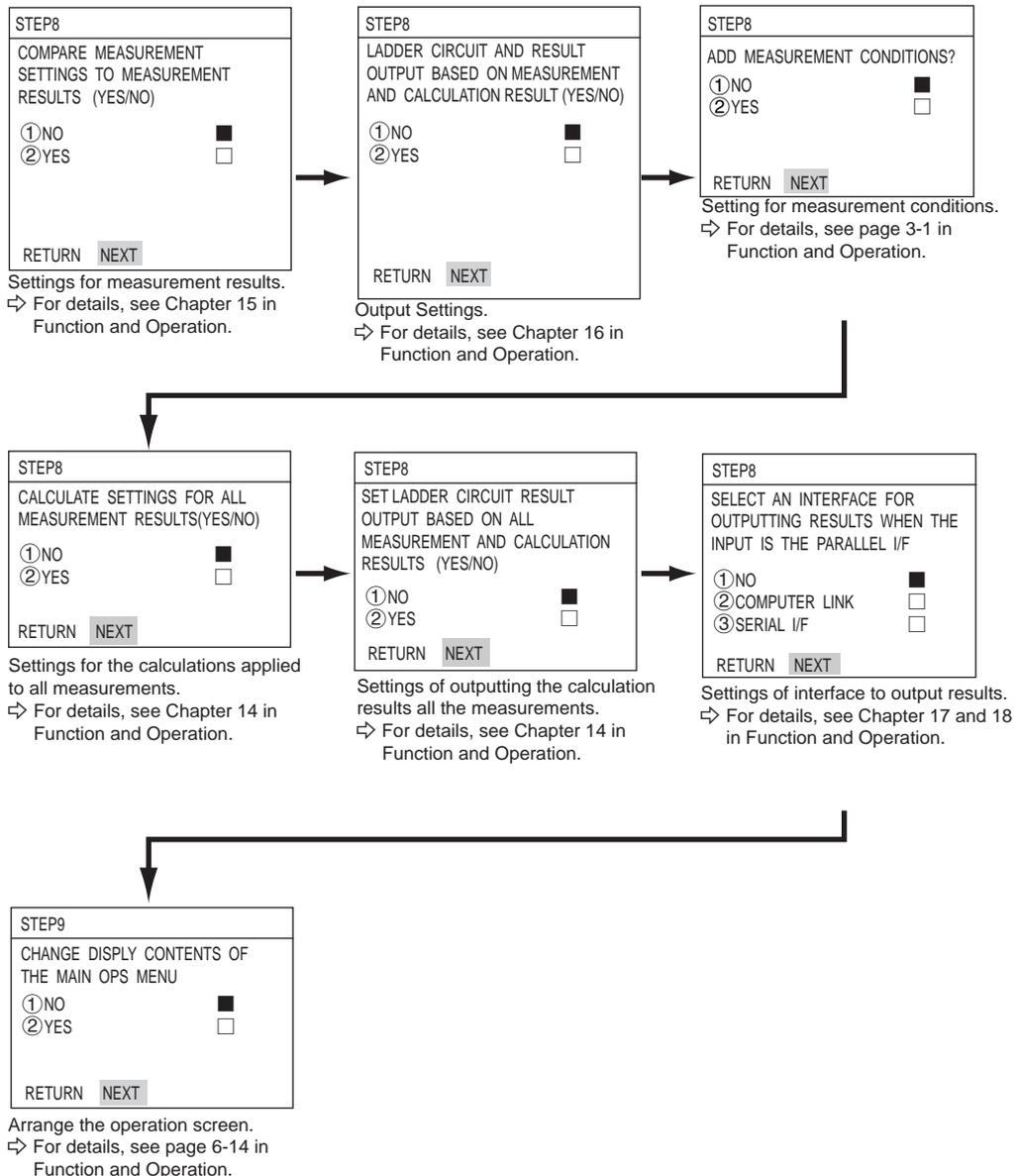
⇒ For details about the evaluation conditions, see page 3-16 in Function and Operation.

After the settings are complete, press the ESC key to return to the "SET WIZARD" screen. Move the cursor to the "NEXT" using the left and right arrow keys, and press the SET key.

| EVALUAT | COND          | SCREEN        | COND | SAVE | EDIT | SEL           | F | C1       | BRT |
|---------|---------------|---------------|------|------|------|---------------|---|----------|-----|
| ①       | CHNG REG      |               |      |      |      | [TEST RESULT] |   | [OUTPUT] |     |
| ②       | CONDITION SET | AUTO(-10%)    |      |      |      |               |   |          |     |
| ③       | REGTSTER 00   | 000000-245760 |      |      |      |               |   |          | NO  |
| ④       | REGTSTER 01   | 000000-002000 |      |      |      |               |   |          | Y   |
| ⑤       | REGTSTER 02   | 000000-245760 |      |      |      |               |   |          | C   |
| ⑥       | REGTSTER 03   | -----         |      |      |      |               |   |          |     |
| ⑦       | REGTSTER 04   | Y OUTPUT      |      |      |      | Use place     |   |          |     |
| ⑧       | REGTSTER 05   | -----         |      |      |      |               |   |          |     |
| ⑨       | REGTSTER 06   | Y0            |      |      |      | NO            |   |          |     |
|         |               | Y1            |      |      |      | NO            |   |          |     |
| ⑩       | REGTSTER 07   | Y2            |      |      |      | NO            |   |          |     |
| ⑪       | TEST          | Y3            |      |      |      | NO            |   |          |     |
|         |               | Y4            |      |      |      | NO            |   |          |     |
|         |               | Y5            |      |      |      | NO            |   |          |     |
|         |               | Y6            |      |      |      | NO            |   |          |     |
|         |               | Y7            |      |      |      | NO            |   |          |     |
|         |               | -----         |      |      |      |               |   |          |     |

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

= In this example, the settings on the STEP8 to STEP9 (MAIN OP MENU) are not changed. Select the "NEXT" on each of these screens to go to the next screen. =



## Setting Examples Using the Setting Wizard

### (10) STORE A TITLE FOR THIS SETTING?

After making this series of settings, select "②YES" to save the settings as a group. By selecting "② YES," "DETAIL" will appear in the lower menu. Select "DETAIL" and press the SET key.

| SET WIZARD                      | EXIT                                | F C1 BRT                        |
|---------------------------------|-------------------------------------|---------------------------------|
| [SAMPLE]                        |                                     |                                 |
| STEP9                           |                                     |                                 |
| STORE A TITLE FOR THIS SETTING? |                                     | TYPE00                          |
| ① NO                            | <input type="checkbox"/>            | Start                           |
| ② YES                           | <input checked="" type="checkbox"/> | STEP1 : PARALLEL+SERIAL         |
| RETURN NEXT <b>DETAIL</b>       |                                     | 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 : TITLE/YES               |
|                                 |                                     | End                             |

The "STR OBJ TITLE" screen will appear. Enter a name using the up, down, left, and right arrow keys. Then, select "END" and press the SET key. The monitor will return to the "SET WIZARD" screen. Select "NEXT" and press the SET key to go to the next screen.

| STR OBJ TITLE SCREEN   | SAVE | F C1 BRT |
|--|------|----------|
| <p style="text-align: center;">A B C D E F G H I J K L M<br/>           N O P Q R S T U V W X Y Z<br/>           0 1 2 3 4 5 6 7 8 9<br/>           - - ( ) &lt; &gt; SP<br/>           ← → DEL <b>END</b></p> |      |          |
| <p>AREA_</p>   |      |          |

### (11) STORE THIS SETTING AS A SAMPLE IN THE WIZARD?

Select "①NO" or "②YES" and then "END." Finally, press the SET key.

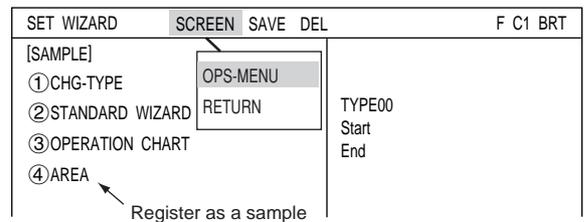
If you selected "②YES" to store the settings, move the cursor to "END" and press the SET key. The wizard will shut down.

| SET WIZARD                                    | EXIT                                | F C1 BRT                        |
|---|-------------------------------------|---------------------------------|
| [SAMPLE]                                      |                                     |                                 |
| STEP9   |                                     |                                 |
| STORE THIS SETTING AS A SAMPLE IN THE WIZARD? |                                     | TYPE00                          |
| ① NO  | <input type="checkbox"/>            | Start                           |
| ② YES   | <input checked="" type="checkbox"/> | STEP1 : PARALLEL+SERIAL         |
| RETURN <b>END</b>                             |                                     | 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 : TITLE/YES               |
|   |                                     | End                             |

- (12) The sample settings are shown with the title you assigned to them on the "SET WIZARD" screen.

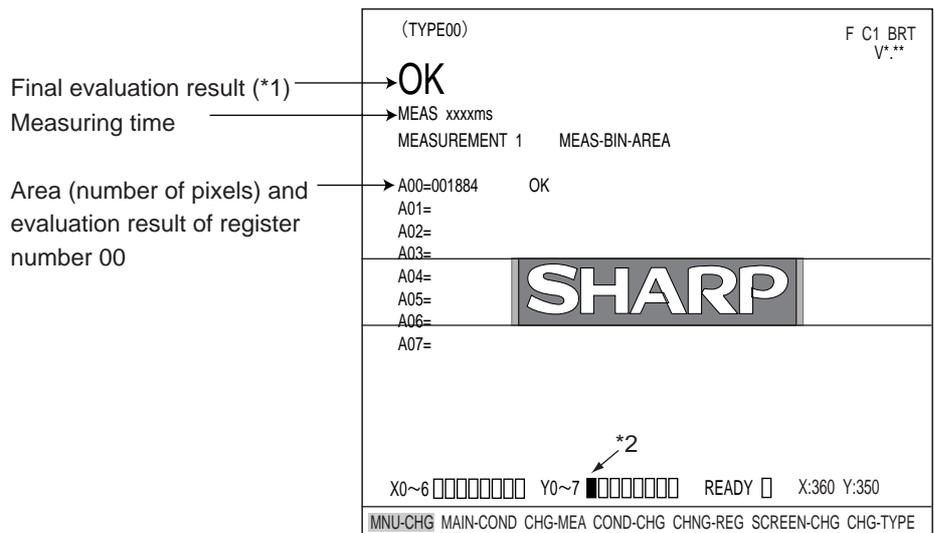
Note 1: If no title was assigned, the sample settings are simply listed as "Sample \*\*"

Note 2: A maximum of eight sample settings can be assigned.



- (13) The monitor will return to display the operation screen.  
To return to the operation screen, press the ESC key twice, or move the cursor to "SCREEN" in the upper menu area and select "OPS-MENU" from the popup menu.

- (14) Execute a measurement.  
The operation screen will appear.  
Press the TRG/BRT key, the area within the specified measurement area will be displayed as a number of pixels.

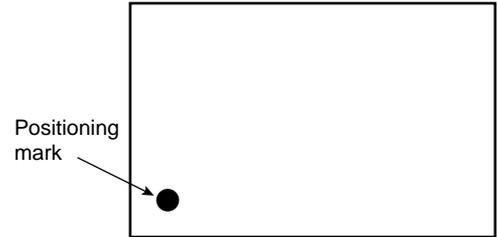


- \*1 The final evaluation result will be displayed as "OK" in the upper left corner of the screen when all of the items have been evaluated acceptable.  
If there is a single unacceptable item, "NG" will be displayed.  
When the "MEAS BIN AREA" is selected, only area is evaluated. When the area is within the range specified in the step (7) (upper and lower limits), the result will be OK.
- \*2 When the final evaluation result is OK, Y0 is turned ON, and a filled box ■ is displayed. (When the result is NG, an empty box □ is displayed.)

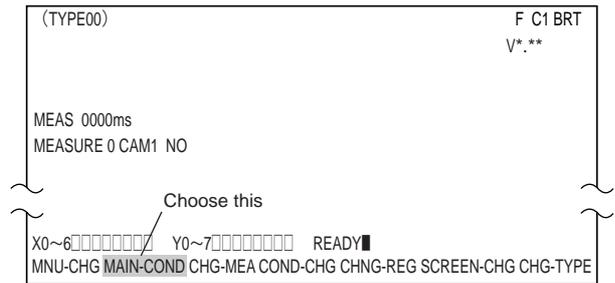
# Chapter 8: Setting Examples Using the Menu Tree

## 8-1 Position deviation measurement

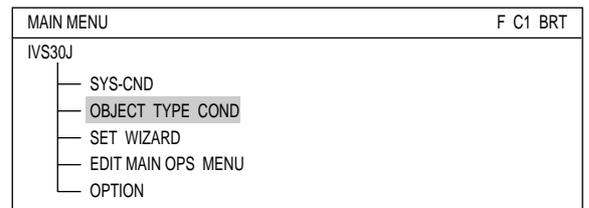
This paragraph describes an example of how to set the measurement positional deviation amount for the positioning mark shown on the right.



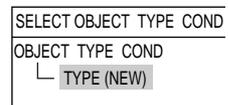
- (1) Move the cursor to "MAIN COND" using the left and right arrow keys and press the SET key.



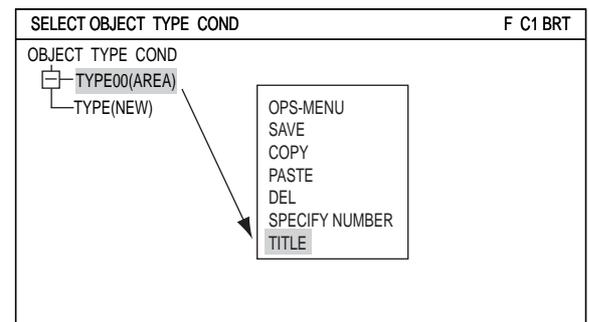
- (2) The "MAIN MEMU" will appear. Move the cursor to the "OBJECT TYPE COND" item using the up and down arrow keys, and press the SET key.



- (3) The "SELECT OBJECT TYPE COND" screen will appear. When the cursor is on "TYPE(NEW)," press the SET key. "TYPE00" will be created.



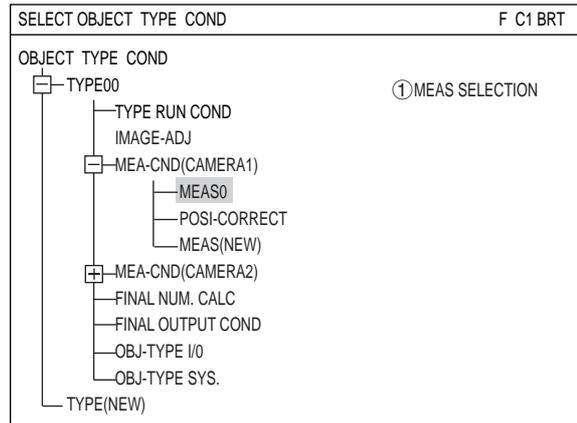
- (4) Enter a title for the object type. Move the cursor to "TYPE00" and press the TRG/BRT key. A popup menu will appear. Move the cursor to "TITLE" on the popup menu and the "STR OBJ TITLE" screen will appear.  
 ⇨ See page 7-9



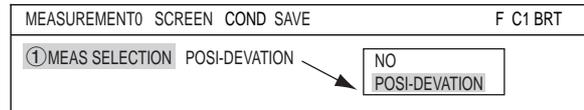
Enter a name and press "END." The name will be added next to the "TYPE00" term.

## Setting Examples Using the Menu Tree

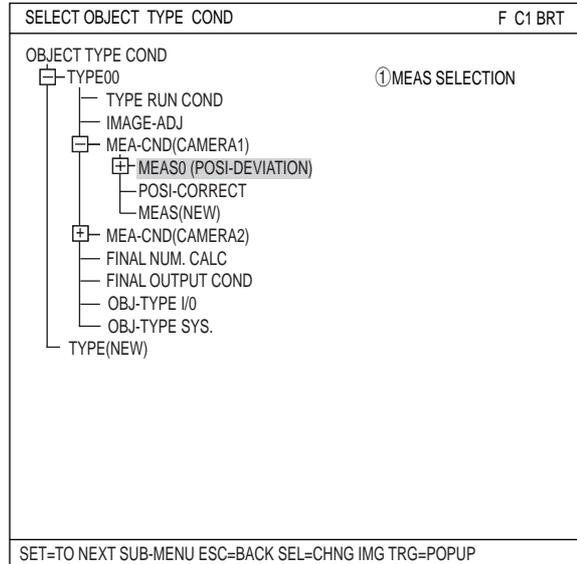
- (5) While the cursor is on "TYPE00," press the right arrow key (or the SET key). A sub menu will be displayed. On the sub menu, select "MEA-CND (CAMERA1)" and then "MEAS0."



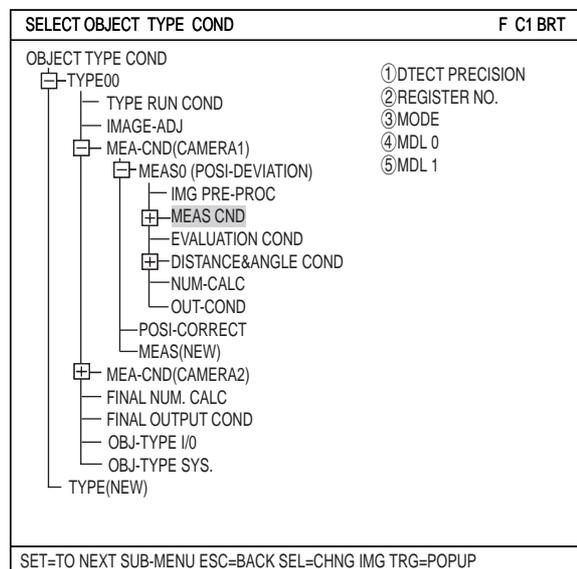
- (6) When "MEAS0" is selected, press the SET key. The "MEAS0" screen will appear. Press the SET key, and a popup menu will appear. Select "POSI-DEVIATION" using the up and down arrow keys, and press the SET key.



- (7) Press the ESC key to return to the menu tree display. Now "MEAS0" will change to "MEAS0(POSI-DEVIATION)."

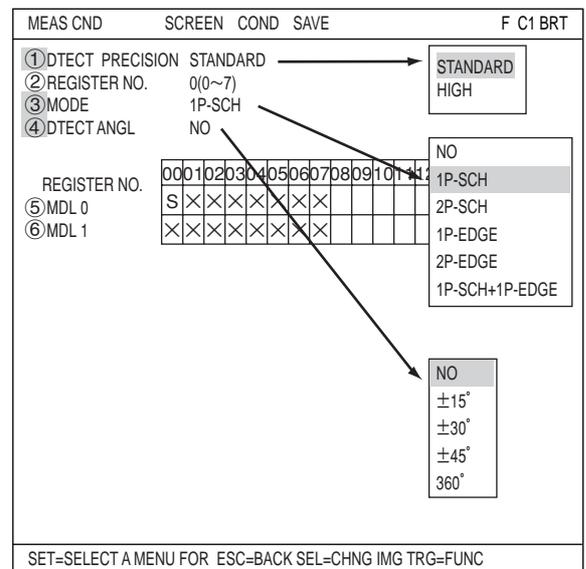


- (8) Select "MEAS0(POSI-DEVIATION)" and then "MEAS CND." Then, press the SET key, the "MEAS CND" screen will appear.



(9) Setting the "MEAS COND" (measurement conditions)

- ① **DETECT PRECISION**  
Select "STANDARD" from the popup menu.  
⇒ For details, see page 3-9 in Function and Operation.
- ② **REGISTER NO.**  
Press the SET key and then press the up and down arrow keys to change the register number.
- ③ **MODE**  
Select "1P-SCH" from the popup menu.
- ④ **DTECT ANGL**  
Select "NO" on the popup menu.
- ⑤ **MDL 0**  
An "S" will be put in the column of the registered number. Move the cursor to the "⑤MDL 0" line and press the SET key twice. The "REG COND" screen will appear.



(10) Setting the "REG COND" (registration conditions)

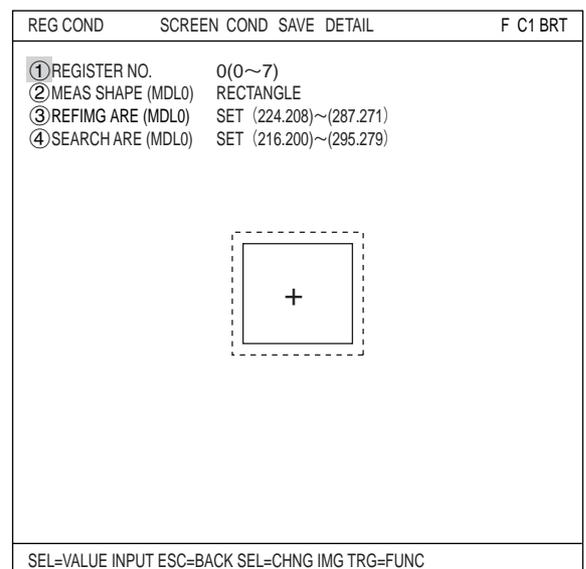
- ① **REGISTER NO.**  
The previously specified register number is displayed.  
⇒ See page 8-3 (9) ②.  
To change the register number, press the SET key. While the number is highlighted, press the up and down arrow keys to change it.

Next, adjust the image you want to measure.

1. Press the SEL key to move the cursor to the "F" position in the upper function menu. Press the up and down arrow keys to change the "F" to "T." Now the image from "CAM1" will be displayed as a through image on the monitor.

Note: When the image is difficult to see, change the image setting between "BRT" and "DRK." After changing from the "Freeze" to the "Through" image display, press the left key once and then press the up key once. The "DRK" image setting can be selected.

2. Adjust the focus and aperture of the camera lens to obtain a clear image of the object.  
⇒ See pages 4-2 and 4-3.
3. After the measurement object image is clearly visible, change the image mode back to "F" (Freeze) using the up and down arrow keys.  
By switching the image display mode from "T" to "F," the image will be captured by the IV-S30J controller.  
Note: Whenever you want to register a reference image, the image display mode should be changed to "F."
4. Press the SEL key and move the cursor from the upper function menu to the "REG COND" screen.

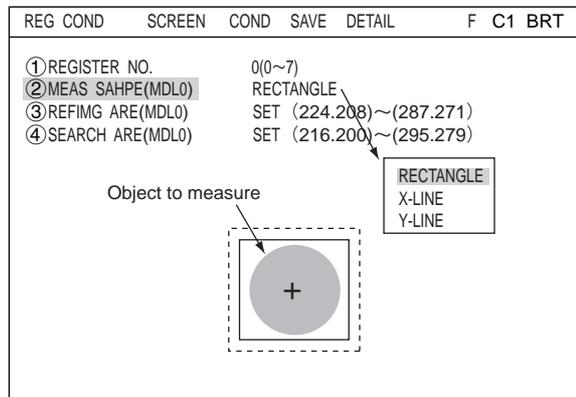


## ② MEAS SHAPE (MDL0)

Move the cursor to this line and press the SET key. A popup menu will appear.

Move the cursor to "RECTANGLE", "X- LINE" or "Y- LINE" and press the SET key. In this example, select "RECTANGLE."

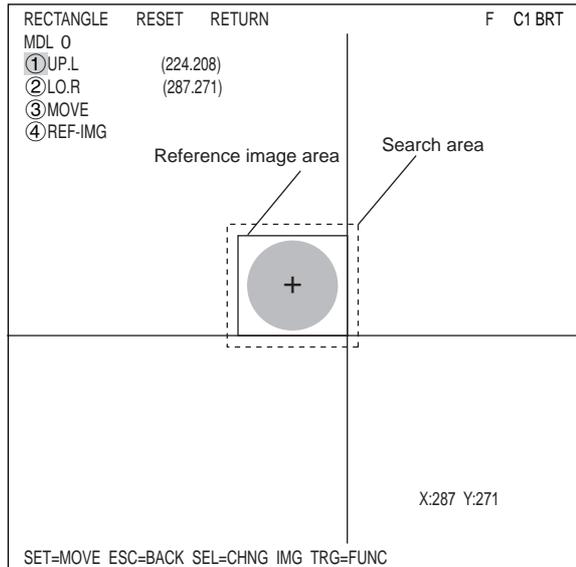
⇒ For details, see page 3-4 in Function and Operation.



## ③ REFIMG ARE (MDL0)

Move the cursor to this line and press the SET key. The "SET" line will be highlighted. Press the SET key again and the "RECTANGLE" setting screen will appear.

Adjust the size of the rectangle by setting "①UP.L" and "②LO.R" (upper left and lower right corners) in order to establish the reference image area.



|             |  |
|-------------|--|
| <b>UP.L</b> | The upper left corner of the rectangle can be moved up, down, left, and right.   |
| <b>LO.R</b> | The lower right corner of the rectangle can be moved up, down, left, and right.  |
| <b>MOVE</b> | The rectangle can be moved up, down, left, and right. Select "MOVE" using the up and down arrow keys. Press the SET key to display a cross hair cursor on the screen. Now, move the rectangle by pressing the up, down, left, and right arrow keys. When it is in position, press the SET key to confirm it. |

Move the cursor to "①UP.L" or "②LO.R." After the position of the rectangle is correct, press the SET key.

### Register a reference image

Move the cursor to "④REF-IMG" using the up and down arrow keys and press the SET key. Then, select "REG" from the popup menu. The reference image that you registered is shown in the lower right corner of the screen.

After the setting is complete, press the ESC key to return to the "REG COND" screen.

Note: If a reference image is not registered, you cannot make measurements.

④ SEARCH ARE (MDL0)

Move the cursor to this line and press the SET key. "SET" will be highlighted. Press the SET key again and the "RECTANGLE" screen will appear.

Use the same procedures as you used for "③REFIMG AREA (MDL0)" to adjust the size and position of the rectangle defining the search area.

After the setting is complete, press the ESC key and return to the "MEAS CND" screen.

- (11) Move the cursor to the upper function key menu by pressing the TRG/BRT key. Then select "COND" using the left and right arrow keys. A popup menu will appear. Select "EVALUATION" and press the SET key.

| MEAS CND          | SCREEN                           | COND | SAVE | F | C1 | BRT |
|-------------------|----------------------------------|------|------|---|----|-----|
| ① DTECT PRECISION | STANDARD                         |      |      |   |    |     |
| ② REGISTER NO.    | 0                                |      |      |   |    |     |
| ③ MODE            | 1                                |      |      |   |    |     |
| ④ DTECT ANGL      | NO                               |      |      |   |    |     |
| REGISTER NO.      | 00010203040506070809101112131415 |      |      |   |    |     |
| ⑤ MDL 0           | S                                |      |      |   |    |     |
| ⑥ MDL 1           | X                                |      |      |   |    |     |

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

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

- (12) The "EVALUAT COND" screen will appear.

Select "①REGISTER NO." using the up and down arrow keys. Change the number to "0" using the up and down arrow keys. Then press the SET key.

| EVALUAT COND       | SCREEN                               | COND          | SAVE     | EDIT | SEL | F | C1 | BRT |
|--------------------|--------------------------------------|---------------|----------|------|-----|---|----|-----|
| ① REGISTER NO.     | 0(0~7)                               | [TEST RESULT] | [OUTPUT] |      |     |   |    |     |
| ② CONDITION SET    | AUTO(-10%)                           |               |          |      |     |   |    |     |
| ③ X COORD. (MDL0)  | 000.0~511.0                          | X0=           |          |      | NO  |   |    |     |
| ④ Y COORD. (MDL0)  | 000.0~479.0                          | Y0=           |          |      | NO  |   |    |     |
| ⑤ x DEVIATE (MDL0) | -511.0~+511.0                        | x0=           |          |      | NO  |   |    |     |
| ⑥ y DEVIATE (MDL0) | -479.0~+479.0                        | y0=           |          |      | NO  |   |    |     |
| ⑦ MATCH LVL (MDL0) | -10000~+10000                        | MO=           |          |      | NO  |   |    |     |
| ⑧ TEST             | EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ) |               |          |      |     |   |    |     |

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

## Setting Examples Using the Menu Tree

Select "⑦MATCH LVL (MDL0)" using the up and down arrow keys and set the upper and lower limit values.

Select a digit using the left and right arrow keys. Select a number using the up and down arrow keys.

After the value is correct, press the SET key. Then press the left and right keys to move the cursor to "OUTPUT." Now press the SET key. A popup menu will appear and you can choose "NO," "Y," or "C."

Move the cursor to "Y" and press the SET key. Then select the Y0 and press the SET key. Now the evaluation results will be output to the Y0 terminal.

⇒ For details about the evaluation conditions, see page 3-17 in Function and Operation.

After the settings are complete, press the ESC key to return to the "MEAS CND" screen.

| EVALUAT  | COND          | SCREEN               | COND          | SAVE | EDIT | SEL | F | C1 | BRT          |
|--|---------------|----------------------|---------------|------|------|-----|---|----|--------------|
| ①  | REGISTER NO.  | 0(0~7)               | [TEST RESULT] |      |      |     |   |    | [OUTPUT]     |
| ②  | CONDITION SET | AUTO(-10%)           |               |      |      |     |   |    |              |
| ③  | X COORD.      | (MDL0) 000.0~511.0   | X0            |      |      |     |   |    | Y0           |
| ④  | Y COORD.      | (MDL0) 000.0~479.0   | Y0            |      |      |     |   |    | Y1           |
| ⑤  | x DEVIATE     | (MDL0) -511.0~+511.0 | x0            |      |      |     |   |    | C000         |
| ⑥  | y DEVIATE     | -----                |               |      |      |     |   |    | C001         |
| ⑦  | MATCH LVL     | Y OUTPUT             | Use place     |      |      |     |   |    | NO<br>Y<br>C |
|  |               | Y0                   | NO            |      |      |     |   |    |              |
|  |               | Y1                   | NO            |      |      |     |   |    |              |
|  |               | Y2                   | NO            |      |      |     |   |    |              |
|  |               | Y3                   | NO            |      |      |     |   |    |              |
|  |               | Y4                   | NO            |      |      |     |   |    |              |
|  |               | Y5                   | NO            |      |      |     |   |    |              |
| ⑧  | TEST          | Y6                   | NO            |      |      |     |   |    |              |
|  |               | Y7                   | NO            |      |      |     |   |    |              |
|  |               | -----                |               |      |      |     |   |    |              |
| SEL=VALUE INPUT ESC=BACK SEL=CHNG IMG TRG=FUNC |               |                      |               |      |      |     |   |    |              |

(13) The monitor will return to display the operation screen.

To return to the operation screen, press the ESC key three times, or move the cursor to "SCREEN" in the upper menu area and select "OPS-MENU" from the popup menu.

(14) Execute a measurement.

While the operation screen is displayed, press the TRG/BRT key. The measurement results will be displayed on the screen.

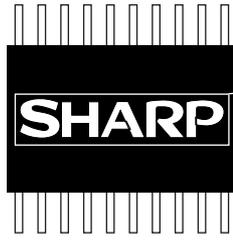
⇒ For details about the measurement results, see page 4-10.

| (TYPE00)  |          | F   | C1       | BRT     |
|---|----------|---|----------|---------|
| OK  |          | V:**  |          |         |
| MEAS XXXXms   |          |   |          |         |
| MEASUREMENT 1   |          | POSI-DEVIATION  |          |         |
| REGISTER NO.0(0~7)  |          |   |          |         |
| X0=247.0  | OK       |  |          |         |
| Y0=245.0  | OK       |   |          |         |
| x0=008.0  | OK       |   |          |         |
| y0=+006.0   | OK       |   |          |         |
| M0=+09735   | OK       |   |          |         |
| B0=   |          |   |          |         |
| X0~6  | □□□□□□□□ | Y0~7  | ■□□□□□□□ | READY □ |
| MNU-CHG MAIN-COND CHG-MEA COND-CHG CHNG-REG SCREEN-CHG CHG-TYPE |          |   |          |         |



## 8-2 Area measurement by binary conversion

This section describes the setting procedures for the binary area measurement of the object below. The area will be measured by counting the number of pixels after binarization.

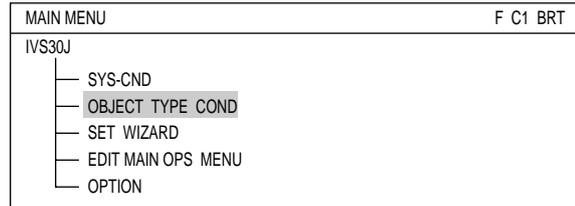


Object to be measured  
(Measure the white area in the "SHARP" logo.)

This section describes only the minimum required settings.

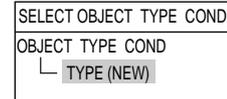
(1) Move the cursor to "MAIN COND" using the left and right arrow keys and press the SET key.

(2) The "MAIN MENU" will appear.  
Move the cursor to the "OBJECT TYPE COND" item using the up and down arrow keys, and press the SET key.



(3) The "SELECT OBJECT TYPE COND" screen will appear.

When the cursor is on "TYPE(NEW)," press the SET key. "TYPE00" will be created.

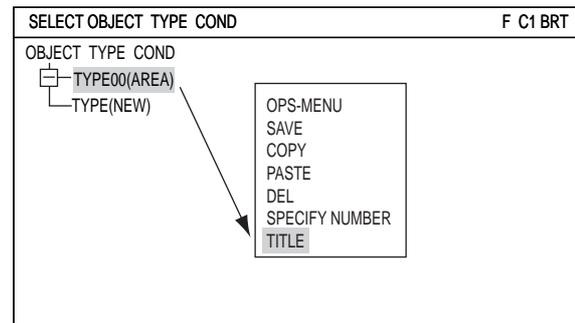


(4) Enter a title for the object type.

Move the cursor to "TYPE00" and press the TRG/BRT key. A popup menu will appear. Move the cursor to "TITLE" on the popup menu and the "STR OBJ TITLE" screen will appear.

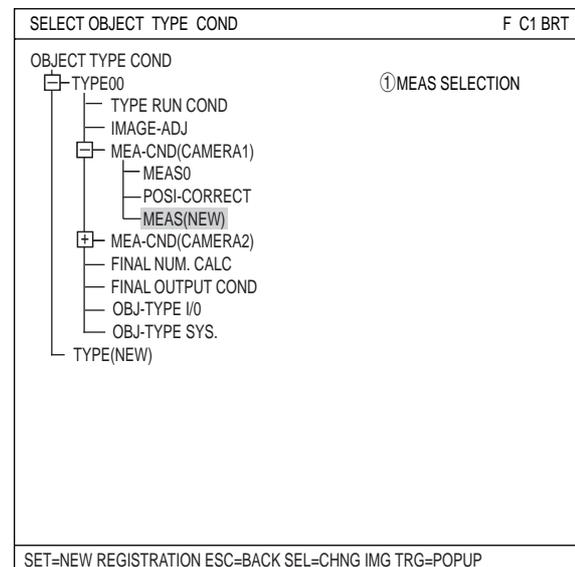
⇒ See page 7-9

Enter a name and press "END." The name will be added next to the "TYPE00" term.



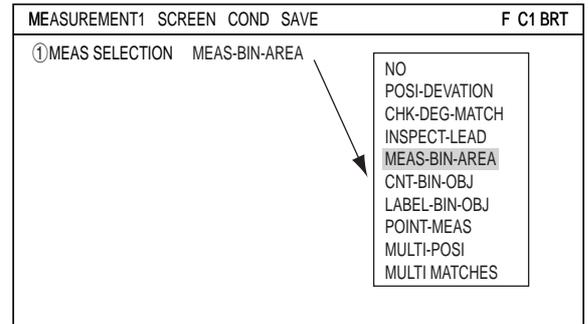
(5) On the menu tree, select "TYPE00," "MEA-CND (CAMERA1)," and then "MEAS(NEW)." Then, press the SET key.

Note: "MEAS0" is used exclusively for positional deviation measurements (position correction). It cannot be used to specify binary processing.

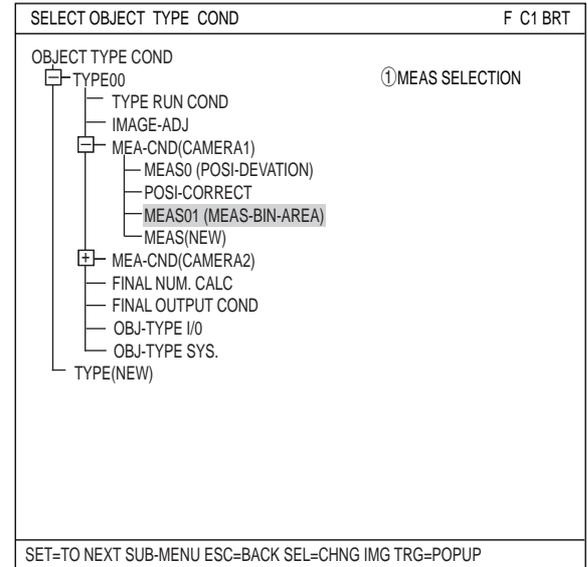


SET=NEW REGISTRATION ESC=BACK SEL=CHNG IMG TRG=POPUP

- (6) The "MEASUREMENT 1" screen will appear. Press the SET key and a popup menu will appear. Select "MEAS-BIN-AREA" and press the SET key



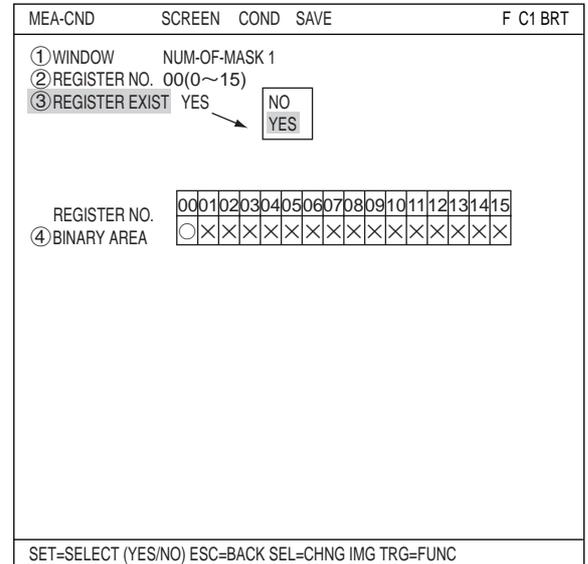
- (7) Press the ESC key to return to the menu tree display. "MEAS01(MEAS-BIN-AREA)" will be displayed on the menu tree.



- (8) Select "MEAS01(MEAS-BIN-AREA)" and then "MEAS CND." Then, press the SET key, the "MEA-CND" screen will appear.

Setting the "MEA-CND" (measurement conditions)

- ② **REGISTER NO.**  
Press the SET key and then press the up and down arrow keys to change the register number.
- ③ **REGISTER EXIST**  
Select "YES" on the popup menu.
- ④ **BINARY AREA**  
A "[O]" will be displayed under the registered number. Press the SET key and move the cursor to the "[O]" display position. Then press the SET key.



### (9) Setting the "REG COND" (registration conditions)

- **Adjust the image**

On the "REG COND" menu, adjust the image to be measured.

1. Press the SEL key to move the cursor to the "F" position in the upper function menu. Press the up and down arrow keys to change the "F" to "T." Now the image from "CAM1" will be displayed as a through image on the monitor.

Note: When the image is difficult to see, change the image setting between "BRT" and "DRK." After changing from the "Freeze" to the "Through" image display, press the left key once and then press the up key once. The "DRK" image setting can be selected.

2. Adjust the focus and aperture of the camera lens to obtain a clear image of the object.

⇒ See pages 4-2 and 4-3.

3. After the measurement object image is clearly visible, change the image mode back to "F" (Freeze) using the up and down arrow keys.

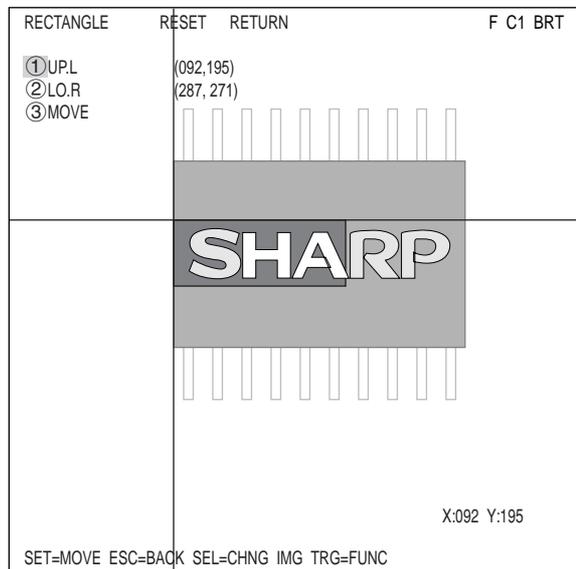
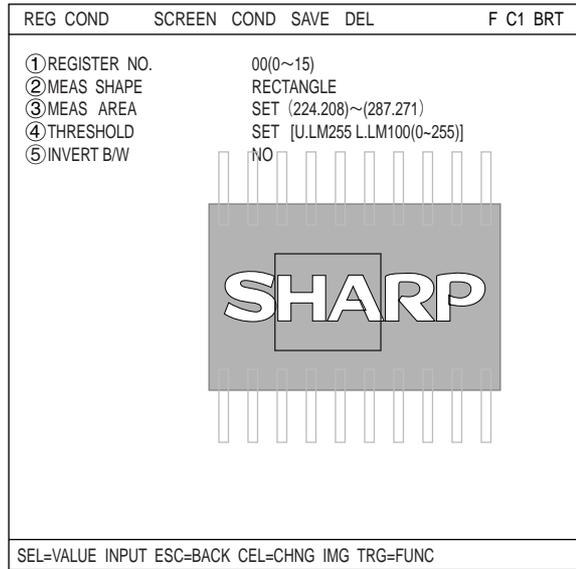
Note: Whenever you want to register a reference image, the image display mode should be changed to "F."

4. Press the SEL key and move the cursor from the upper function menu to the "REG COND" screen.

- **Specify the measurement area**

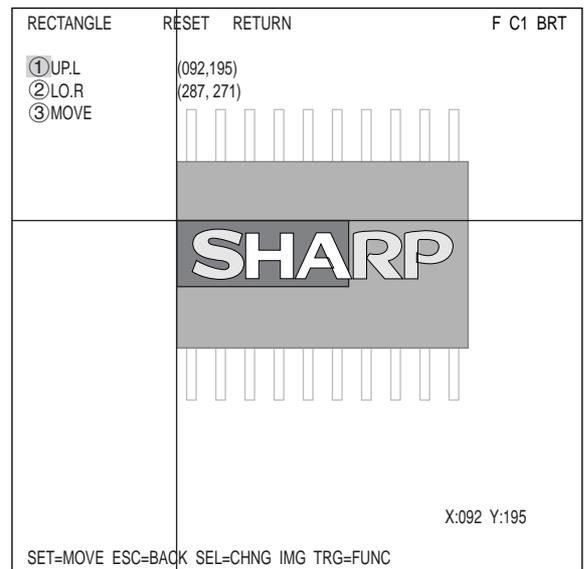
Move the cursor to "③MEAS AREA" and press the SET key. "SET" will be highlighted.

Press the SET key again and the "RECTANGLE" screen will appear.



Move the cursor to "①UP.L" and press the SET key. The X and Y coordinates of the rectangle are displayed on the screen. Identify the coordinates of the upper left corner of the measurement area using the up, down, left, and right arrow keys. After the coordinates of the upper left corner are correct, press the SET key.

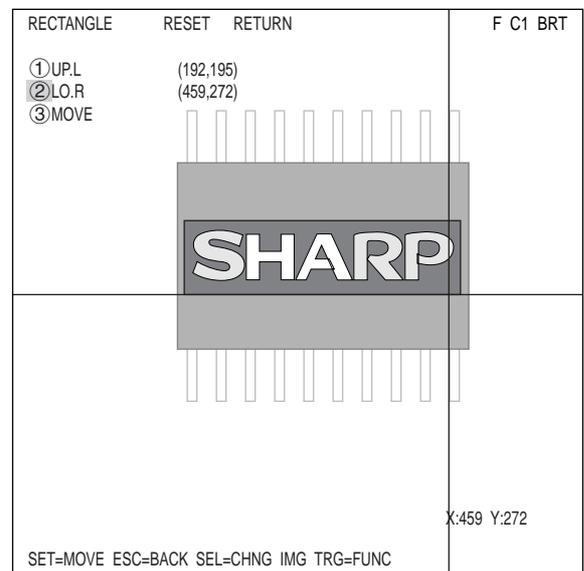
Note: If you press the ESC key, the setting will be canceled.



Next, move the cursor to the "②LO.R" line and press the SET key. Then set the coordinates of the lower right corner of the measurement area, the same as done for the upper left corner.

After the setting is complete, press the ESC key and the monitor will return to the "REG COND" screen.

If "③MEAS AREA" setting is highlighted, press the ESC key again to remove the highlighting.



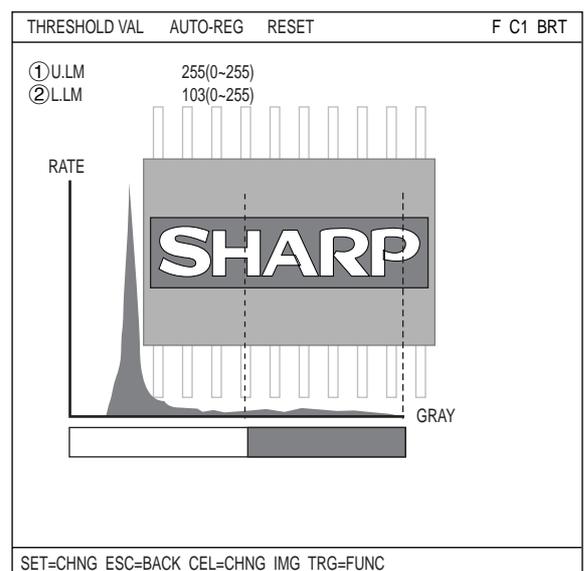
#### - Setting the threshold value

Move the cursor to "④THRESHOLD" and press the SET key. The "SET" will be highlighted, press the SET key again. The "THRESHOLD (graphic)" screen will appear.

Move the cursor to "①U.LM" or "②L.LM" and press the SET key. The number will be highlighted. Next, press the up and down arrow keys. The bar on the graph will move left and right and you can adjust the upper and lower limit values.

#### - Auto setting

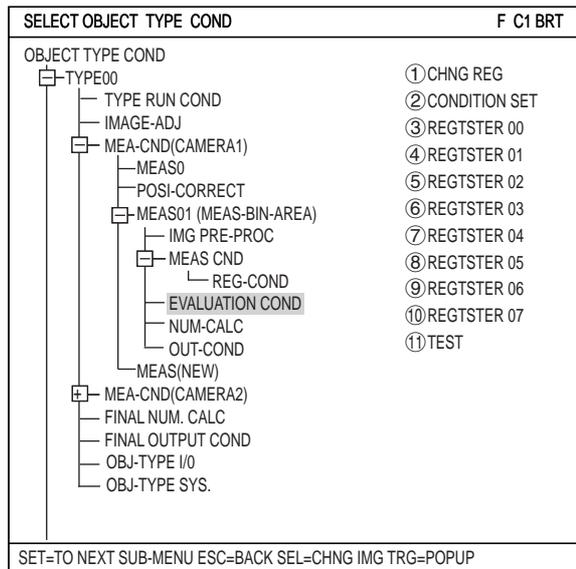
On the "THRESHOLD VAL" screen, press the TRG/BRT key to move the cursor to the upper function menu. Move the cursor to "AUTO-REG" and press the SET key. A popup menu will appear. The controller will set the threshold to the optimum values automatically when you select the "L LIMIT ONLY" or "U&L LIMITS."



After the settings are complete, press the ESC key twice to return to the "menu tree" screen.

## Setting Examples Using the Menu Tree

- (10) On the menu tree, select "EVALUATION COND" and press the SET key. The "EVALUAT COND" menu will appear.



- (11) Set items on the "EVALUAT COND" screen.  
 Select "③REGISTER 00" using the up and down arrow keys and press the SET key twice. The cursor will move to the leftmost digit of the lower limit value. Select a digit using the left and right arrow keys. Set the value of the digit using the up and down arrow keys.  
 After the value is correct, press the SET key.

| EVALUAT COND    | SCREEN                               | COND | SAVE | EDIT | SEL           | F | C1       | BRT |
|-----------------|--------------------------------------|------|------|------|---------------|---|----------|-----|
| ① CHNG REG      |                                      |      |      |      | [TEST RESULT] |   | [OUTPUT] |     |
| ② CONDITION SET | AUTO(-10%)                           |      |      |      |               |   |          |     |
| ③ REGTSTER 00   | 000000-245760                        | A00= |      |      | NO            |   |          |     |
| ④ REGTSTER 01   | 000000-245760                        |      |      |      |               |   |          |     |
| ⑤ REGTSTER 02   | 000000-245760                        |      |      |      |               |   |          |     |
| ⑥ REGTSTER 03   | 000000-245760                        |      |      |      |               |   |          |     |
| ⑦ REGTSTER 04   | 000000-245760                        |      |      |      |               |   |          |     |
| ⑧ REGTSTER 05   | 000000-245760                        |      |      |      |               |   |          |     |
| ⑨ REGTSTER 06   | 000000-245760                        |      |      |      |               |   |          |     |
| ⑩ REGTSTER 07   | 000000-245760                        |      |      |      |               |   |          |     |
| ⑪ TEST          | EXEC(WITH-POSI.ADJ WITHOUT-POSI.ADJ) |      |      |      |               |   |          |     |

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

Press the left and right keys to move the cursor to "OUTPUT." Now press the SET key. A popup menu will appear and you can choose "NO," "Y," or "C."

Move the cursor to "Y" and press the SET key. Then select the Y0 and press the SET key. Now the evaluation results will be output to the Y0 terminal.  
 ⇨ For details about the evaluation conditions, see page 3-17 in Function and Operation.

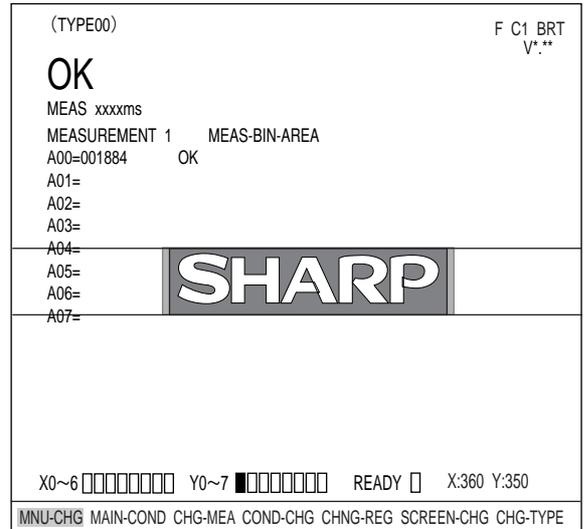
After the settings are complete, press the ESC key to return to the "SELECT OBJECT TYPE COND" screen.

| EVALUAT COND    | SCREEN               | COND      | SAVE | EDIT | SEL           | F | C1       | BRT |
|-----------------|----------------------|-----------|------|------|---------------|---|----------|-----|
| ① REGISTER NO.  | 0(0-7)               |           |      |      | [TEST RESULT] |   | [OUTPUT] |     |
| ② CONDITION SET | AUTO(-10%)           |           |      |      |               |   |          |     |
| ③ X COORD.      | (MDL0) 000.0-511.0   | X0        |      |      |               |   | Y0       |     |
| ④ Y COORD.      | (MDL0) 000.0-479.0   | Y0        |      |      |               |   | Y1       |     |
| ⑤ x DEVIATE     | (MDL0) -511.0-+511.0 | x0        |      |      |               |   | C000     |     |
| ⑥ y DEVIATE     | -----                |           |      |      |               |   | C001     |     |
| ⑦ MATCH LVL     | Y OUTPUT             | Use place |      |      |               |   | NO       |     |
|                 | Y0                   | NO        |      |      |               |   | Y        |     |
|                 | Y1                   | NO        |      |      |               |   | C        |     |
|                 | Y2                   | NO        |      |      |               |   |          |     |
|                 | Y3                   | NO        |      |      |               |   |          |     |
|                 | Y4                   | NO        |      |      |               |   |          |     |
|                 | Y5                   | NO        |      |      |               |   |          |     |
| ⑧ TEST          | Y6                   | NO        |      |      |               |   |          |     |
|                 | Y7                   | NO        |      |      |               |   |          |     |

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

- (12) The monitor will return to display the operation screen.  
To return to the operation screen, press the ESC key twice.

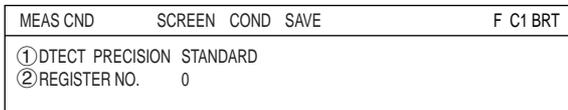
- (13) Execute a measurement.  
The operation screen will appear.  
Press the TRG/BRT key, the area within the specified measurement area will be displayed as a number of pixels.  
⇒ For details about the measurement results, see page 7-9.



• Saving data

- Although the specified data is temporarily stored in RAM memory, it is not stored in the flash memory. So, you must save the data manually using the save operation. If you do not save the data in the flash memory, it will be deleted when the IV-S30J controller is turned OFF.
- You can save data at any time using the "SAVE" item on the [MEAS COND], [TYPE RUN COND], or [SYSTEM COND] menu.

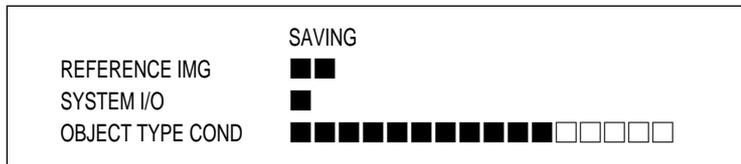
[MEAS COND] menu



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



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

# Chapter 9: Specifications

## 9-1 Controller (IV-S30J)

| Item   |  | Specifications  |
|--|--|---|
| 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, $\gamma$ (+/-) 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 to contraction, contraction to 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)<br>Angle: $\pm 15^\circ$ , $\pm 30^\circ$ , $\pm 45^\circ$ , $360^\circ$ (1-point search, 1-point search + 1-point edge)<br>[Maximum 8 windows x 2 models] |
|  | Degree of match inspection                 | Degree of match, XY coordinate, density (1-point search, 2-point search)<br>[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<br>[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<br>[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.)<br>[Maximum 16 windows]   |
|  | Multiple position inspection               | Number of objects (max. 128), degree of match, XY coordinate (1-point search, 1-point edge)<br>[Maximum 4 windows]  |
|  | Multiple degree of match inspection        | Number of objects (max. 128), degree of match, XY coordinate (1-point search)<br>[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.

## Specifications

| Item                                     |                                     | Specifications   |
|--|-------------------------------------|--|
| Number of measurement programs           |                                     | Maximum 6 per object type (measurement 0 - camera 1, measurement 0 - camera 2, measurements 1 to 4)<br>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 (maximum 32: when using area measurement by binary conversion, object counting by binary conversion, and object identification by binary conversion.) |
| 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 edit function, change image display (through/freeze), change image brightness (bright/dark), select item of evaluation condition.   |
| Micro PC section                         | Input relays                        | Parallel input: 7 points (X0 to X6)  |
|  | Output relays                       | Parallel output: 8 points (Y0 to Y7)<br>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 (terminal block) | Input: 7 points, 12/24 VDC<br>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   |
| Measurement start input                  | Internal trigger                    | CCD trigger (using the CCD camera)   |
|  | External trigger                    | Trigger input (parallel I/F), general-purpose serial I/F, keypad trigger (for manual measuring)  |
| Terminal block                           | Interrupt processing input          | 1 point: External trigger (X0)   |
|  | Inputs                              | 4 points: Object type change (X1 to X4), 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 supply voltage / power consumption |                                     | 24 VDC ( $\pm 10\%$ ), 7 W   |

| Item                          | Specifications  |
|-------------------------------|---|
| Storage ambient temperature   | -20 to 70°C   |
| Operation ambient temperature | 0 to 45°C   |
| Operation ambient humidity    | 35 to 85% RH (non-condensing)   |
| Operation atmosphere          | No corrosive gases or dust  |
| Vibration resistance          | JIS C 0911 or equivalent<br>- Amplitude 0.15 mm (10 to 57 Hz), 9.8 m/s <sup>2</sup> (57 to 150 Hz)<br>Number of sweeps: 10 (1 octave/min.), 3 directions (X, Y, Z)  |
| Shock resistance              | JIS C 0912 or equivalent : 147 m/s <sup>2</sup> (three times each in X, Y, and Z directions)  |
| Noise immunity                | 1000 Vp-p 1ms width impulse (by noise simulator) when applied to the primary side (100 VAC) of an external DC power supply  |
| Outside dimensions            | 130 (W) x 92 (D) x 30 (H) mm (except protruding portions)   |
| Weight                        | 300 g   |
| Accessories                   | <ul style="list-style-type: none"> <li>- 1 camera (IV-S30C1)</li> <li>- 1 camera cable (IV-S20HC3)</li> <li>- 1 remote keypad</li> <li>- 2 main housing angle bracket</li> <li>- 1 monitor cable</li> <li>- 1 conversion connector</li> <li>- 1 D-sub connector (9-pin D-sub male, M2.6 lock screw: for communication connector of the controller)</li> <li>- 4 securing screws (M3 x 6: for fixing the angle bracket)</li> </ul> |

## 9-2 Camera specifications

### [1] Camera (IV-S30C1/C2)

| Item                          |                         | Specifications  |  |
|-------------------------------|-------------------------|---|--|
|                               |                         | Standard, IV-S30C1<br>(IV-S30J accessory)               | Micro, IV-S30C2  |
| Optical system                | Lens mount method       | C mount   | Custom $\phi$ 17 mm mount  |
| Picture taking element        | Method                  | Interline transmission method, monochrome CCD           |  |
|                               | Reading system          | Full pixel type, partial image scanning is available    |  |
|                               | Reading                 | 33.3 ms   |  |
|                               | Size                    | 1/3 inch  |  |
|                               | No. of effective pixels | 512 (horizontal) x 480 (vertical)                       |  |
| Shutter                       | Pixel shape             | Square  |  |
|                               | Shutter speed (s)       | Settable between 1/30 and 1/10,000 for each object type |  |
|                               | Method                  | Random shutter  |  |
| Connector                     |                         | Round, 12-pin female connector                          |  |
| Connection to controller      |                         | - Using custom camera cables (IV-S20HC3)                |  |
| Operation ambient temperature |                         | 0 to 45°C   |  |
| Operation ambient humidity    |                         | 35 to 85% RH (non-condensing)                           |  |
| Operation atmosphere          |                         | No corrosive gases or dust                              |  |
| Outside dimensions            | Camera body (mm)        | 30 (W) x 32 (H) x 40 (D)                                | 30 (W) x 32 (H) x 50 (D)   |
|                               | Head                    | ---   | $\phi$ 17· 35.6 mm   |
|                               | Head cable              | ---   | 1m   |
| Weight                        |                         | 50 g (not including the lens)                           | 125 g (The head weighs approximately 12 g)                                 |
| Accessories                   |                         | - 1 camera angle bracket<br>- 2 securing screws         | - 1 camera angle bracket<br>- 1 camera head bracket<br>- 3 securing screws |

### [2] Camera lens (IV-S20L16)

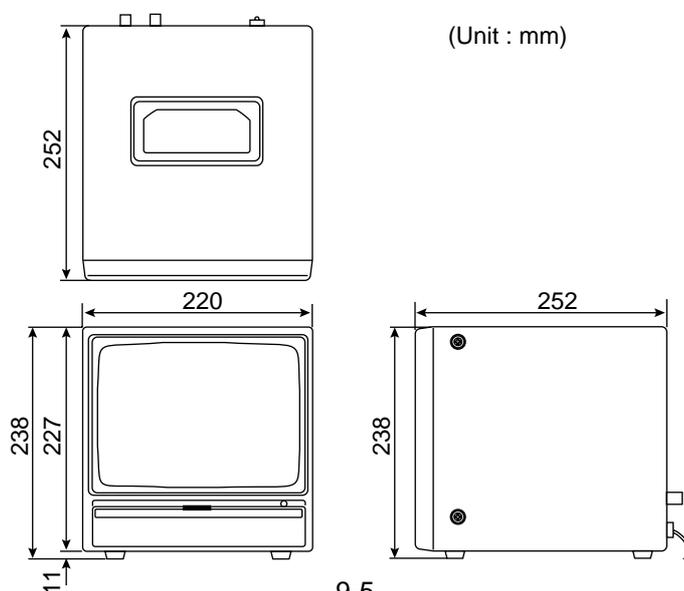
| Item                     | Specifications                                |
|--------------------------|---|
| Focal distance           | 16 mm   |
| Maximum f-stop           | 1.6   |
| Aperture range           | 1.6 to 16, Close                              |
| Focal range              | 50 mm to $\infty$                             |
| Filter installation dia. | M 25.5, P = 0.75, U1                          |
| Mount system             | C mount                                       |
| Compatible cameras       | IV-S30C1/C3, IV-S20C1 (camera for the IV-S20) |

## 9-3 Support tools

### [1] Monochrome monitor (IV-09MT)

| Item                          |       | Specifications  |
|-------------------------------|-------|---|
| Power input voltage           |       | 90 to 110VAC, 50/60Hz   |
| Input capacity                |       | 25 VA   |
| Signal voltage                |       | 1.0Vp-p/75 ohms   |
| Screen display resolution     |       | 900 scanning lines (center), 600 scanning lines (edges)   |
| Scan method                   |       | EIA 525 lines (2:1 interlaced)  |
| Scan frequency                |       | Horizontal : 15.75 kHz, vertical : 48 to 62 Hz  |
| Image size                    |       | 8% under scan   |
| Linearity                     |       | Horizontal : 10% or less, vertical : max. 10%   |
| Image input connector         |       | BNC   |
| Image input impedance         |       | 75 ohms/ High-Z   |
| Video output connector        |       | BNC   |
| Adjustments                   | Front | Brightness, contrast, vertical position, horizontal position  |
|                               | Back  | Focus, vertical width, horizontal linearity, sub-brightness (only used by our service staff)  |
| Storage ambient temperature   |       | -20 to 60°C   |
| Operation ambient temperature |       | 0 to 45°C   |
| Operation ambient humidity    |       | 35 to 85 %RH (non-considering)  |
| Atmosphere                    |       | No corrosive gases  |
| Vibration resistance          |       | JIS C 0911 or equivalent<br>- Amplitude 0.15mm, (10 to 57Hz), 9.8m/s <sup>2</sup> (57 to 150Hz),<br>No. of sweeps : 10 (1 octave/min.) 3 directions (X, Y, Z) |
| Shock resistance              |       | JIS C 0912 or equivalent, 147m/s <sup>2</sup> (3 times each in X,Y, and Z directions)   |
| Weight                        |       | Approx. 6 kg  |
| Dimensions (mm)               |       | 220 (W) × 238 (H) × 257 (D) (not including protrusion)  |
| Dielectric resistance         |       | 1000 VAC, 1 minute (between AC plug and chassis)  |
| Insulation resistance         |       | DC 500VDC, 10M ohms or more (between AC plug and chassis)   |
| Accessories                   |       | One instruction manual  |

#### External dimension drawings



[2] LCD monitors (IV-10MT/10MTV/10MTK)

| Item                  | IV-10MT  | IV-10MTV  | IV-10MTK  |
|-----------------------|--|---|---|
| Display device        | 10.4-inch, TFT liquid crystal module   |   |   |
| Display size          | 211.2 (horizontal) x 158.4 (vertical) mm   |   |   |
| No. of pixels         | 640 (horizontal) x 480 (vertical) dots   |   |   |
| Display colors        | Approx. 260,000 colors (RGB 6-bit)   |   |   |
| Contrast control      | 3 steps  |   |   |
| Backlight             | Cold-cathode tube (service life 25,000 hours *)  |   |   |
| White brightness      | 400 cd/m <sup>2</sup>  |   |   |
| Angle of visibility   | Up/down: 40/60 degrees, left/right: 65 degrees   |   |   |
| Image input connector | RCA connector (1 channel)  |   |   |
| Input signal method   | NTSC system  |   |   |
| Input signal level    | VBS 1.0 V (p-p)/75 ohms  |   |   |
| Power supply          | 90 to 110 VAC, 50/60 Hz (when the supplied AC adapter is used)   |   |   |
| Power consumption     | 28 W (when the supplied AC adapter is used)  |   |   |
| Storage temperature   | -20 to 60 degrees  |   |   |
| Operating temperature | 0 to 45 degrees  |   |   |
| Operating humidity    | 35 to 85% RH (no condensation)   |   |   |
| Atmosphere            | No corrosive gases   |   |   |
| Vibration resistance  | Compliance with JIS C0911<br>Vibration and acceleration: 0.15 mm (10 to 58 Hz), 9.8 m/s <sup>2</sup> (58 to 150 Hz)<br>Vibration frequency: 10 to 150 to 10 Hz (1 oct/min)<br>2 hours in each of X, Y and Z directions (15 sweeps) |   |   |
| Shock resistance      | Compliance with JIS C0912 147 m/s <sup>2</sup> (3 times in each of X, Y and Z directions)  |   |   |
| Noise immunity        | 1000 Vp-p 1 micro second impulse (by noise simulator)<br>(when applied to the primary side (100 VAC) of the supplied AC adapter)   |   |   |
| Withstand voltage     | 1000 VAC, 1 min. (between AC adapter plug and chassis)   |   |   |
| Insulation resistance | 500 VDC, over 100 M ohms (between AC adapter plug and chassis)   |   |   |
| Dimensions (mm)       | 282.6 (W) x 196.6 (H) x 46.9 (D)   | 300 (W) x 231.7 (H) x 49.5 (D)  |   |
| Panel cut size (mm)   | -  | 286.6 <sup>+0.5</sup> <sub>-0</sub> x 218.3 <sup>+0.5</sup> <sub>-0</sub> (not including bracket) |   |
| Weight (approx.)      | 1.8 kg   | 2.4 kg  | 2.5 kg  |
| Accessories           | One AC adapter, one instruction manual   | One AC adapter, one instruction manual, 4 brackets  | One AC adapter, one instruction manual, 4 brackets, one cable |

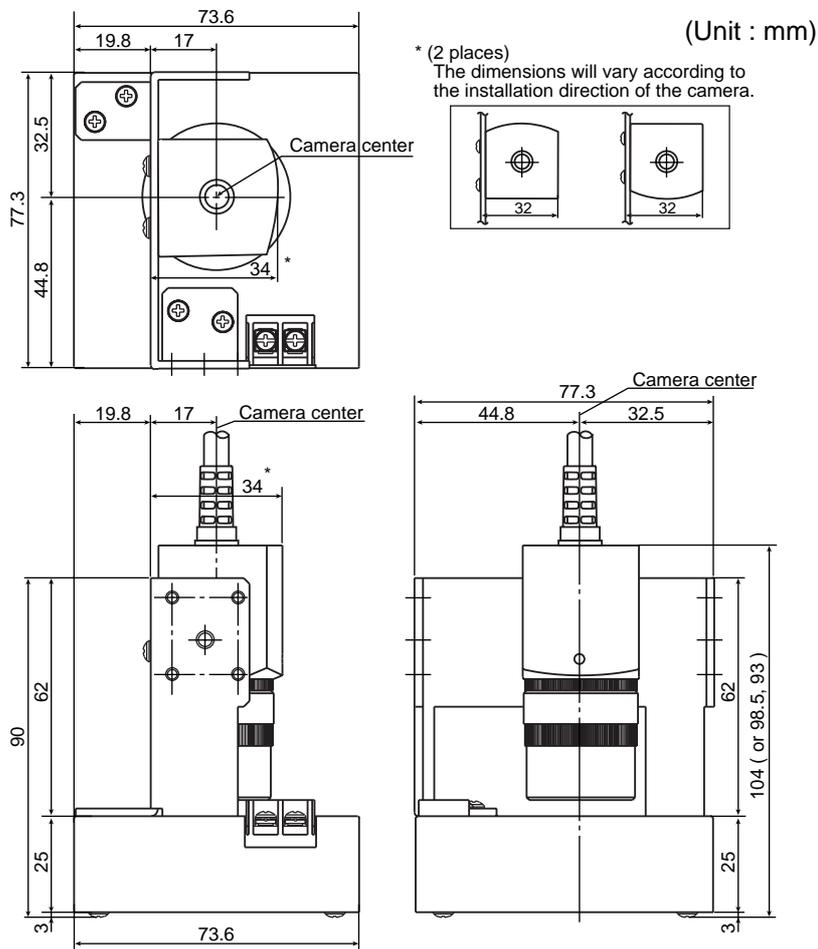
\* The product life above means a time until the the monitor luminous level drops to 50% of the initial value or start flickering while it has been used under the ambient temperature 25±5°C, selecting the light level as the "standard."

[3] LED lighting equipment (IV-60LD)

| Item                          | Specifications   |
|-------------------------------|--|
| LEDs used                     | 36 pcs of 5 mm diameter<br>- High brightness LEDs  |
| Standard lighting range       | Approx. 50 mm x 50 mm (workpiece distance at 150mm)  |
| Input voltage                 | 24 VDC $\pm$ 10% , 2P terminal   |
| Current consumption           | Approx. 2W   |
| Lighting level adjustment     | Semi-fixed volume  |
| Operation ambient temperature | 0 to 45°C  |
| Storage ambient temperature   | -10 to 60°C  |
| Operation ambient humidity    | 35 to 90%RH (non-condensing)   |
| Operation atmosphere          | No corrosive gases or dust   |
| Vibration resistance          | JIS C 0911 or equivalent<br>- Amplitude 2 mm (10 to 61 Hz), 147m/s <sup>2</sup> (61 to 150Hz),<br>No. of sweeps : 10 (1 octave/min.), 3 directions (X,Y,Z) |
| Shock resistance              | JIS C 0912 or equivalent, 147m/s <sup>2</sup> (each 3 times in X, Y, and Z directions)   |
| Outside dimensions (mm)       | 76.9 x 73.6 x 25.0 (except camera angle bracket)   |
| Weight                        | Approx. 230g (IV-60LD body : Approx. 140g + Camera angle bracket : Approx. 90g)  |
| Accessories                   | One camera angle bracket, 6 installation screws (M3 x 6 mm), one instruction manual  |

■ External dimension drawings

Shown below are an IV-S30C1 camera with an IV-S20L16 camera lens installed.



# Glossary

[A]

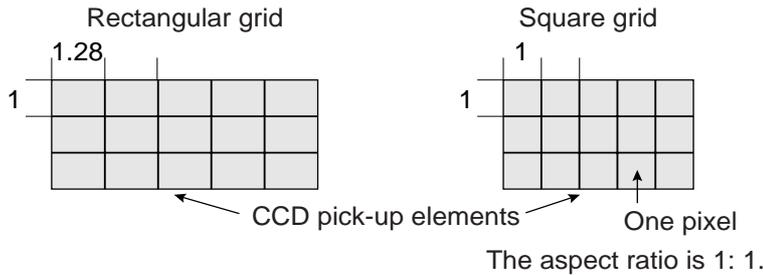
■ **Area filter**

A function used to eliminate an island if its area is smaller than the specified size after each of the objects in an image have been identified.

■ **Arrangement of the square pixels**

This refers to CCD elements whose pixels are square and arranged at the same vertical and horizontal interval.

If this type of CCD element is used, length corrections do not need to be calculated and the precision and processing time do not deteriorate.

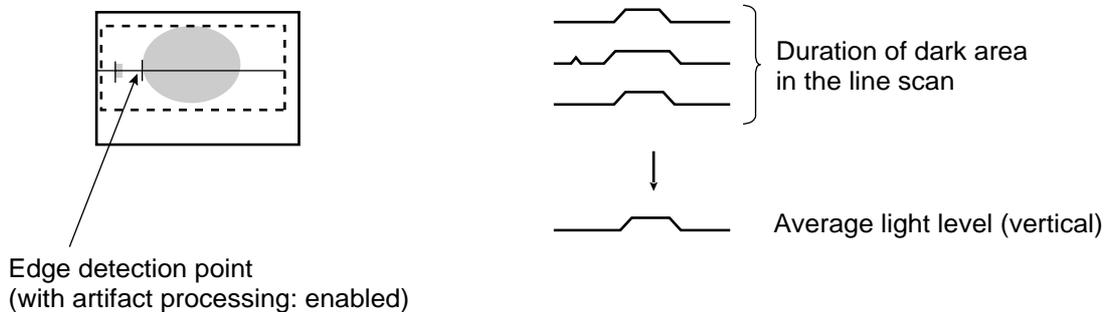


■ **Artifact processing**

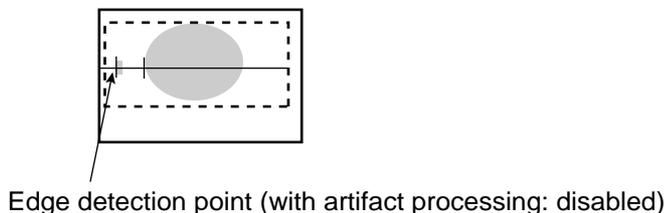
Artifact processing is a method of processing that eliminates the false detection of the edge of the target object when an artifact is in the line being scanned. This process can be used during edge detection. The real edge of the target object is detected by computing the average duration of the dark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

[Example of detection]

- An example of light to dark averaging (DTCT MODE: BRT - DRK) while scanning horizontally (SEARCH DIR.: HORIZ -), with artifact processing (enabled) .



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



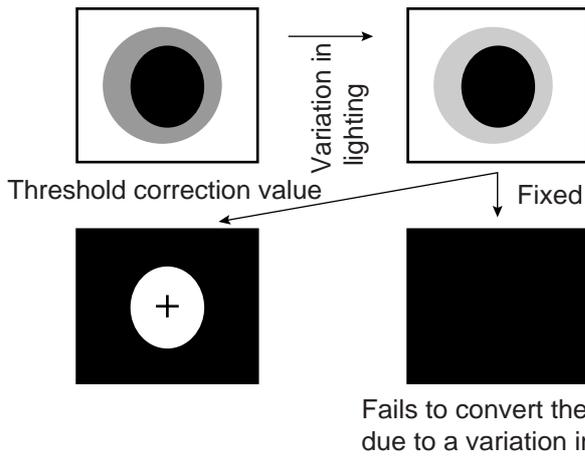
[B]

■ **Binary image**

Pixels in images are converted to one of two values, "1" when the pixel is lighter than the specified threshold value (level), and "0" when it is darker than the specified threshold value (level).

■ **Binary processing (fixed/threshold value correction)**

By setting THESHLD. ADJ (threshold adjustment function), the IV-S30J can cope with variations in lighting.



Note: In order to use the THRESHOLD (threshold adjustment function), the monitor brightness functions must be selected to measure variations in lighting. If you don't select the monitor brightness function, a BINARY CORR.: LIGHT LVL NOT SET (correcting binary value: monitor illumination not selected) error will occur.

■ **Boundary processing**

⇒ See "Setting window boundaries (enable/disable)."

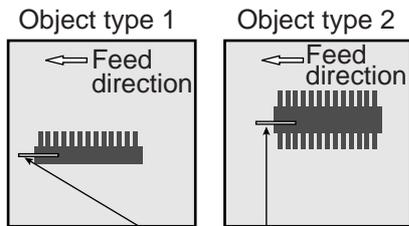
[C]

■ **CCD (charge capture device)**

A charge capture device (CCD) converts light into electric signals. It consists of a photo-electric converter to convert light and store it as an electric charge signal, a scanner to read the stored electric charges, and an output section to transmit the signals as a stream of data.

■ **CCD trigger**

The CCD trigger allows sampling a part of the CCD camera image at high speed. When the sampled image changes, the camera starts the shutter operation to capture a new image. With this built-in shutter operation, an external sensor, such as a photo sensor, is not needed to trigger the shutter. A window can be created to trigger the shutter operation. The window can be set for each item on the production line so that adjustments to the position of an external sensor are no longer needed. This feature reduces the down time needed to change object types on production lines.



Window for triggering the shutter operation

■ **Center of gravity**

The "center of gravity" is the geographical center of the image. It is determined by treating the binary image to be measured as an object that has mass.

■ **C mount**

A system for mounting lenses on a camera body. The flange back (the distance from the reference level for mounting a lens to the focal plane surface) is defined as 17.526 mm.

■ **Computer link**

Programmable controllers (PC) are equipped with communication protocols. The "computer link" is used to transfer data between the PC and an external computer, or the like, using this communication protocol. The IV-S30J supports the computer link protocols used by Sharp, Omron, and Mitsubishi PCs. Therefore, the PC does not need a custom communication program in order to create a computer link with the IV-S30J.

■ **Contraction**

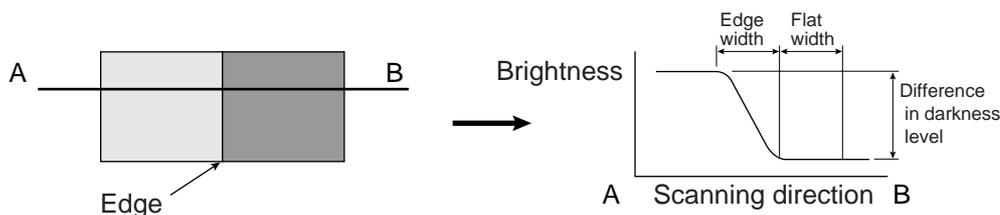
⇒ See "Expansion and contraction to eliminate binary noise in the image."

G

[E]

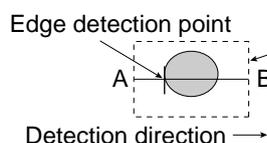
■ **Edge detection**

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

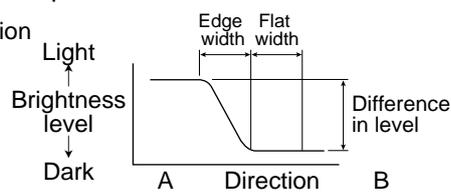
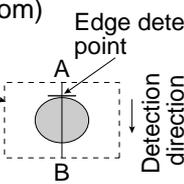


[An example of detecting a point using the edge detection function and user specified criteria]

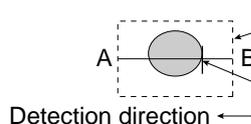
- Horizontal transition point from light to dark (moving from left to right)



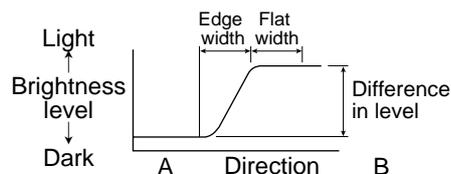
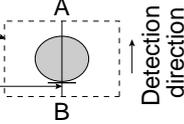
- Vertical transition point from light to dark (moving from top to bottom)



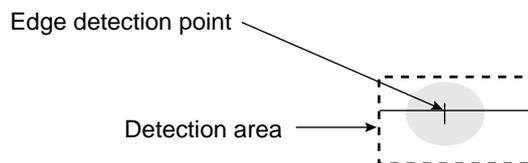
- Horizontal transition point from light to dark (moving from right to left)



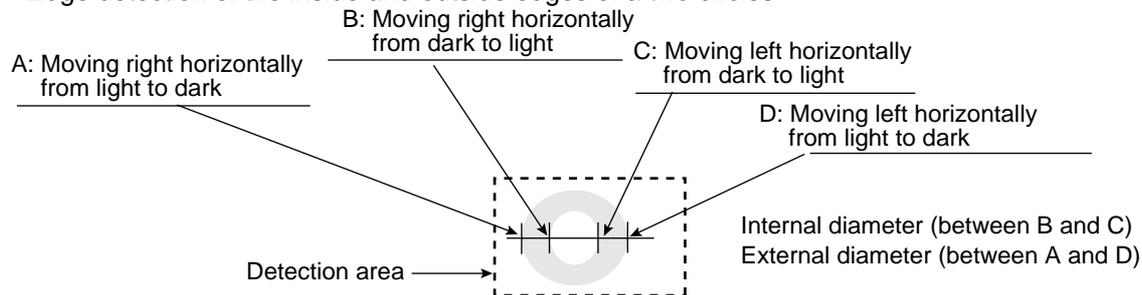
- Vertical transition point from light to dark (moving from bottom to top)



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



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



■ **Edge emphasis**

⇒ See "Space filter."

■ **Edge extraction**

⇒ See "Space filter."

■ **Expansion**

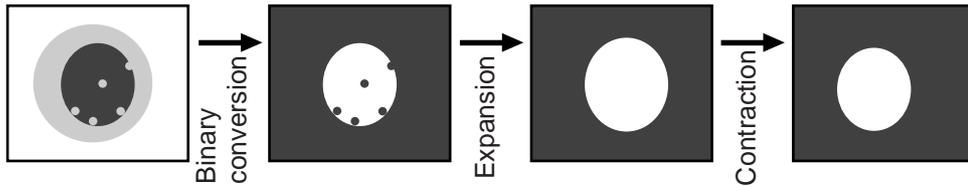
⇒ See "Expansion and contraction to eliminate binary noise in the image."



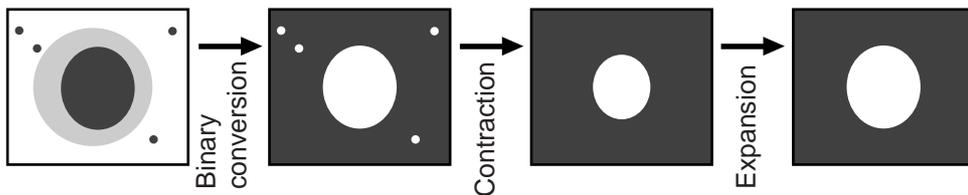
■ **Expansion and contraction to eliminate binary noise in the image**

When an image is converted to black and white, a number of unwanted dots may appear in the image. These noises can be eliminated during the preliminary processing. Dot control processing of binary values is used to eliminate this problem, as described below.

- ① Expansion  
If a white area contains a single, isolated black point, the system will interrupt the black point to white.
  - ② Contraction  
If a black area contains a single, isolated white point, the system will convert the white point to black.
- ① Expansion ➡ contraction  
Delete isolated black points by expansion and then restore the original image size by contraction.



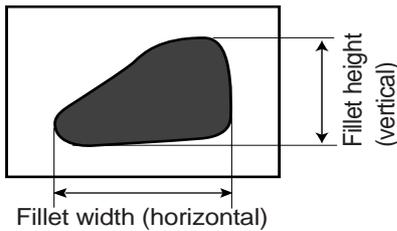
- ② Contraction ➡ expansion  
Delete isolated white points by contraction and then restore the original image size by expansion.



[F]

■ **Fillet width (shading width)**

Size of a hollow rectangle which closely matches to the target object in a binary image (white part). Horizontal direction: Length of a side parallel to the X axis. Vertical direction: Length of a side parallel to the Y axis.



■ **Flat width**

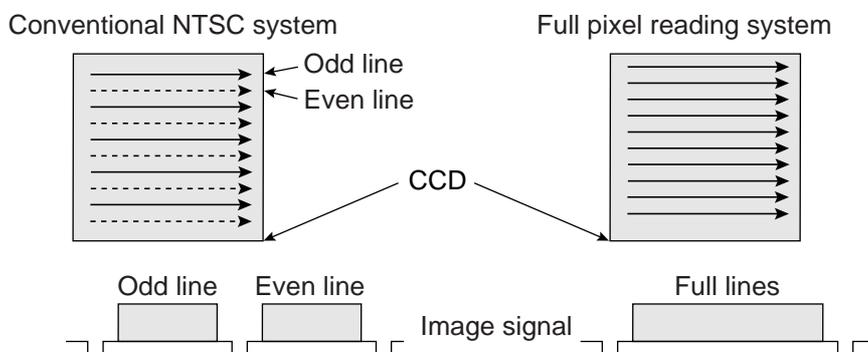
⇒ See "Edge detection."

G

### ■ Full pixel reading (progressive scan)

A system which reads all of pixels of image information from the CCD element one after another is referred to as "full pixel reading system." This system provides the same high resolution for moving objects as it does for static objects.

On the other hand, conventional CCDs using the NTSC scanning technique must read an object two times. First the odd lines are read and then the even lines. Therefore, NTSC system produces blurry images of moving objects. In order to solve this problem, the NTSC system can read only the odd lines. The disadvantage is that only half the resolution is available.



[G]

### ■ Gray scale check using the normalization correlation method

Even when the IV-S30J is looking at the same object as the object used for the reference image, the new target image and the previously stored reference image may not match completely, due to variations in the illumination conditions and the ambient light.

In order to check the resemblance between the two sets of image data, the normalization correlation method can be used.

In order to check whether or not the levels match using the normalization correlation method, the system slides the reference image one pixel at a time in the measurement objective range (measurement window), and calculates correlation value between the reference image and the target image. The position where the maximum correlation value can be obtained is treated as the position where the target image might exist, and the IV-S30J calculates resemblance level at this position.

The normalization correlation method also can be applied to binary images. However, gray scale images (images with shades of light) contain large volumes of information, compared with binary images (images with 256 levels of gray have 256 times the volume of information than in binary images). Therefore, gray-scale images offer more precision and more reliable results.

However, the larger the information volume, the larger the number of calculations that must be made for correlation values. This means that high speed processing hardware and software are required to use the normalization correlation method on the gray scale images.

### ■ Gray scale processing (gray image processing)

This is a process used to handle the unmodified captured image data, obtained from the CCD camera. In other words, the image data is not converted to binary values.

- This process produces more precise results than binary image processing (one pixel = one bit) by using 8 bits (one pixel = 256 gray levels) to represent each pixel in a gray scale image.

[Advantage] Theoretically, better precision and reliability can be offered because the image contains more information about the brightness of each pixel in the image.

[Disadvantage] More processing time is required because this approach must handle a large amount of data.

■ **Gray scale search (corrected gray scale search)**

The "gray scale search" function is a system for detecting a point where the input image and the reference image match, after calculating the matching levels in the input image and the reference image.

**[Procedures]**

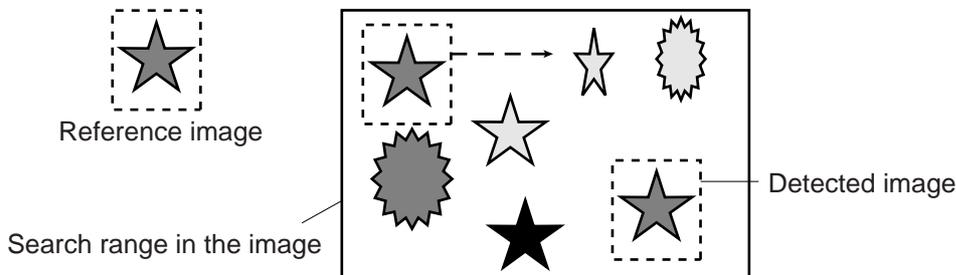
- ① Store the reference image as a gray scale image with 256 levels of gray.
- ② Capture the workpiece image to be measured.
- ③ Move the captured image of the object so that the upper left corner of the captured image is right on top of the upper left edge of the reference image. Calculates the level of matching between the two images, based on the stored gray scale image data.
- ④ Slide the reference image over one pixel width and then measure the level of matching at that position.
- ⑤ Repeat step ④ above for the whole workpiece image until a good match is found.

**(Output)**

Maximum matching level value  
The center coordinates where the highest level of matching is obtained

**(Application)**

Shape inspection  
Positional deviation measurement



[H]

■ **Halogen lamp**

Light source with halogen gas in the bulb. When a halogen lamp is lit, the halogen gas and vaporized tungsten combine. When the filament is heated, these combined particles reattach to the tungsten, instead of being deposited on the glass bulb, so that the original brightness of the lamp is maintained throughout its life span.

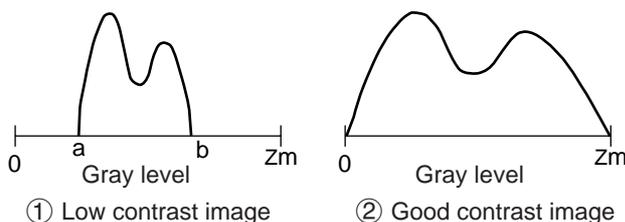
■ **High frequency lighting**

If a fluorescent lamp is powered by commercial electricity, it will flicker at 50 Hz or 60 Hz. Since the CCD scans images at 60 Hz, the brightness of the image may fluctuate due to the flickering of the fluorescent lamp.

By increasing frequency used to power the fluorescent lamp (employing a high frequency light), this type interference is eliminated and a stable image can be obtained.

■ **Histogram widening**

This is a method to widen the histogram for an image in which the histogram only occupies part of the available scale, thus improving the contrast. For example, in figure 1, the gray level values are concentrated in the [a, b] part of the range, and the [0, a] and [b, Zm] parts of the range are not used (the histogram is not expanded to use all of the gray scale values). This image has low contrast, since the image does not use the full dynamic range efficiently. Expand the histogram to cover the entire range of gray scale values, as shown in figure 2. The contrast will be improved.



[I]

■ **Illumination monitor alarm density setting**

The "illumination (light level) monitor" is a function which automatically monitors the environmental lighting conditions when measuring objects.

If the illuminance exceeds the alarm density setting, the IV-S30 will display an alarm message.

■ **Interline transfer system**

The interline transfer system is a system for transferring electrical charges from the CCD receiving elements to the read-out matrix.

The frame transfer system is a system for transferring electrical charge which uses the photo sensitive area to read out the charges. This system is subject to smearing noise since the area is used for both receiving and transferring the image.

■ **Island**

An "island" is a separate area which is created after labeling (object identification) process of the binary image.

[M]

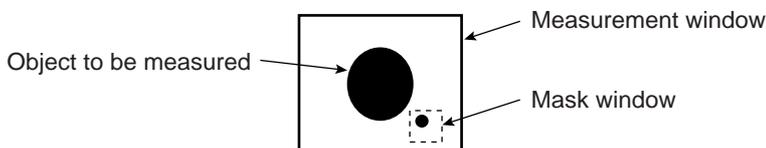
■ **Main axis angle**

The acute angle between the longitudinal and horizontal axes of a shape in the image after the measurement object is converted to binary. This angle cannot be measured for nearly circular or square-shaped objects.



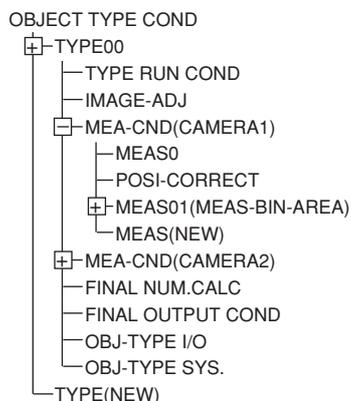
■ **Mask window**

The image being examined may contain an area that does not need to be processed. To eliminate such an area, a mask window is used.



■ **Menu tree**

The tree structure menu lets you find the setting parameter you need easily. Using the short cut function, you can move directly to a desired menu.



■ **Mid gray level emphasis**

Emphasize the mid gray level. This improves contrast while remaining the background image. Input image density(G) becomes output image density with the following formulas.

| Input image density | Output image density           |
|---------------------|--------------------------------|
| 0 to 127            | $(G - 127)^2 \times 127$       |
| 128 to 255          | $((G - 127) \times 127) + 127$ |

[N]

■ **Normalization correlation**

To determine whether the levels between the reference image and the input image match, the IV-S30J uses an information processing method called "normalization correlation." This is a method used to calculate relationship between two groups of data.

- Factors determining the correlation value

If the densities of the two images have the same tendency (positive correlation), the two images are said to resemble each other. If the densities of the two images have opposite tendencies (negative correlation), the two images are said not to resemble each other. Therefore, areas of the reference image and the input image which resemble each other (the areas of both images are brighter, or darker) are positive, and areas which do not (the areas of one is brighter and the other is darker) are negative.

- Correlation formula =  $\{ A \div \sqrt{B \times C} \} \times 10000$

A =  $N \sum (I \times T) - (\sum I) \times (\sum T)$ : Correlation between input image and reference image

B =  $N \sum (I \times I) - (\sum I) \times (\sum I)$ : Correlation between input images

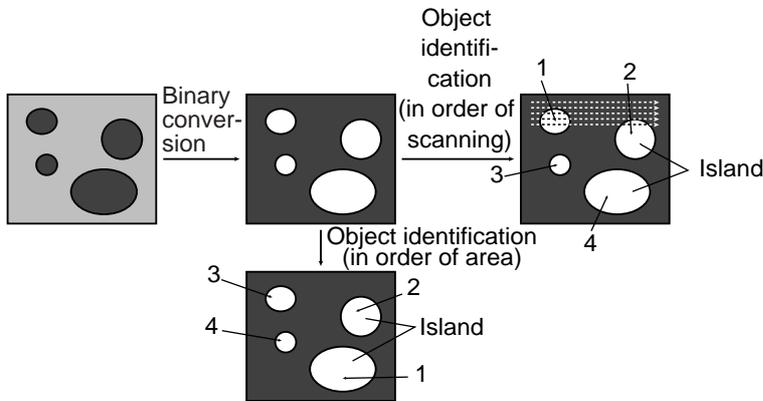
C =  $N \sum (T \times T) - (\sum T) \times (\sum T)$ : Correlation between reference images

(N: Area of reference image, T: Density of reference image, I: Density of input image)

[O]

■ **Object identification and numbering function (labeling)**

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



G

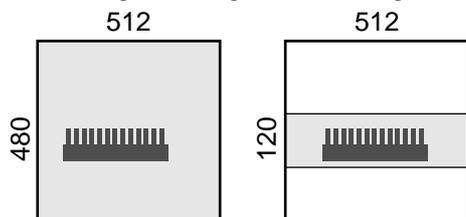
## [P]

### ■ Partial CCD reading

The "partial CCD reading" technique reads only that part of the CCD which contains the object needed for image processing. This can shorten the data transfer time from the CCD camera to the image memory. To read the entire CCD image (480 horizontal lines) takes approximately 33 ms. With the partial reading technique (e. g.: 120 horizontal lines) can take only 25 % of the time to read the entire image.

The IV-S30J can automatically determine the width of the partial image window. You can change back and forth between reading the whole image and a partial image.

Whole image reading    Partial image reading



### ■ Pixel

On the CCD, the electrically charged elements are in close proximity, arranged in a matrix (480 lines in vertical direction, 512 rows in horizontal direction). One element is equivalent to one pixel.

### ■ Progressive scan

⇒ See "Full pixel reading."

## [R]

### ■ Random shutter function

This function allows the CCD camera shutter operation to be triggered when even an object to be measured reaches a specified position in the camera's field of view.

In order to make a partial reading of the CCD image at high speed, the IV-S30J is equipped with the detection function described above with the works just like a proximity sensor to trigger the CCD. A proximity sensor can also be connected to the system.

### ■ Resolution

The CCD in the IV-S30J contains 512 pixels horizontally and 480 pixels vertically. If it takes a full picture, the resolution will be X/512 and Y/480.

## [S]

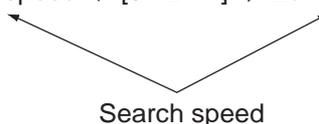
### ■ Search area

A portion of the target image to be compared with the reference image, using the gray scale search function.

### ■ Search pixel

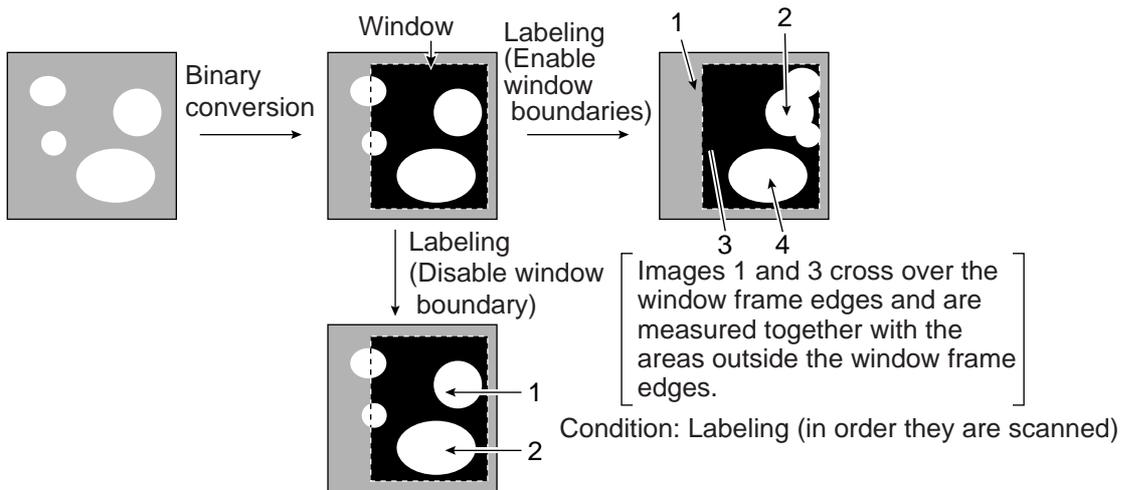
The relationship between detection precision and search speed, and also between pixel contraction (reduce the number of pixels in the image that must be searched) and search speed, is shown below:

- DETECTION PRECISION: High speed ← [STANDARD-HIGH] → Low speed
- PIXEL CONTRACTION: High speed ← [3 - 2 - 1] → Low speed



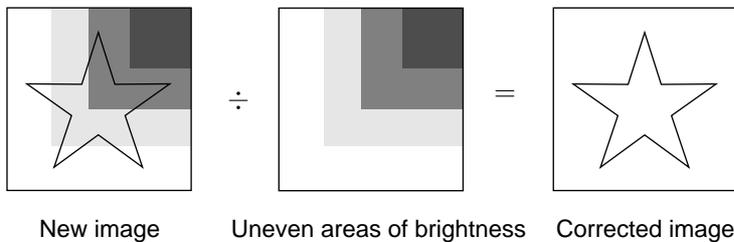
■ **Setting window boundaries (enable/disable)**

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



■ **Shading correction**

The process used to remove uneven gray areas (light level) from an image is called a shading correction. The figures below illustrate the principle of the shading correction. The new image has the areas of uneven brightness subtracted from it to produce a corrected image.



■ **Smoothing**

⇒ See "Space filter"

■ **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.

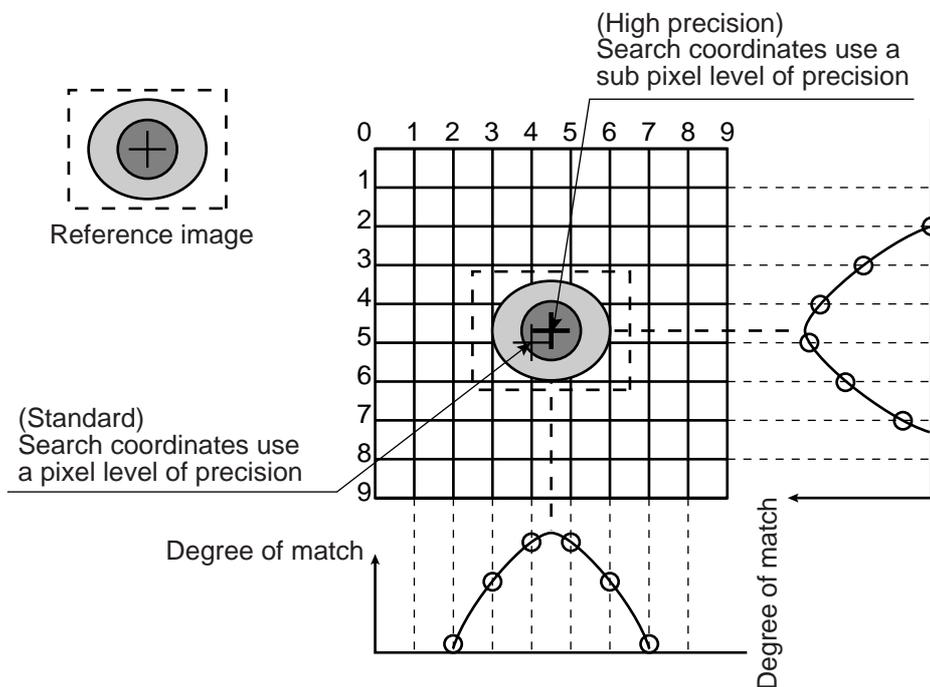
In the IV-S30J, you can select a "smoothing (average, center)," "edge emphasis," "edge extraction," "horizontal edge," and "vertical edge."

| Item                | Contents   |   |
|---------------------|--|---|
| Smoothing (center)  | - Specify the median pixel gray level from the surrounding 3 x 3 area.<br>- Since noise elements are difficult to select, they will not affect the output.       | - Display smooth images with decreased noise.<br>- Used to eliminated surface flaws and unevenness in the reflected light caused by protrusions or dents. |
| Smoothing (average) | - Specify the average pixel gray level from the surrounding 3 x 3 area.<br>- Since noise elements are included in the average, the noise will affect the output. | - This type of smoothing (averaging) is faster than the median smoothing.   |
| Edge emphasis       | - Display images with sharp boundaries between brighter and darker areas.<br>- 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.   |   |

■ **Sub pixel, pixel**

Refers to the pixel precision level to be used with the gray scale search function.

- A "pixel" is one picture element (DTECT PRECISION: STANDARD (detection precision: standard) in case of the IV-S30J). "Sub pixel" refers to a unit smaller than a single pixel (DTECT PRECISION: HIGH (detection precision: high) for 1/10 pixel in case of the IV-S30J).



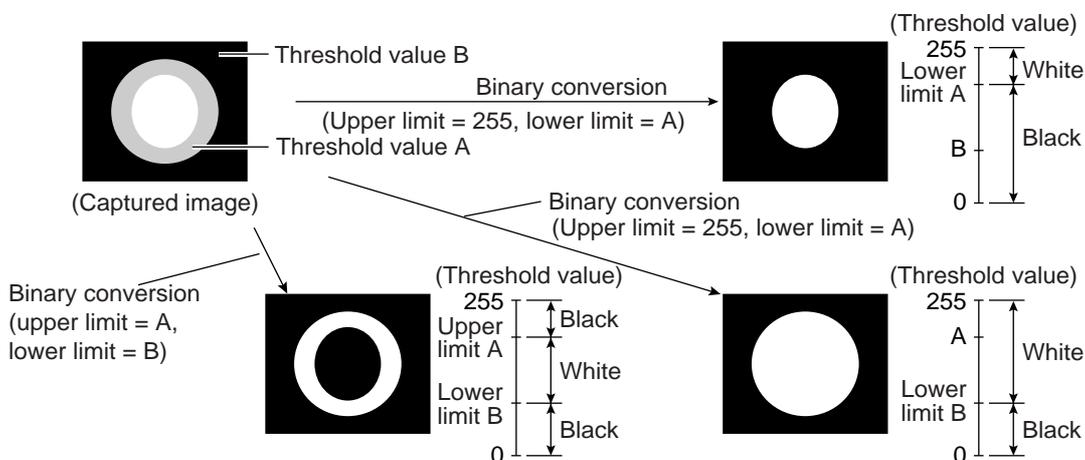
[T]

■ **Threshold value**

The criteria used for binary conversion of a gray scale image. If an area of the image is lighter than this threshold value, it is converted to 1. If an area of the image is darker than the threshold value, it is converted to 0.

■ **Threshold value setting**

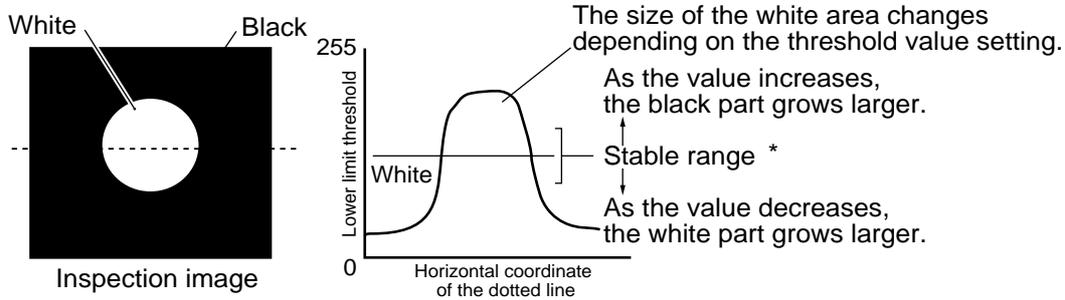
The IV-S30J treats the "areas darker than the lower limit value" or "brighter than the upper limit value" as "black." It treats that the areas between the upper limit value and lower limit value as "white." However, if the white-black reverse function is enabled, conversion to white/black will be reversed. 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.



G

**( Example for adjustment )**

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



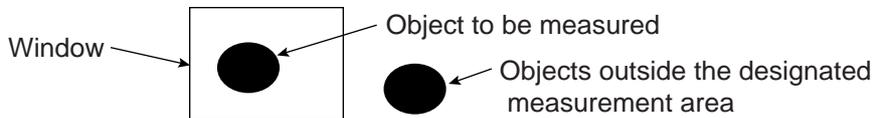
Changing the lower limit threshold value

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

[W]

■ **Window**

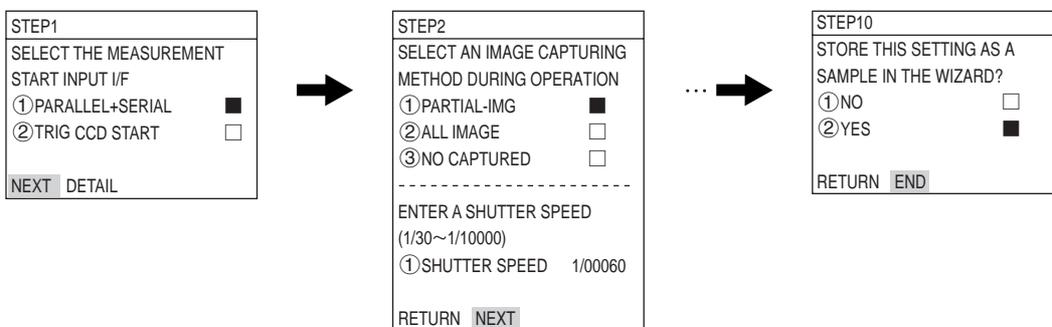
The IV-S30J captures images using CCDs, which are the light sensitive elements in the camera. The IV-S30J may capture more than one target image to be measured for image processing, and it may capture images not required for measurement. In these cases, a window is used to pick out just the desired target for measurement. The area inside the window will contain the object to be measured and the areas outside the window will be ignored.



■ **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.

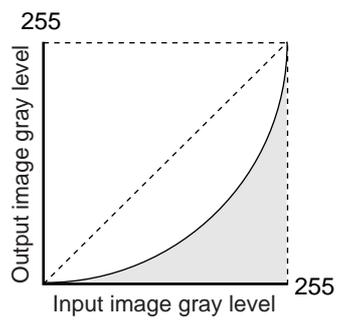
The wizard is convenient for making settings when beginners and inexperienced operators are operating the machine. However, operators who are familiar with the operation may save a lot of time by using other setting methods.



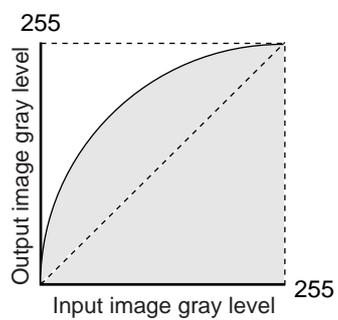
[γ]

**■  $\gamma$  negative correction**

Used when the mid gray level is too high.

**■  $\gamma$  positive correction**

Used when the mid gray level is too low.



# Appendix

## Appendix 1: Commercially available peripheral devices

Described below for your reference are peripheral devices needed to build a system around the IV-S30J. (Items handled by SHARP are listed on the next page.)

### (1) Lighting equipment

| Supplier   | Address  | Phone        |
|--|--|--------------|
| Moritex Corporation                                    | 3-1-14, Jingumae, Shibuya Ku, Tokyo, 150-0001                  | 03-3401-9711 |
| Nippoin-PI   | 1-17-1, Toranomom, Minato Ku, Tokyo, 105-000                   | 03-3504-3321 |
| Dentsu Sangyo Co., Ltd                                 | 6-1, 3 Chome, Kamifukuoka, Kamifukuoka City, Saitama, 356-0004 | 0492-64-1391 |
| Hayashi Watch-Works Co., Ltd., Special Item Department | 1-28-3, Kita Otshuka, Toshima Ku, Tokyo, 170-000               | 03-3918-5237 |

### (2) Lens (mirror barrel)

| Supplier  | Address   | Phone        |
|---|---|--------------|
| Moritex Corporation                                   | 3-1-14, Jingumae, Shibuya Ku, Tokyo, 150-0001         | 03-3401-9711 |
| Seiwa Optical Mfg. Co., Ltd.                          | 12-17, 4 Chome, Yayoi Cho, Nakano Ku, Tokyo, 164-0013 | 03-3383-6301 |
| Asahi Precision Co., Ltd., Optical machine Department | 1-21, 1 Chome, Shirako, Wako City, Saitama 351-0101   | 048-466-8801 |
| CBC Co., Ltd.   | 2-15-13, Tsukishima, Chuo ku, Tokyo, 104-0052         | 03-3536-4766 |
| Tamuron Co., Ltd., Special Item Sales Department      | 1385, Hasunuma, Ohmiya City, Saitama, 330-0015        | 048-684-9129 |
| Canon Sales Co., Ltd., Optical Lens Sales Department  | 2-13-29, Minato Minami, Minato Ku, Tokyo, 108-0072    | 03-3740-3388 |

### (3) Optical filter

| Supplier  | Address                                  | Phone        |
|---|--|--------------|
| Sakai Glass Engineering Co., Ltd., Optic Department | 2-3-6, Sengoku, Koto Ku, Tokyo ,135-0015 | 03-3647-6031 |

■ Table of standard items related to the IV-S30J handled by SHARP

| SHARP's article Nbr. | Moritex's article Nr. | Item name                        | Specifications                                      |
|----------------------|-----------------------|----------------------------------|---|
| IV-1A0101            | ML-0614               | CCTV lens                        | C mount f = 6 mm                                    |
| IV-1A0102            | ML-0813               | CCTV lens                        | C mount f = 8 mm                                    |
| IV-1A0103            | ML-1214               | CCTV lens                        | C mount f = 12 mm                                   |
| IV-1A0104            | ML-2514               | CCTV lens                        | C mount f = 25 mm                                   |
| IV-1A0105            | ML-3514               | CCTV lens                        | C mount f = 35 mm                                   |
| IV-1A0106            | ML-5018               | CCTV lens                        | C mount f = 50 mm                                   |
| IV-1A0107            | ML-7527               | CCTV lens                        | C mount f = 75 mm                                   |
| IV-1A0201            | ML-EXR                | Close up ring                    | A set of 7 intermediate rings                       |
| IV-1A0301            | MIML1-65D             | Telecentric lens MY              | C mount 1x  |
| IV-1A0302            | MIML2-65D             | Telecentric lens                 | C mount 2x  |
| IV-1A1101            | ML17-07516            | CCTV lens                        | φ17 mm mount f = 7.5 mm                             |
| IV-1A1102            | ML17-1520             | CCTV lens                        | φ17 mm mount f = 15 mm                              |
| IV-1A1103            | ML17-2431             | CCTV lens                        | φ17 mm mount f = 24 mm                              |
| IV-1A1301            | MML1-65D-CM1          | Telecentric lens                 | φ17 mm mount 1x                                     |
| IV-1A1302            | MML2-65D-CM1          | Telecentric lens                 | φ17 mm mount 2x                                     |
| IV-2A0101            | MHF-H50LR             | Halogen light source             | 50 W  |
| IV-2A0102            | MHF-D100LR            | Halogen light source             | 100 W   |
| IV-2A0103            | MHF-150L              | Halogen light source             | 150 W   |
| IV-2A0201            | LM-50                 | Halogen lamp                     | 12 V, 50 W  |
| IV-2A0202            | LM-100                | Halogen lamp                     | 12 V, 100 W   |
| IV-2A0203            | LM-150                | Halogen lamp                     | 12 V, 150 W (high luminous)                         |
| IV-2A0204            | LM-150C               | Halogen lamp                     | 12 V, 150 W (long life)                             |
| IV-2A0301            | MRG31-1500S           | Ring light guide                 | φ 31 x 1500 mm                                      |
| IV-2A0302            | MRG48-1500S           | Ring light guide                 | φ 48 x 1500 mm                                      |
| IV-2A0401            | MSG4-1100S            | Straight light guide             | φ 4 mm, 1100 mm                                     |
| IV-2A0701            | MPP60-1500S           | Surface illuminating light guide | 60 x 60 mm, 1500 mm                                 |
| IV-2A0901            | KA-03                 | Crystal adapter                  | Needed when the IV-2A0701 is used with an IV-2A0102 |

The items listed above are all Moritex products.

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