SHARP®

®

Compact image sensor camera

IV-S30

User's Manual (Introduction and Hardware)

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

Thank you for purchasing the SHARP IV-S30 compact image sensor camera. Read this introductory user's manual carefully to thoroughly familiarize yourself with the functions and proper procedures for operation. Store this user's manual in a safe place. We are confident that the manual will be helpful whenever you encounter a problem.
In addition to this manual, there are two other IV-S30 manuals as follows. Read them in conjunction with this manual.

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

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

Notes

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

Important

When you install the IV-S30 at an European site, use only equipment that complies with the EMC standards. Take the steps described below using the specified cable and EMC core.
- Install a noise filter on the DC power source input lines.
- Use shielded wires for input/output lines.
- Install ferrite cores on input/output lines.

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 rinstruction 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 IV-S31M/S32M/S33M 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-S30 compact image sensor camera). Otherwise a breakdown or damage to other equipment may occur due to a problem with the IV-S30.

⚠ 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

⬦ Warning
- The IV-S32M/S33M controller contains a lithium battery. Do not expose the IV-S32M / S33M directly to flames as the battery may explode and seriously injure people nearby.

🚫 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-S30.   If you don't, electric shocks, malfunctions or breakdowns may occur.

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Chapter 1: Outline

This compact image sensor camera system, the IV-S30 (using the IV-S33M controller), dramatically reduces overall processing time, thanks to a camera with double and quadruple speeds, SHARP's partial-image capture function, and a high-speed gray search function. It will not only contribute to high-speed, high-efficiency inspection and measurement processes, but it will also help you keep your prices competitive.

1-1 Features

■ It is now possible to inspect every item in a production run, thanks to high-speed processing

High-speed camera offers double and quadruple speeds. SHARP's unique partial-image capture function and high-speed gray search function provide higher overall speed. This system can inspect approximately 5,000 * pieces per minute (using the IV-S33M controller). Such high speed makes it possible to inspect all the chips or parts in a production lot.
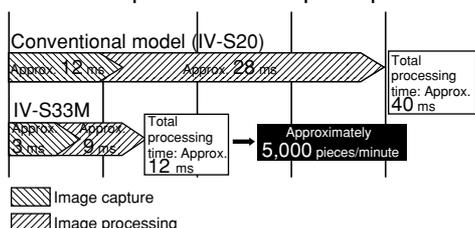
    * The total processing times above are true when the measurement conditions are: a 64 x 64 model; a 160 x 160 search, contraction is set to 3; the shutter speed is 1 ms; and a partial image that is 33% of the total image area is specified.

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

The IV-S30C2/C4 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.

■ Conventional EIA (data) cameras can be used with the controller

The IV-S33M controller can connect two EIA specification cameras using a converter. Just by replacing the controller in the image processing section, you can achieve high-speed processing at decreased cost.
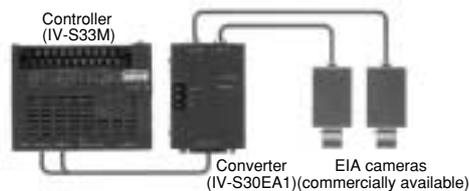
■ Simple and speedy setting makes for easy setups

No need to create a measuring program. You just set the measuring conditions using the remote keypad. In addition, the IV-S33M can automatically set the binary conversion threshold value and evaluation conditions by just pressing the SET key.

■ NG displays and data are transferred quickly, for truly useful NG handling

The IV-S33M can check an NG image and a part's NG history while measuring. Using the USB communication bus, NG images can be transferred to a personal computer in less than 7 seconds. The causes of NG products can be fed back to the design section, leading to quick improvements in the quality of your products.

■ 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.

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- **High-speed processing now possible using a high-speed camera and a partial-image capture function**

  The IV-S30 (with the IV-S33M controller) can use double and quad-speed cameras that employ progressive type CCDs. Using SHARP's unique, partial-image capture function, the IV-S30 offers very high-speed image capturing. By selecting the best of five image capturing modes to match your inspection and measurement conditions, this system helps reduce the processing time even further.

Full-image, full-line mode
Scan every line in the whole image
IV-S31M/32M/33M + standard camera
33.3ms
IV-S33M + hight-speed camera
16.7ms

Full-image, half-line mode
Scan half of the lines in the whole image
IV-S33M + hight-speed camera
8.3ms

Partial-image, full-line mode
Scan every line in the whole image
IV-S31M/32M/33M + standard camera
16.7ms
IV-S33M + hight-speed camera
8.3ms
Note

Partial-image, half-line mode
Scan half of the lines in just the specified area
IV-S33M + hight-speed camera
4.2
Note

Partial-image, full-line mode and background half line mode
Scan every line in part of the image and scan half of the lines in the rest.
IV-S33M + hight-speed camera
12.5ms

* The Partial-image modes are available when scanning 240 out of 480 vertical lines.
* Standard camera: IV-S30C1/C2, High-speed camera: IV-S30C3/C4
* Full-line mode: Scan odd and even lines. Half-line mode: Scan only the odd lines.

Note: The scan time will vary with the position of the partial image to scan. (In the cases given above, there is a maximum of 0.4 ms of difference.)

- **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-S30 can shorten this process using 9 ms high-speed processing * (IV-S33M)

Gray search time
Conventional model (IV-S20) Approx. 37 ms
IV-S31M Approx. 18 ms
IV-S32M Approx. 12 ms
IV-S33M Approx. 9 ms

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

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

  The IV-S33M can be simultaneously connected to two IV-S30C3/C4 high-speed cameras or 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. By triggering the cameras at the same time, the system can capture two images, and display the images above and below each other, or left and right.

  * Combined use of a high-speed camera and a standard camera is not possible.

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- **You can cut your camera costs by using your current camera (IV-S33M)**
  Two, commercially available EIA cameras can be connected using an IV-S33EA1 special converter. This means that you can use your current EIA cameras the same as before, and just replace your image processing section with the IV-S33M. Installation and adjustment of lighting, camera, and lenses is easy and can cut your costs.

- **CCD trigger function does not need an external sensor**
  After a trigger window is setup, the IV-S30 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.
  * The gray search trigger function is only available on the IV-S33M.
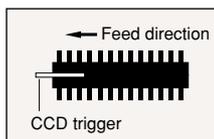
- **Shutter speed freely set**
  The shutter speed can be set anywhere between 1/30 and 1/10000 second for each object type. Practically, this means that the light level can be adjusted without changing the lighting equipment for each object type. The random shutter function is used to close the shutter 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 (IV-S33M)**
  Using the SET key, the IV-S33M can automatically set the threshold values (binary conversion, density difference, and edge width), that used to be set by entering numbers manually. To determine the upper and lower limits of the OK and NG criteria, you only need to measure an OK workpiece. Therefore, you no longer need to rely on skill, or experience to make accurate measurements at high speed.

- **Automatic search reference images (IV-S33M)**
  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 (IV-S33M)**
  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.

- **CE approval applied for, widely accepted in international markets**
  The reliability of the IV-S30 means that it can be used in units destined for overseas markets.

- **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, BGA/CSP inspection[1], multiple position measurement[2], and multiple degree of match inspection[2].

  [1] IV-S32M/S33M only, [2] IV-S33M only.

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• **Measure a large number of object types: the IV-S30 can register up to 64 object types**
The IV-S30 can keep track of more than one set of measurement conditions. The shape of an object, its position and your desired measurements are all programmable. Therefore, it can be used on a production line that produces multiple, slightly or greatly different models.
(IV-S33M: Maximum 64 items, IV-S32M: Maximum 32 items, IV-S31M: Maximum 16 items)

• **Integrated micro PC function**
The IV-S30 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.

• **Displays and transfers NG images while measurements are being made (IV-S32M/S33M)**
The IV-S33M can check an NG image history (up to 128 images) while measuring, or simultaneously display a measured image and an NG image by splitting the screen. While measuring, the controller can send NG images over the USB bus (12 Mbps) to a personal computer at high speed (approximately 7 seconds per image). Since you can collect and analyze NG images in real time, the NG rate can be decreased by finding the cause and making corrections immediately.
(The IV-S32M can display NG images when measurements are stopped.)
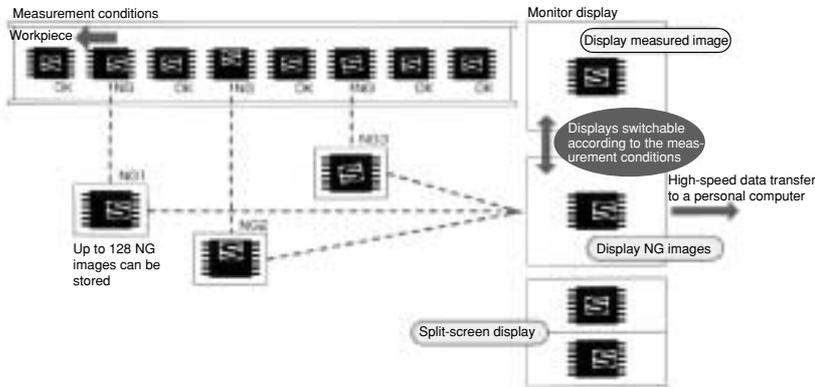
1-2 Controller

[1] Software version of the controllers

This manual describes the controllers (IV-S31M/S32M/S33M) and their respective software versions below.

Controller	Software version
IV-S31M	V2.02
IV-S32M	V2.02
IV-S33M	V1.01

[2] Differences between types of controllers

The controller models (IV-S31M/S32M/S33M) have the following specifications.

Item		IV-S31M	IV-S32M	IV-S33M
Number of object types handled		16	32	64
Maximum number of reference images/ total number of images		300/3	600/8	600/8
Gray search time*		18 ms	12 ms	9 ms
Connecting camera	Standard camera (IV-S30C1)	○	○	○
	Micro camera (IV-S30C2)	○	○	○
	High-speed camera (IV-S30C3)	-	-	○
	Micro, high-speed camera (IV-S30C4)	-	-	○
	EIA camera (commercially available)	-	-	○
Split display of two camera images on the left and right sides of the screen		-	-	○
Number of NG images that can be stored (Maximum 128 images)		-	○	○
Calendar/timer		-	○	○
BGA/CSP inspection		-	○	○
Input terminal block	Object type be changed	X1 to X4	X1 to X5	X1 to X6
	External input	X5 to X7	X6, X7	X7
Power consumption		7W	7W	7W

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

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

For other specifications, see pages 8-1 to 8-3 in "Chapter 8: Specifications."

[3] Upgrade details

(1) IV-S33M

This manual describes the IV-S33M using software version V1.01.

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

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

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

For details about using the added functions (standard menu), see the "IV-S30 (IV-S31M/S32M/S33M) User's Manual, Function and Operation"

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(2) IV-S31M/S32M

This manual describes the IV-S31M/S32M using software version V2.02.

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

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

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

For details about the added functions (standard menu), see the "IV-S30 (IV-S31M/S32M/S33M) User's Manual, Function and Operation"

1-3 Measurement program

The IV-S30 integrates the following eight measurement programs: Positional deviation,degree of match inspection, lead inspection, BGA/CSP inspection (IV-S32M/S33M), area measurement by binary conversion, object counting by binary conversion, object identification (labeling) measurements by binary conversion, multiple position measurement (IV-S33M), 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-S30.

[1] Positional deviation measurement

Purpose	The gray scale search function makes it possible to measure positional deviation as well as the absolute position. - It is also possible to detect the position of sub-pixel units with great accuracy. - A rotation angle of 360° can be detected. (When a one point gray search is selected).
Application	Used to determine the position of machine parts and substrates.
Example	**[Determining the location of the positioning (the fiducial mark) mark that identifies the position of the substrate]** **(1) 1 point search: Detecting the deviation in position in X and Y directions** **(2) 2 point search: Determining positional deviation in X and Y directions as well as rotational deviation** - The deviation angle θ, determined in the 2-point search, is used to readjust the rotation of the image for measurements 1 to 4.
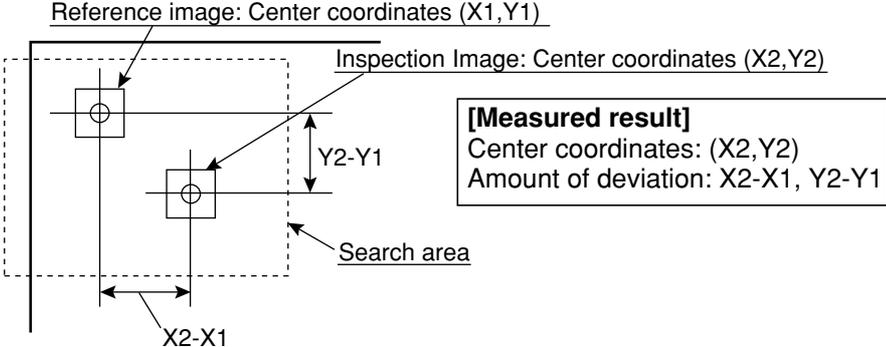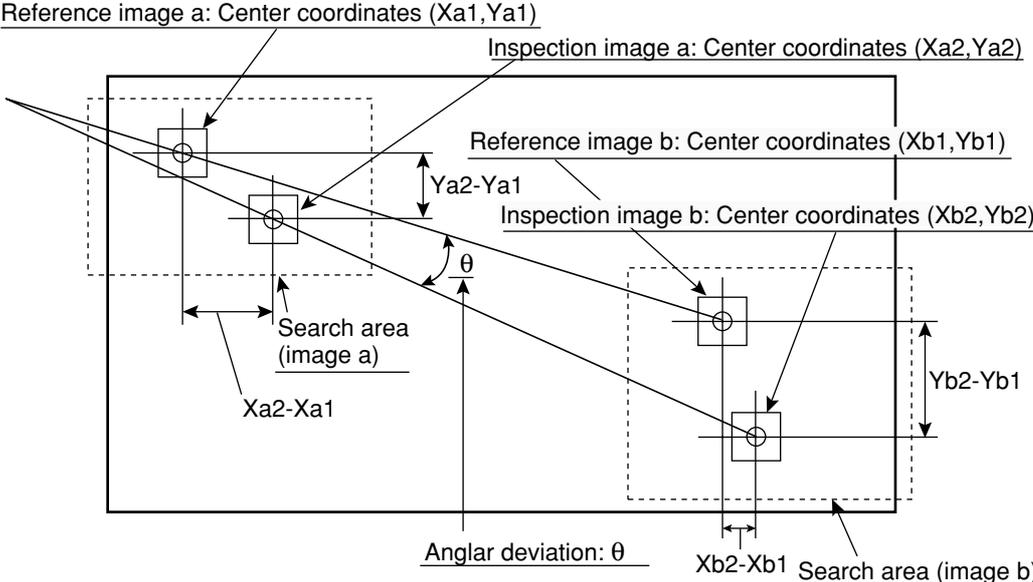
[2] Degree of match inspection

Pur-pose	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.) A matching level comparison using binary images is also possible.
Appli-cation	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.
Exam-ple	**[Detecting label deviations on packages]** ▲**Good label**　　　▲**NG label** 　**[Measured results]** 　- Degree of match compared with the reference image 　- Detected coordinates (X/Y) of the measurement image. 　- Light level in the measured image (average light level/absolute value of difference) **- Inspection procedure** 　① Conduct a gray scale search of the criterion image position 　② Correct the position of the object being measured from the coordinates for the criterion image obtained in item ① above. 　③ If the matching level of the test image is low, the IV-S30 can determine that the label position is NG.
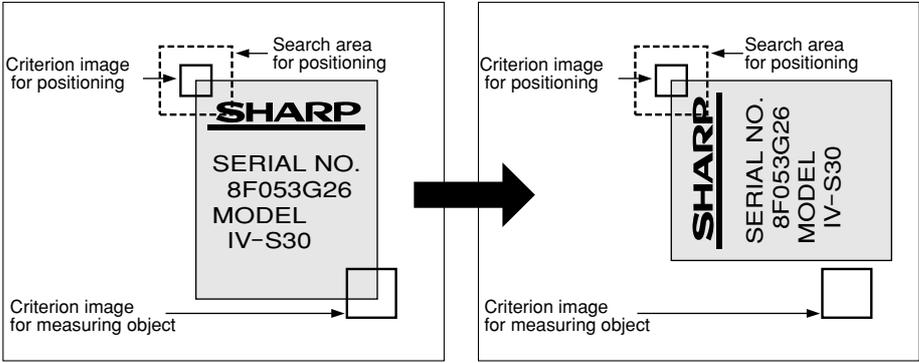
[3] Lead inspection

Pur-pose	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.)
Appli-cation	Inspect the IC leads and connector pins
Exam-ple	**[Inspect the layout of the IC leads and connector pins]** **[Lead inspection]** 　- Number of leads K 　- D0 to D2:　Distance between leads 　- W0 to W3: Lead width 　- L0 to L3:　Lead length **- Inspection procedure** 　① Determine the measurement points (K0 to K3) from the mid points of the leads and the reference line. 　② Calculate the distances between the leads (D0 to D2) using the measurement points. 　③ Calculate the lead lengths (L0 to L3) from the measurement points (K0 to K3) toward the lead measurement limit line. 　④ Calculate the lead widths (W0 to W3) centering the measurement points.
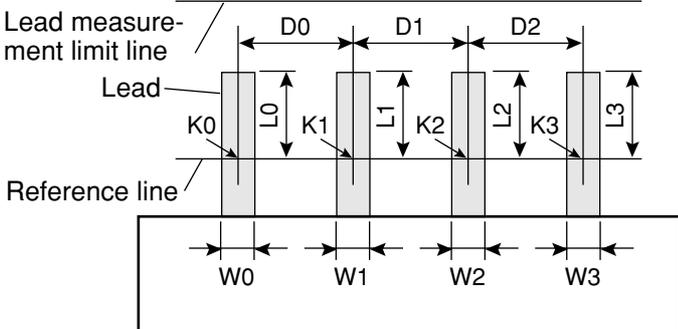
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[4] BGA/CSP inspection (IV-S32M/S33M)

Pur- pose	Measure the center of gravity, area of each object, number of objects, and fillet diameter using the object identification function after binary conversion.
Appli- cation	Inspecting BGA/CSP solder balls.
Exam- ple	**[Measurement of 6 balls]** Object 0 Object 1 Object 2 **[Measured results]** - Number of objects: K - Area of each object: R0 to R127 - Distance between centers of gravity: (DX0, DY0) to (DX127, DY127) - Fillet diameters: FX, FY Object 3 Object 4 Object 5 **- Inspection procedure** Image capture → Binary conversion → Object identification (numbering) → Measure centers of gravity → Fillet diameters Area of each object → Ball size Distance between centers of gravity for pairs of balls → Distance between balls → Number of balls

[5] Area measurement by binary conversion

Pur- pose	Detect the existence/absence and size of a workpiece when "the workpiece is one point" or "measurement position is fixed." - Convert the specified pixel area to binary values and measure the size of the white area.
Appli- cation	Check for the existence of bearings inserted by a bearing insert machine, prevent contamination of different parts in automobile production lines, determine the type of water-proof caps, check for the existence/absence of bottle labels, inspect the cuircuit traces on PWBs, check for the presence of grease, check for existence of frozen foods.
Exam- ple	Workpiece **[Measured result]** - Workpiece area **- Inspection procedure** Capture image → Convert to binary values → Measure (area)
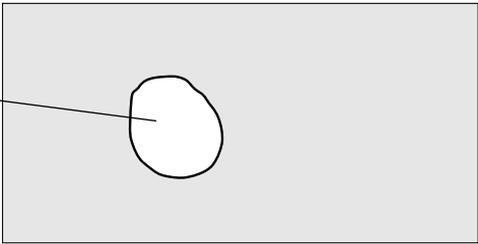
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[6] Object counting by binary conversion

Pur-pose	Checks the number of objects (max. 3000 pcs.) when there is more than one object in an image arranged arbitrary. - When the specified pixel field has been converted to a binary image, the white areas are measured or identified as separate objects and counted.
Appli-cation	Counting pieces of food or parts
Exam-ple	 **[Measured result]** - Number of workpieces/total area size **- Inspection procedure** Capture image → Convert to binary values → Measure (quantity, total area size)
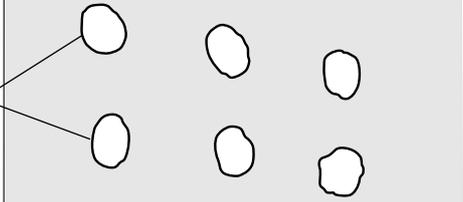
[7] Object identification (labeling) by binary conversion

Pur-pose	When there are several objects and the measuring position is arbitrary, the presence or absence of objects and the size of the objects can be determined. - The specified pixel area is converted to a binary image. The number of objects, total size of the white area (the objects) and the area, center of gravity, main axis angle, fillet diameter, center point, and circumference of each white area can be measured.
Appli-cation	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.
Exam-ple	**[Measurement of 6 objects]** **[Measured result]** - Object identification (numbering), number of objects present, total area. - Center point (IV-S33M only),area, center of gravity, main axis angle, fillet diameter, circumference, and center point of each object. **- Inspection procedure** Image capture → Convert to binary values → Object identification (numbering) → Measurement (area, gravity center, main axis angle, fillet diameter, circumference, and center point)
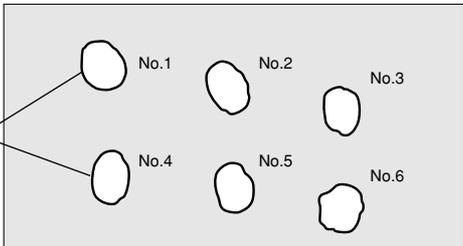
1

[8] Point measurements

Purpose	The presence or absence of target objects is examined. - A simple black or white evaluation is made in the specified pixel area of binary images. - The light level in the specified pixel area is averaged, and a decision is made whether or not it is within the specified lightness range in gray scale images.
Applications	Checking the presence or absence of packed parts, inspecting the working condition of LEDs or fluorescent character display tubes, and sorting household electric appliances.

Example	**[Inspection at 6 points]**
	
	Number of points (max.)
	  : 128 points at average light levels
	    256 points in binary images
	Point size: 2 m x 2n pixels
	        (m, n = 1 to 16)
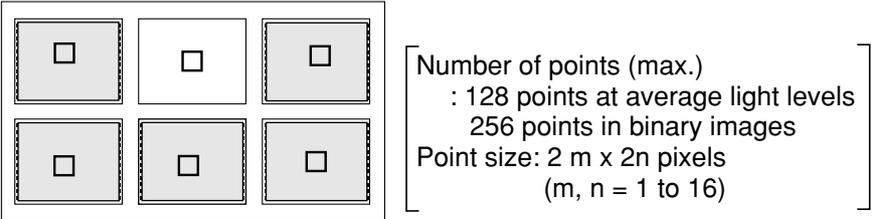	
	- Inspection procedures
	
	Image capture → Binary conversion → Black/white evaluation of points
	
	→ Average light level → Light level evaluation of points

[9] Distance and angle measurement

Purpose	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. - This function can measure the following distances and angles: distance between two points, X coordinate distance, Y coordinate distance, the angle between three points, the horizontal angle of two points, and the vertical angle of two points. - The following points and lines can be set: center point, circle center point, gravity center, point where two straight lines cross, line passing through two points.
Application	Measurement of mounted electronic parts
Example	**[Measuring IC packages]** Criterion image a Search area (criterion image b) Search area (criterion image a) Criterion image b Register criterion image a and b by matching edges of the IC package. **- Measurement procedures** ① Find the center points of criterion images a and b using a 2-point gray scale search. ② Determine the distance between the two center points.
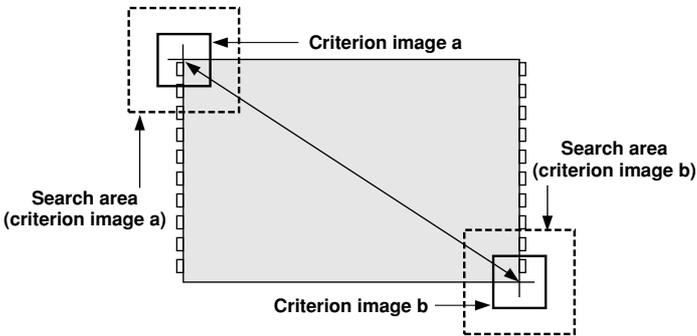
1

[10] Multiple position measurement (IV-S33M)

Purpose	The IV-S33M 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. - The positional deviation measurement needs to have a number of positions registered for measurement. However, this measurement only requires you to register one position and reduces the set up time.
Application	Measure the position of workpieces with a complicated light level that cannot be converted into binary images.
Example	● **Gray search** Reference image ⇒ Four workpieces detected **[Measured results]** - Number of images detected - Coordinates and degree of match detected for each image ● **Edge detection** **[Measured results]** - Number of points detected - Coordinates detected for each points L1 L2 L3 This is useful for obtaining the distance between the coordinates of a position. - L1 to L3 can be calculated by measuring distances and angles.
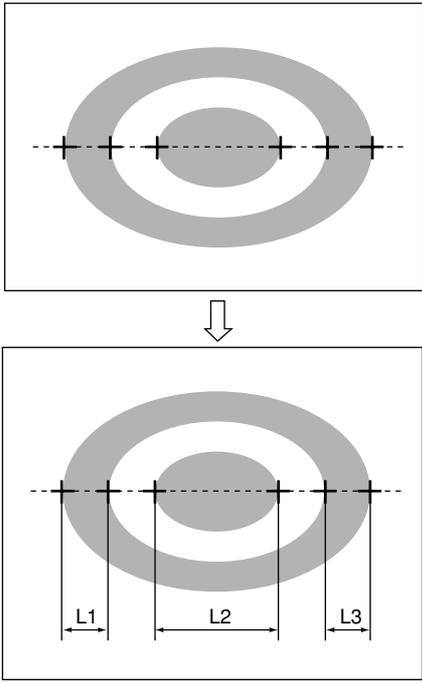
[11] Multiple degree of match inspection (IV-S33M)

Purpose	Using the gray search function, the IV-S33M can detect up to 128 workpieces whose captured image exceeds the required degree of match with the reference image.
Application	Inspect (or count) workpieces that have complicated light levels and cannot be converted into binary images
Example	Reference image ⇨ Four workpieces detected **[Measured results]** - Number of images detected - Degree of match, density (average/absolute difference), and detected coordinates

Chapter 2: Precautions for Use

Pay attention to the points below when handling the IV-S30.

(1) Installation
- Each device in the IV-S30 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-S30 (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-S31M/S32M/S33M 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-S30. 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-S30 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-S30.

(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

[1] When the IV-S31M/S32M is used as the controller
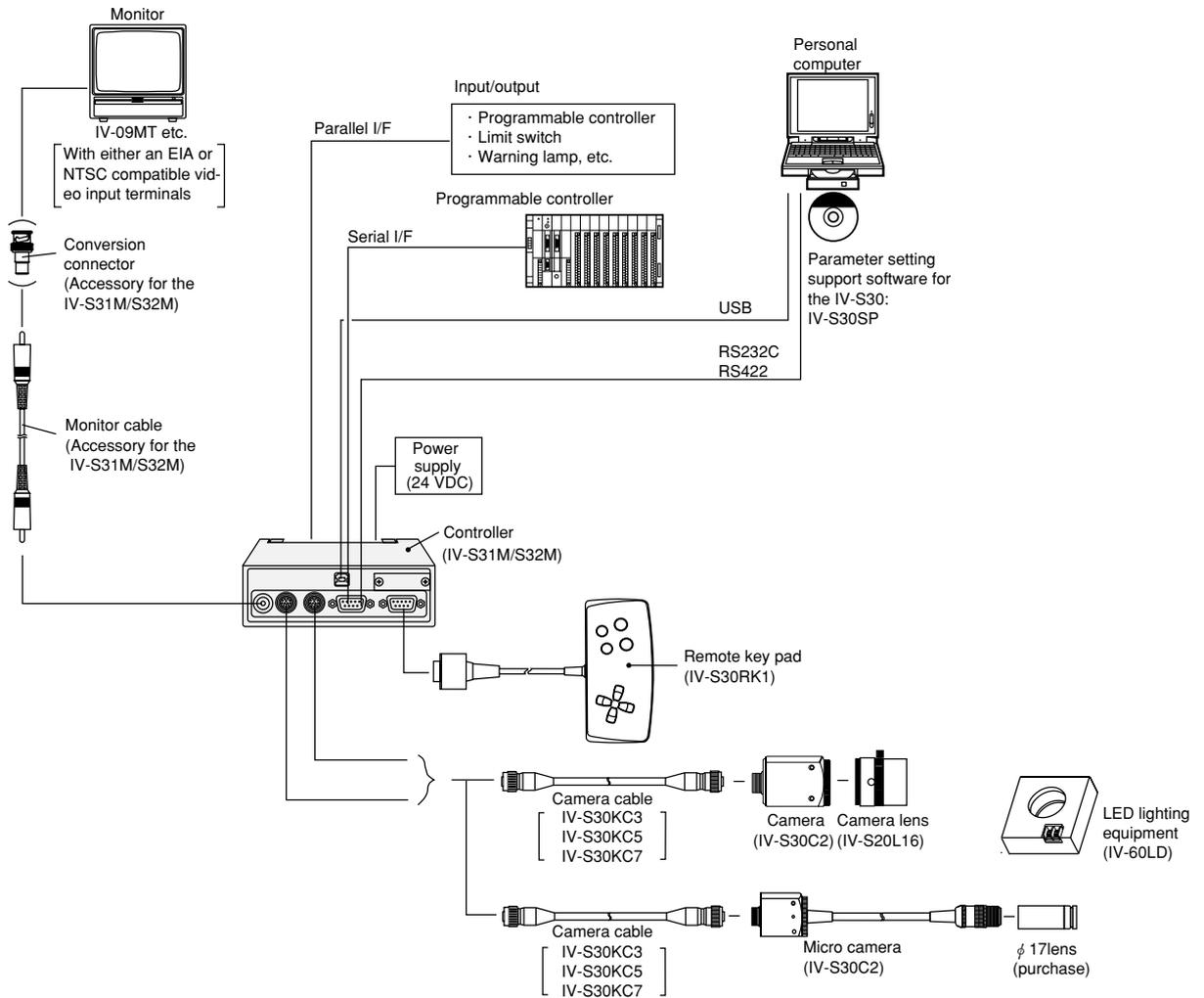
- A maximum of two cameras can be connected to the IV-S31M/S32M.
- An IV-S20C1 camera (for the IV-S20) also can be connected using a camera conversion cable (IV-S30HC).

■ Product lines

Item name		Model name	Specification or details
Camera	Standard	IV-S30C1	Camera main housing (without lens or camera cable)
	Micro	IV-S30C2	Camera main housing (without lens or camera cable)
Camera cable		IV-S30KC3	Cable for IV-S30C1/C2 camera, 3 m
		IV-S30KC5	Cable for IV-S30C1/C2 camera, 5 m
		IV-S30KC7	Cable for IV-S30C1/C2 camera, 7 m
Camera lens		IV-S20L16	C mount lens with a 16 mm focal length
Remote keypad		IV-S30RK1	Keys for remote entry
Parameter setting support software		IV-S30SP	Runs on Windows95/98/NT4.0
Image processing library		IV-S30LB1	Runs on Windows95/98/NT4.0
Monochrome monitor		IV-09MT	Monochrome 9 inch monitor
LED lighting equipment		IV-60LD	Integrated light source and controller in one housing

- For details about the IV-S30SP, IV-S30LB1, IV-09MT, and IV-60LD, see the individual instruction manuals.

[2] When the IV-S33M controller is used

3

Monitor

IV-09MT etc.
[With either an EIA or
NTSC compatible vid-
eo input terminals]

Conversion
connector
(Accessory for the
IV-S31M/S32M)

Monitor cable
(Accessory for the
IV-S31M/S32M)

Parallel I/F

Input/output
· Programmable controller
· Limit switch
· Warning lamp, etc.

Serial I/F

Programmable controller

Personal
computer

Parameter setting
support software for
the IV-S30:
IV-S30SP

USB

RS232C
RS422

Power
supply
(24 VDC)

Monitor cable
(Accessory for the
IV-S33M)

Remote key pad
(IV-S30RK1)

Camera cable
[IV-S30KC3
IV-S30KC5
IV-S30KC7]

Camera
(IV-S30C1)

Camera lens
(IV-S20L16,etc)

LED lighting
equipment
(IV-60LD)

Camera cable
[IV-S30KC3
IV-S30KC5]

High-speed
camera
(IV-S30C3)

Camera lens
(IV-S20L16,etc)

Camera cable
[IV-S30KC3
IV-S30KC5
IV-S30KC7]

Micro camera
(IV-S30C2)

ϕ 17 lens
(purchase)

Camera cable
[IV-S30KC3
IV-S30KC5]

Micro, high-speed camera
(IV-S30C4)

ϕ 17 lens
(purchase)

Main housing cable
(IV-S30EA1 accessory)

Camera converter
(IV-S30EA1)

EIA camera
(Maximum of two --
commercially available)

- A maximum of two cameras of the same type can be connected to the IV-S33M.
- Mixed use of different camera types (IV-S30C1/C2, IV-S30C3/C4, and EIA cameras) is not
  supported.
- The IV-S30KC7 camera cable cannot be used with the IV-S30C3/C4 high-speed camera.
- The IV-S20C1 camera for the IV-S20 can also be connected using a camera conversion cable
  (IV-S30HC).

■ **Product lines**

Item name		Model name	Specification or details
Camera	Standard	IV-S30C1	Camera main housing (without lens or camera cable)
	Micro	IV-S30C2	Camera main housing (without lens or camera cable)
	High-speed	IV-S30C3	Camera main housing (without lens or camera cable)
	Micro, high-speed camera	IV-S30C4	Camera main housing (without lens or camera cable)
Camera converter		IV-S30EA1	Connect up to two EIA cameras (commercially available)
Camera cable		IV-S30KC3	Cable for IV-S30C1/C2/C3/C4 camera, 3 m
		IV-S30KC5	Cable for IV-S30C1/C2/C3/C4 camera, 5 m
		IV-S30KC7	Cable for IV-S30C1/C2 camera, 7 m
Camera lens		IV-S20L16	C mount lens with a 16 mm focal length
Remote keypad		IV-S30RK1	Keys for remote entry
Parameter setting support software		IV-S30SP	Runs on Windows95/98/NT4.0
Image processing library		IV-S30LB1	Runs on Windows95/98/NT4.0
Monochrome monitor		IV-09MT	Monochrome 9 inch monitor
LED lighting equipment		IV-60LD	Integrated light source and controller in one housing

- For details about the IV-S30SP, IV-S30LB1, IV-09MT, and IV-60LD, see the individual instruction
  manuals.

3

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 "Setting the Input/Output Conditions" in the IV-S30 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-S30 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.
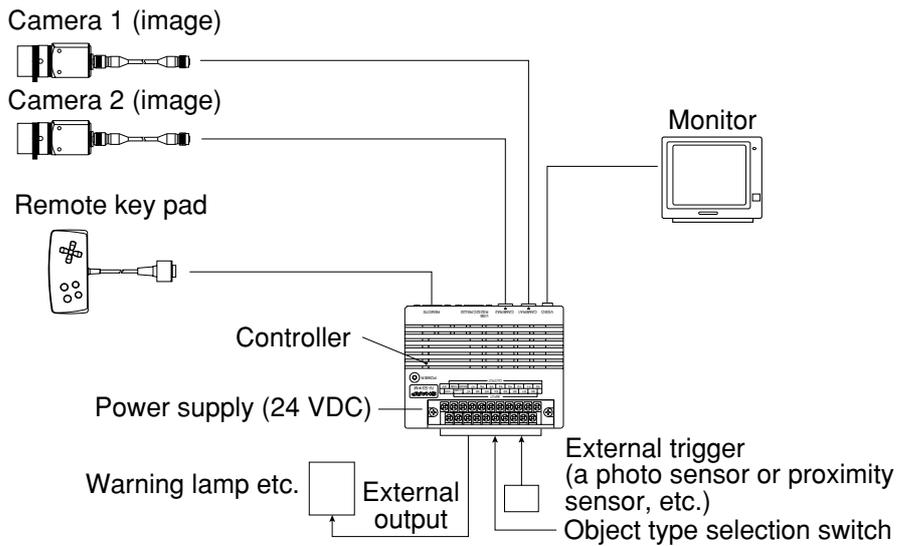
(2) When a programmable controller is connected

- 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.
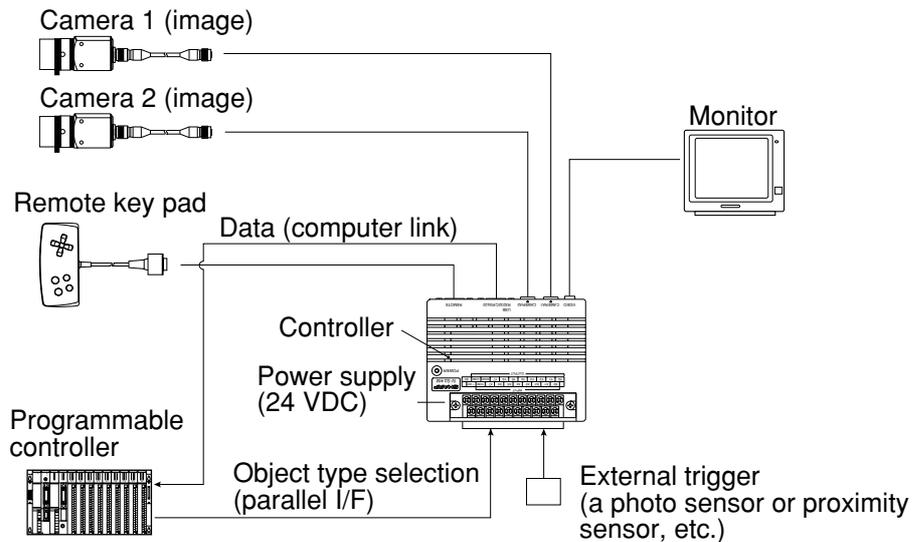
(3) When a personal computer is connected

  - 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.

3
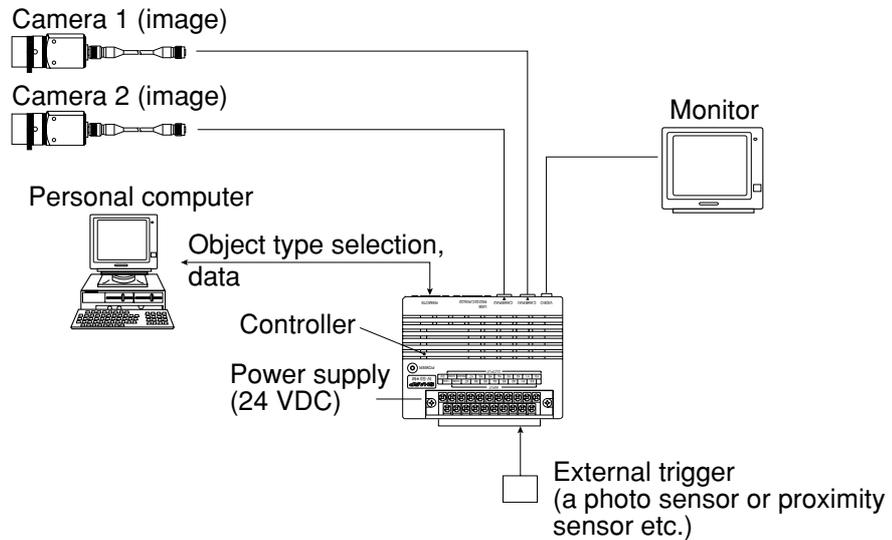
[2] System configuration example for measurement triggered by the internal CCD sensor trigger

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

(1) When IV-S30 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.
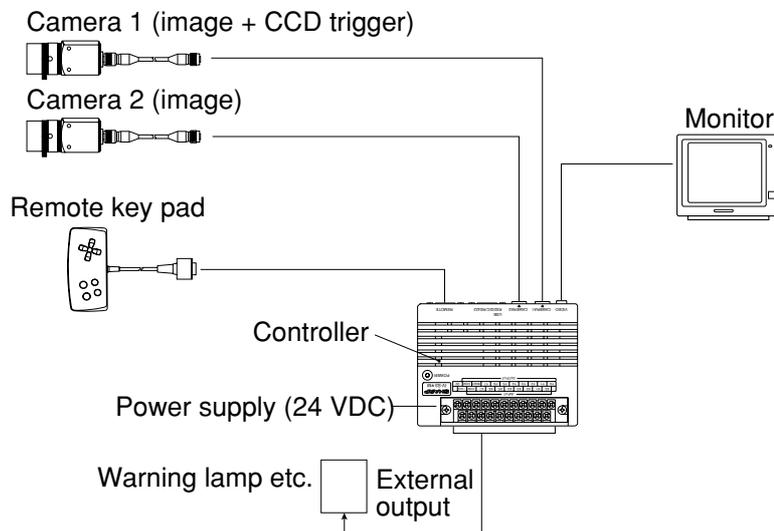
(2) When a programmable controller is connected

- 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.

Camera 1 (image + CCD trigger)

Camera 2 (image)

Monitor

Remote key pad

Data (computer link)

Controller

Power supply
(24 VDC)

Programmable controller

Object type selsection
(parallel I/F)

Start sampling input
(a photo sensor or proximity sensor etc.)
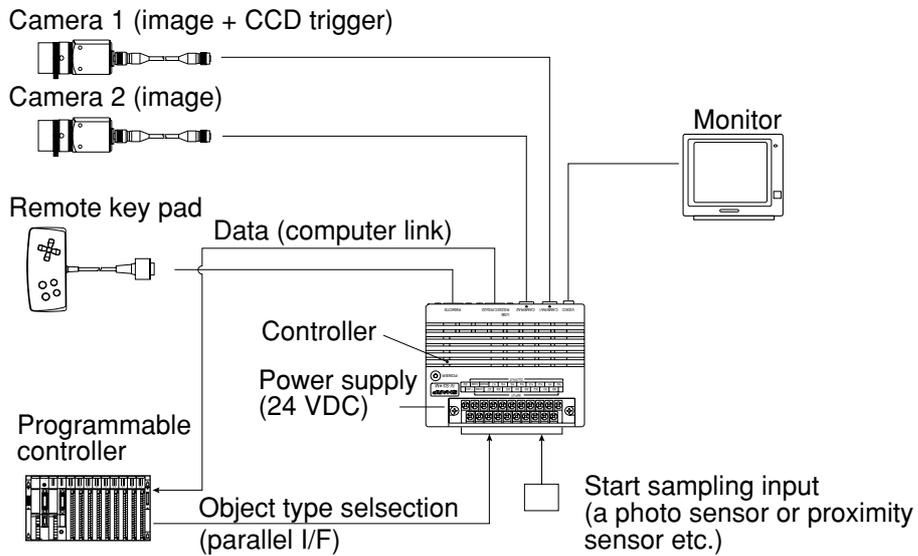
(3) When a personal computer is connected

- 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.

Camera 1 (image + CCD trigger)

Camera 2 (image)

Monitor

Personal computer

Start sampling input
Object type selection, data

Controller

Power supply
(24 VDC)

3-6
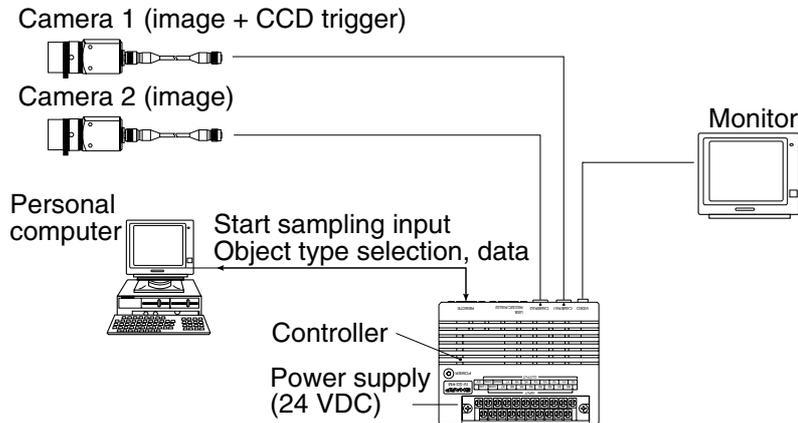
[3] System configuration example for measurement triggered by a command from a personal computer

- 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.
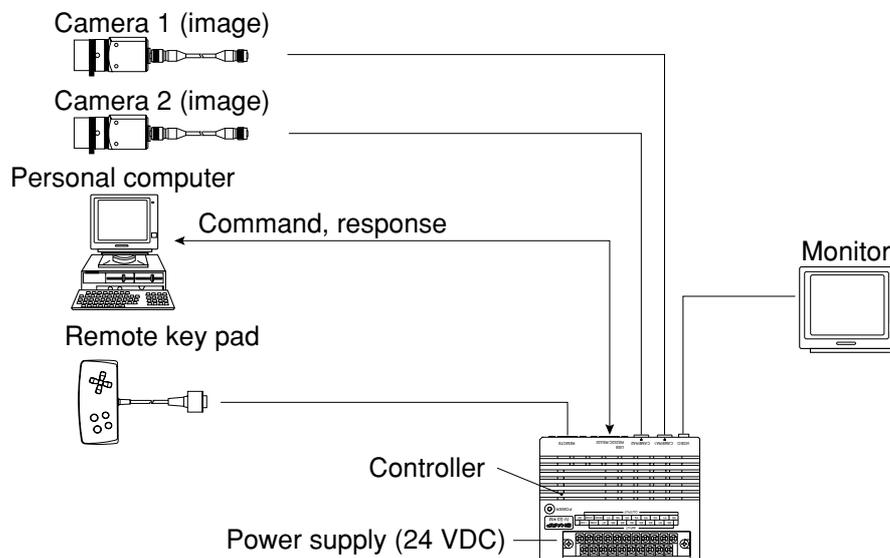
Chapter 4: Part Names and Functions

This section describes the names and functions of the controller, camera (camera lens, camera converter, camera body and camera cable), and the remote keypad which comprise the IV-S30 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-S31M/S32M/S33M)

⑨ Frame ground terminal

② Power terminal block

① I/O terminal block

S∗.∗∗ mark
(software version ∗.∗∗)

4

Controller (front)

③ Power lamp (POWER)

Controller (side)

⑩ Communication connector (USB)

④ Monitor connector (VIDEO)

⑧ Remote key pad connector (REMOTE)

⑤ Camera 1 connector (CAMERA1)

⑥ Camera 2 connector (CAMERA2)

⑦ Communication connector (RS232C/RS422)
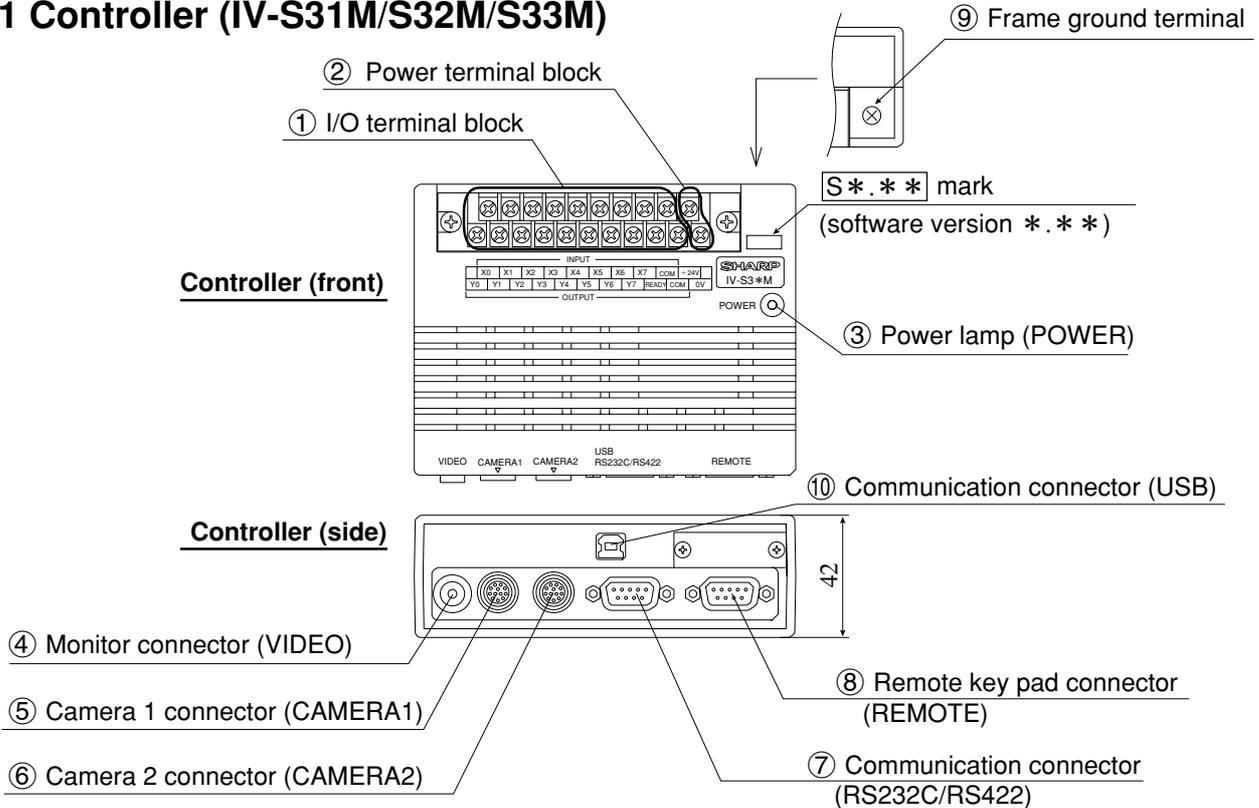
	Name	Function
①	I/O terminal block [INPUT: X0 to X7, C (+) OUTPUT: Y0 to Y7, READY, C (-)]	This block has 8 input terminals and 9 output terminals. - External devices are connected to these terminals for input and output (parallel I/F). ⇨ See page 5-17.
②	Power terminal block (+24V, 0V)	Commercially available constant-voltage power supply (24 V DC ± 10%, 500 mA or more) is connected here. ⇨ See page 5-15.
③	Power lamp (POWER)	When the power is applied to the controller, the green lamp will light.
④	Monitor connector (VIDEO)	A monitor is connected here. - The monitor connector is an RCA jack.
⑤	Camera 1 connector (CAMERA1)	The camera cable connector is connected here. - The camera connected to the CAMERA 1 position is camera 1, and the camera connected to the CAMERA 2 position is camera 2.
⑥	Camera 2 connector (CAMERA2)	
⑦	Communication connector (RS232C/RS422: 9-pin, D-sub,female, rock screw	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 5-20
⑧	Remote key pad connector (REMOTE)	The remote key pad connector is used to make selections from the menues on the screen (to set parameters). It is connected here.
⑨	Frame ground terminal	Be sure to ground the housing frame ground terminal together with the frame ground of the constant-voltage power supply in accordance with class 3 grounding procedures. ⇨See page 5-15.
⑩	Communication connector (USB)	This connector is used to connect a cable to a USB port on a personal computer. - The USB port only functions with Windows 98.

4-2 Camera

[1] Camera

(1) Standard camera (IV-S30C1)

	Name	**Function**
①	Lens holder	The holder is used to make fine adjustment to the distance (back plane focus) between the CCD section and camera lens using a focus fixed lens. (The distance has been adjusted before shipment. Usually, it does not need to be adjusted.) - To adjust it, loosen the upper lock screw, and turn the lens holder counter-clockwise. The maximum allowable distance is 1.5 mm.
②	Cable connector	Connect this connector to the camera cable (IV-S30KC3/S30KC5 /S30KC7).

- To connect an IV-S30C1 camera, use the IV-S31M/S32M/S33M controller and camera cable shown above.

(2) Micro camera (IV-S30C2)

	Name	**Function**
①	Camera head	Install a (commercially available) lens. - The maximum external diameter of the camera head is ϕ 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 cable (IV-S30KC3/KC5/KC7).

- To connect an IV-S30C2 camera, use the IV-S31M/S32M/S33M controller and camera cable shown above.

(3) High-speed camera (IV-S30C3)

Lock screw (for securing the lens holder)

② Cable connector

CCD section

⇐ A

① Lens holder

Front view (view A) of the CCD

	Name	Function
①	Lens holder	The holder is used to make fine adjustment to the distance (back plane focus) between the CCD section and camera lens using a focus fixed lens. (The distance has been adjusted before shipment. Usually, it does not need to be adjusted.) - To adjust it, loosen the upper lock screw, and turn the lens holder counter-clockwise. The maximum allowable distance is 1.5 mm.
②	Cable connector	Connect this connector to the camera cable (IV-S30KC3/S30KC5 /S30KC7). Note: This cable cannot be used to connect the IV-S30KC7.

- To connect an IV-S30C3 camera, use the IV-S33M controller and camera cable shown above. Do not connect to the IV-S31M/S32M.

(4) Micro, high-speed camera (IV-S30C4)
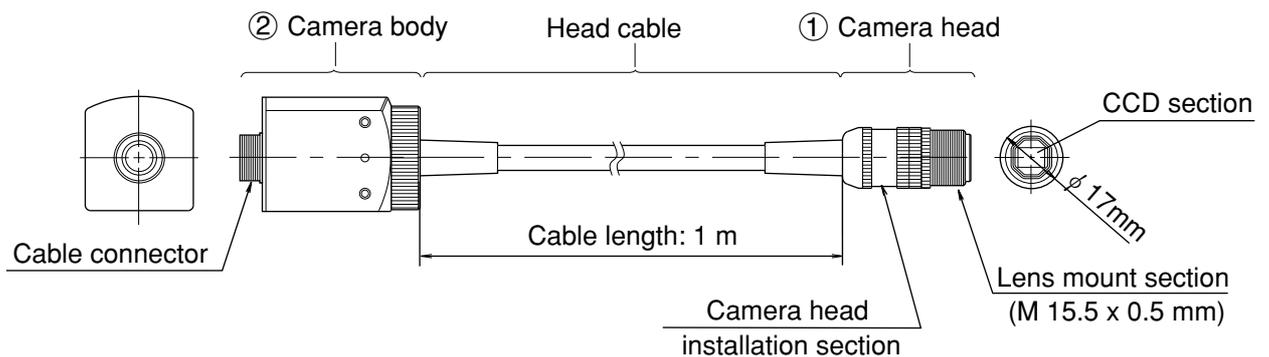
② Camera body   Head cable   ① Camera head

CCD section

Cable connector

Cable length: 1 m

Camera head installation section

Lens mount section (M 15.5 x 0.5 mm)

φ17mm

	Name	Function
①	Camera head	Install a (commercially available) lens. - The maximum external diameter of the camera head is φ17 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 cable (IV-S30KC3/ KC5/KC7). Note: This cable cannot be used to connect the IV-S30KC7.

- To connect an IV-S30C4 camera, use the IV-S33M controller and camera cable shown above. Do not connect to the IV-S31M/S32M.

[2] IV-S30EA1 camera converter

② EIA camera connector 2: CAMERA2　　　　① EIA camera connector 1: CAMERA1

⑤ Power terminals
(+24 V, 0 V)

⑥ Frame ground terminal
(FG)

IV-S30EA1
POWER

③ Mode switch: MODE

⑦ Power indicator:
POWER

CAMERA2　CAMERA1

CONTROLLER

④ Controller connector:
CONTROLLER

	Name	**Function**
①	EIA camera connector 1: CAMERA1	Connect an EIA camera (commercially available). Any camera connected to CAMERA1 will be camera 1, and any camera connected to CAMERA2 will be camera 2.
②	EIA camera connector 2: CAMERA2	Note: Do not connect SHARP's special IV-S30C1/C2/C3/C4 camera.
③	Mode switch: MODE	Select the camera synchronization mode from EXT and INT. Use a thin pointed object such as a ballpoint pen. - EXT = Lets you use an EIA camera with an externally synchronized mode (a synchronizing signal is sent from the IV-S33M to the EIA camera). - INT = Lets you use an EIA camera with an internally synchronized mode.
④	Controller connector: CONTROLLER	Connect to the main housing cable (supplied with the IV-S30EIA, see the next page)
⑤	Power terminals (+24 V, 0 V)	Connect to any commercially available constant voltage DC power supply (24 VDC±10%, 500 mA or more)
⑥	Frame ground terminal (FG)	This terminal is commoned with the enclosure. When the EIA camera is connected to the controller using a shielded cable, the EIA camera housing will be electrically connected to this terminal.
⑦	Power indicator: POWER	When power is supplied to the IV-S30EA1, this lamp will light green.

- To connect the IV-S30EA1 to the IV-S33M controller, use the cable supplied with the IV-S30 (see the next page).
  The IV-S30EA1 cannot be connected to the IV-S31M/S32M controller.

■ **Cable to connect the converter to the controller (supplied with the IV-S30EA1)**

② CAMERA 2 connector   ③ Converter connector

① CAMERA1 connector
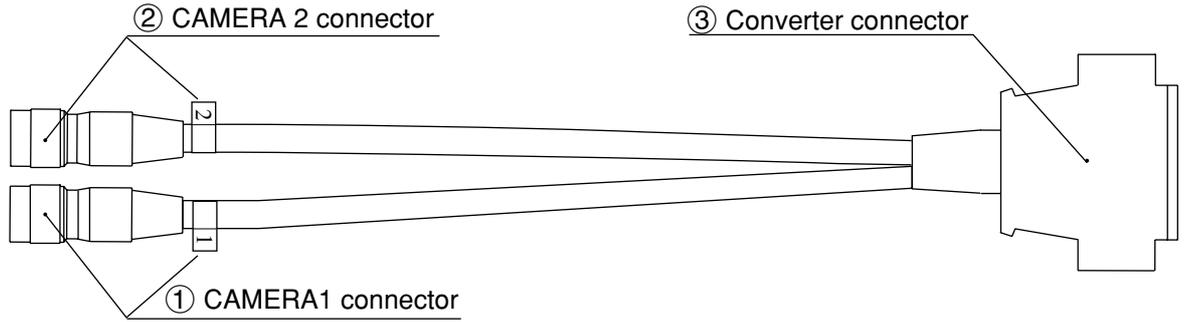
	Name	**Function**
①	Camera 1 connector	Connect to the CAMERA 1 and CAMERA 2 connectors on the IV-S33M controller.
②	Camera 2 connector	
③	Converter connection connector	Connect to the controller side connector on the IV-S30EA1.

[3] Camera lens (IV-S20L16)

① Focus   Lock knob 1 (for fixing the iris)

Lock knob 2 (for fixing the focus)

② Iris

TV LENS 1:1.6 16mm   0.05m   focus   ∞   C   1.6

5.5 mm
(Movable range for focus adjustment)

4
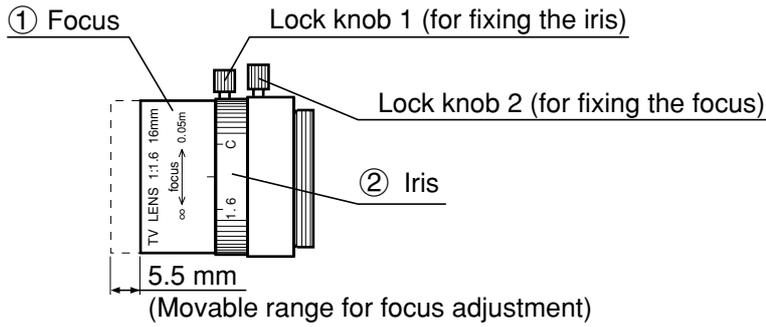
	Name	Function
①	Focus	To focus an image -The focall enght (distance from an object) is 50 mm to infinity (from the front of lens).
②	Iris	To adjust the image brightness. -The iris a perture can be set from 1.6mm to closed.

[4] Camera cable (IV-S30KC3/KC5/KC7)

① Camera connector
(Threaded type)

② Controller connector
(Quick-connect type)

Cable length
⌈ IV-S30KC3: 3 m ⌉
| IV-S30KC5: 5 m |
⌊ IV-S30KC7: 7 m ⌋
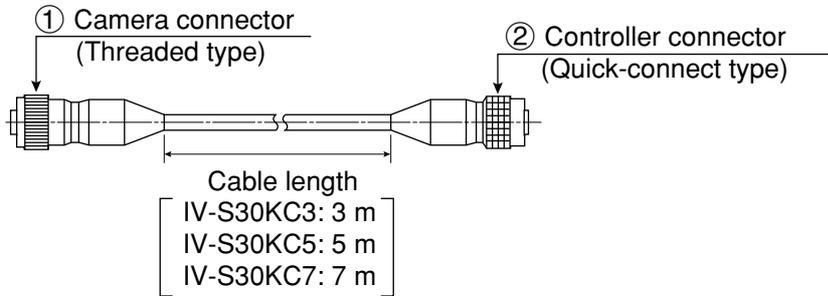
	Name	**Function**
①	Camera connector	Connect to a connector of camera cable (IV-S30C1/C2/C3/C4). Note: The IV-S30KC7 cannot be connected to the IV-S30C3/C4.
②	Controller connector	Connect to camera 1 connector or camera 2 connector of the controller (IV-S31M/S32M/S33M).

4-3 Remote keypad (IV-S30RK1)

Connector
- Connected to the controller
(IV-S31M/S32M/S33M)

Cable length 3 m

④ Image change key (SEL)

⑤ Measurement start/brightness
select key (TRG/BRT)

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

4

② Set (select) key (SET)

Dimensions (mm)
130 (W) × 61 (D) × 22.5 (H)

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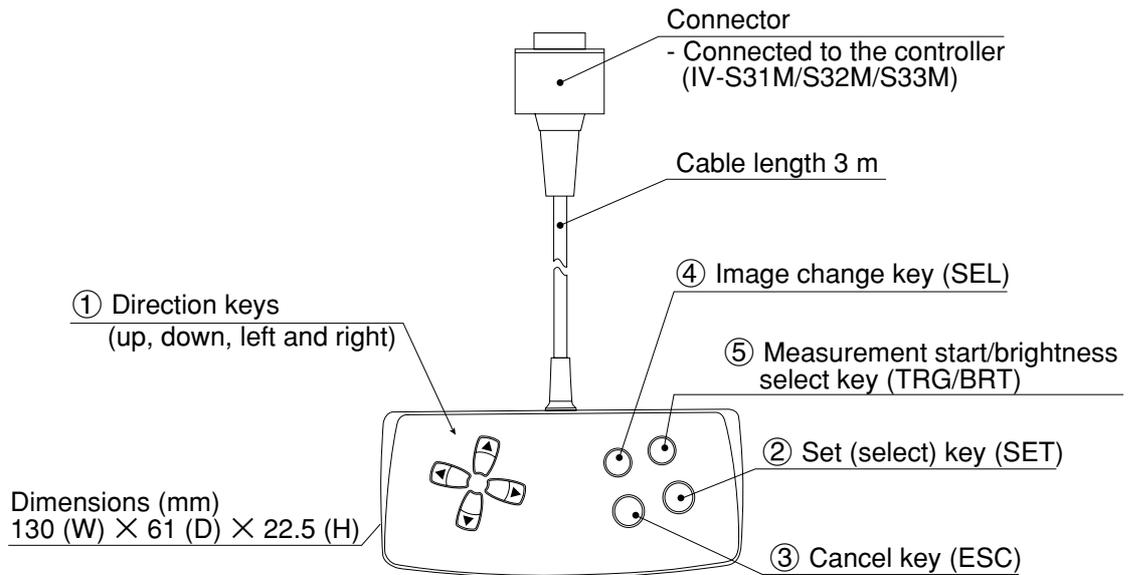
	Key name	**Function**	**Description**
①	* Direction keys (up, down, left and right)	Selecting an item on a menu screen	Select an item with the up, down, left and right keys.
		Setting a window	Set each coordinate.
		Setting a value	- Select a digit or an item with the left and right keys, and then specify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

* The direction keys have an auto-repeat function.

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-S30 measure the object with it's shadow. Since the shadow picture will be converted to binary values, reliable measurements can be executed.

Example:

Backlighting equipment
Light
IV-S30C1 or similar
Conveyor
Inspection of a processed part
IV-S30C1 or similar
Light
Linear feeder
Hole inspection
Miss-processed product
Backlighting using surface illuminance LED
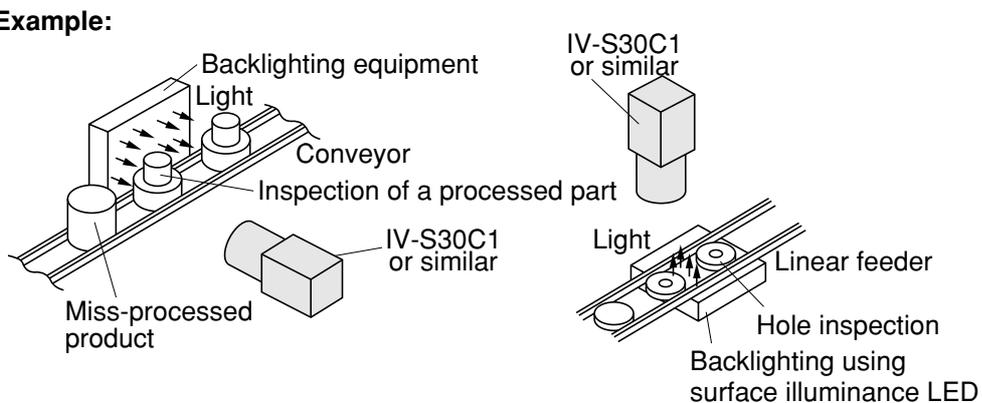
(2) Reflective lighting

A light shone on the front of an object with angle will be reflected, and the IV-S30 will pick up the reflected light. If too much light is reflected, such as from a metallic surface or similar materials, a proper image may not be obtained.

Example:

Label
Light beam
IV-S30C1 or similar
Light beam
IV-S30C1 or similar
Light beam
Label detection

Measurement of the center coordinates of a hole

5
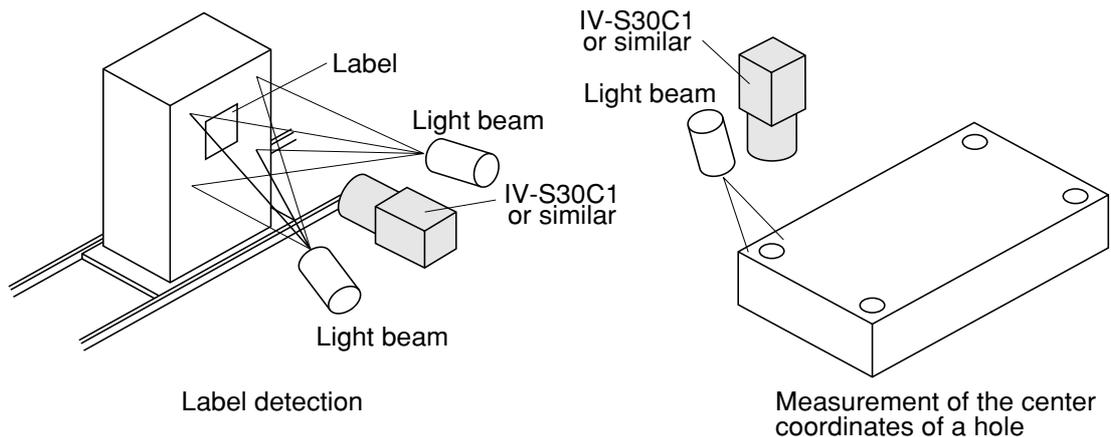
■ **When using the IV-60LD**
This paragraph describes how to use Sharp IV-60LD LED lighting equipment. For details about the installation and wiring of the IV-60LD, see the instruction manual.
The distance between the IV-60LD and an object (distance at which to install lighting equipment) should be approximately 150 mm, and the lit area is approximately 50 mm ¥ 50 mm.
If the lighting distance is reduced approximately 60 mm, the lighting may be uneven.

IV-S30 camera

Camera angle bracket

IV-60LD body
(Lighting section)

- View A

Light area

Camera center

Camera center

50mm

50mm

Workpiece surface
(Object to be
measured)

77.3mm

87mm

Lighting distance : 150mm

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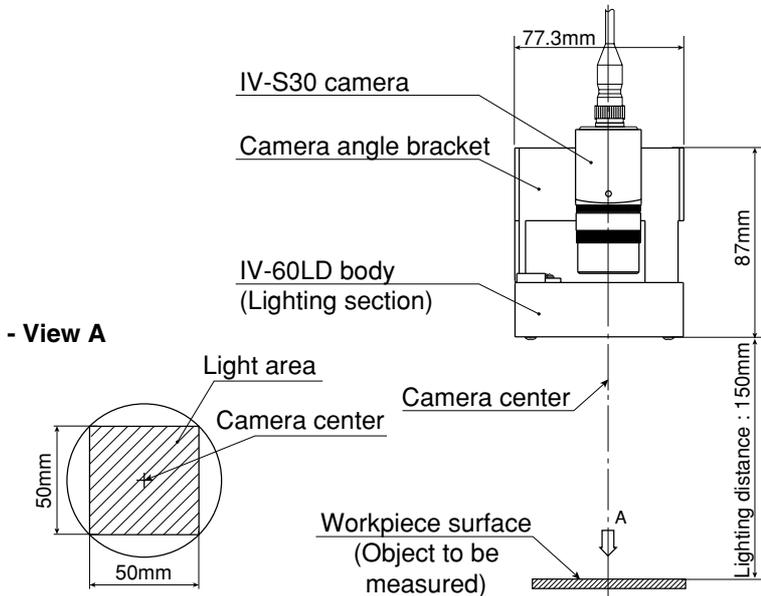
When the light is projected from above the object and if reflection off the object influences the image processing, try the following countermeasures.

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

IV-S30 camera

IV-60LD body

Reflected light

Workpiece surface
(Object to be
measured)
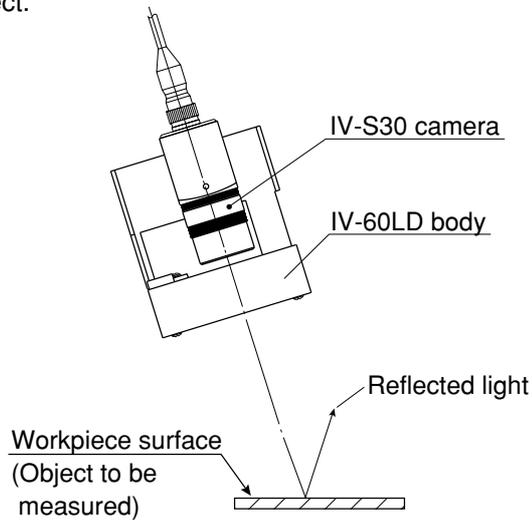
②Separate the camera from the lighting equipment. Install the IV-60LD lighting equipment so that it will shines from an angle that prevents creation of the reflection.

- One light

IV-S30 camera

IV-60LD body

- Two lights

IV-S30 camera

IV-60LD body

IV-60LD body
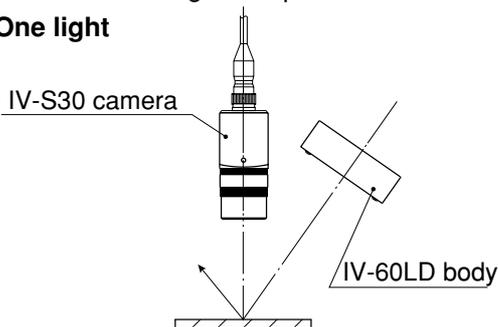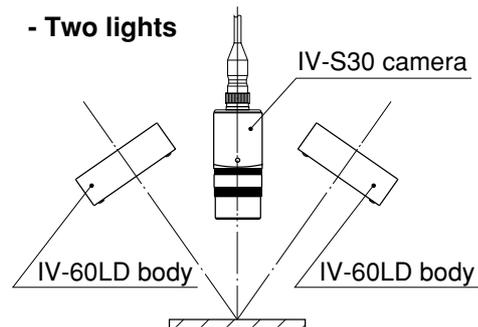
[2] Illuminance and shutter speed

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]

Illuminance (lux)

Proper range (shaded zone)

32000
16000
8000
4000
2000
1000
500
250
125

1/30   1/60   1/125   1/250   1/500   1/1000   1/2000   1/4000   1/10000
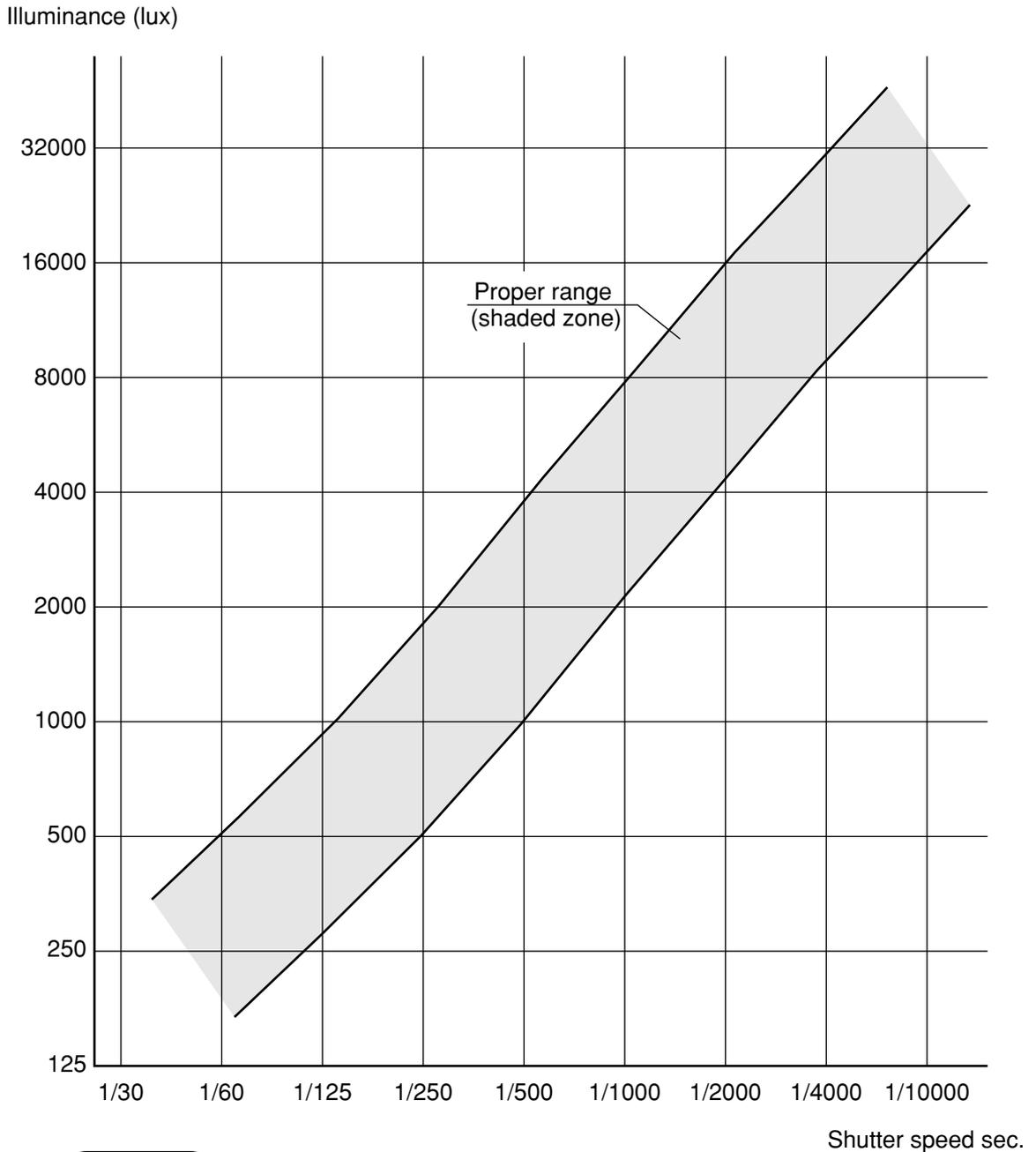
Shutter speed sec.

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).

• **When the IV-S30C1/C3 camera is used**

Vertical direction

Rounded surface of camera body

View (mm)

Horizontal direction

IV-S30C1/C3

Workpiece

(Horizontal direction)

Lens

Vertical direction

Camera installation distance (mm)

Lens holder

Workpiece

Lens

Close-up shot ring

5

• **When the IV-S30C2/C4 camera is used**

IV-S30C2/C4 camera head

Vertical direction

Lens (commercially available)

A dented side is the vertical (upper) direction.

Dented part

View (mm)

Horizontal direction

Workpiece

(Horizontal direction)

Vertical direction

Camera installation distance (mm)

Lens rear end

Workpiece

Lens (commercially available)

IV-S30C2/C4

5-4

There is a relationships as shown on page 5-7 to page 5-9, 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/C3 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 5-7.

Camera installation distance (mm)		Lens focal length f=16mm			
		View (mm)		Focal length (mm)	Resolution (μm)
		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.

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

See "Glossary" for the diefinition 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.
- When the IV-S30C1/C3 camera is used.
  • If you want to use a camera lens other than the IV-S20L16, buy a lens with a C type lens base. (The IV-S20L16 has a C type lens base.)
  • A lens with too short focal length (f = 4.2 mm or 8 mm) will distort the edges of the field of view.
- When the IV-S30C2/C4 camera is used
  • Use a commercially available ø17 mm lens.
  • When a wide-angle lens is used, the distortion at the edges will be larger.

5

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

- Spectral sensitivity characteristics of the CCD element
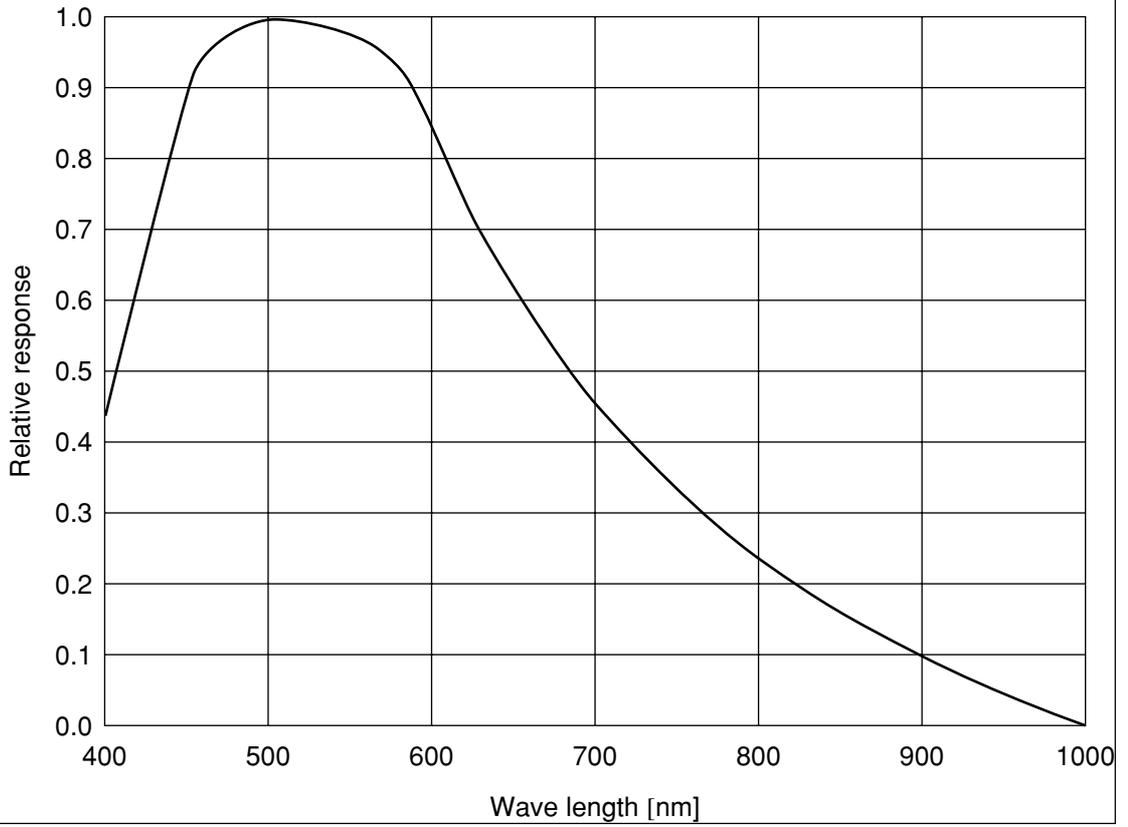
■ **Relation among the camera installation distance, the field of view, and the focal length**

• **When the IV-S30C1/C3 camera is used**

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

5

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

• **When the IV-S30C2/C4 camera is used**

Camera installation distance (mm)	Lens focal length f=7.2mm				Lens focal length f=15mm				Lens focal length f=24 mm			
	Vertical direction Workpiece size (Hmm)	Vertical direction 7.50 Workpiece size (Hmm)	Focal length (mm)	Resolution (μm)	Vertical direction Workpiece size (Hmm)	Vertical direction 15.00 Workpiece size (Hmm)	Focal length (mm)	Resolution (μm)	Vertical direction Workpiece size (Hmm)	Vertical direction 24.00 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

■ Table of magnifications and viewing size

(Vertical size x Horizontal size x Diagonal size) mm

Magnification	1/3" viewing field	14" monitor magnification
×0.14	25×27×36.6	8.3
×0.16	22×23×32.2	9.4
×0.18	20×21×29.2	10.6
×0.2	18×19×26.3	11.8
×0.3	12×13×17.5	17.8
×0.5	7.2×7.7×10.53	29.6
×0.75	4.8×5.1×7.02	44.4
×0.8	4.5×4.8×6.58	47.4
×1	3.6×3.8×5.26	59.3
×2	1.8×1.9×2.63	118.6
×4	0.9×0.96×1.316	237.2
×4.5	0.8×0.85×1.170	266.8
×6	0.6×0.64×0.877	355.8
×8	0.45×0.48×0.658	474.4
×10	0.36×0.38×0.526	593
×12	0.3×0.32×0.439	711.6

5-2 Installing, connecting and wiring the IV-S31M/S32M/S33M controller

[1] Connecting equipment to the controller

Connect the cameras (up to 2 cameras), remote key pad, and monitor to the controller (IV-S31M/S32M/S33M).
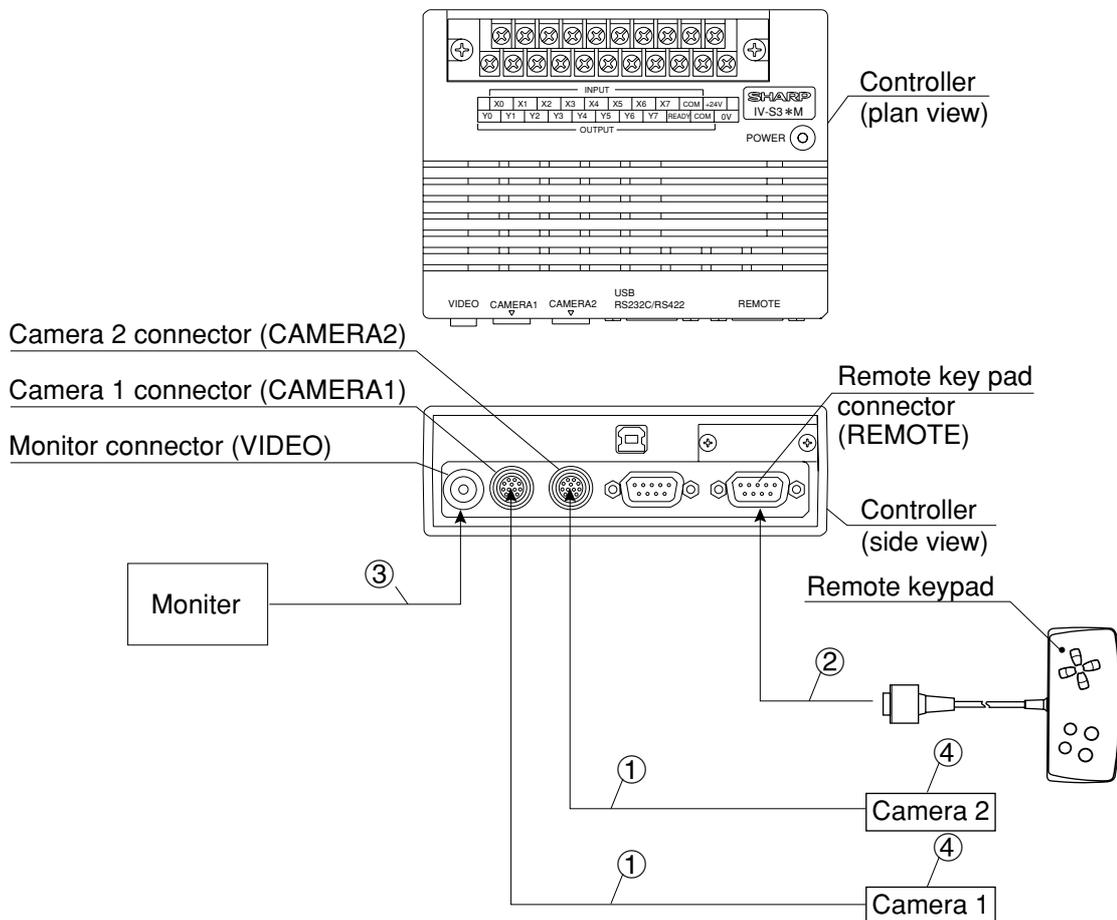
① Connect the camera cable (IV-S30KC3/S30KC5/S30KC7) connector or a connector of the main housing connection cable (IV-S30EA1) to the camera 1 (CAMERA1) and camera 2 (CAMERA2) connectors on the controller.
  Note: Only connect or disconnect the camera connectors while the power is OFF.
      The main housing connection cable (IV-S30EA1) can be connected to the IV-S33M only.
  - 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.
  - You must have a camera connected to the camera 1 connector.
② Plug the remote key pad (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.
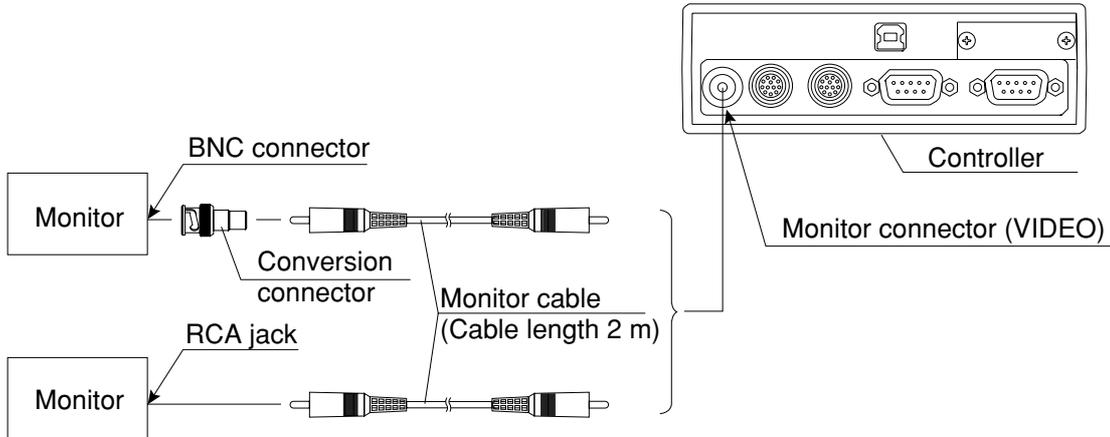
- If you need a monitor cable longer than 2 m, you can purchase a one at a video store.

④ For details about connecting and installing cameras, see page 5-23 in this manual.

■ **Leave enough space around the controller (IV-S31M/S32M/S33M)**
In order to connect camera cables, the remote key pad cable, monitor cable and D-sub connector to the controller, the following space (min.) is required.
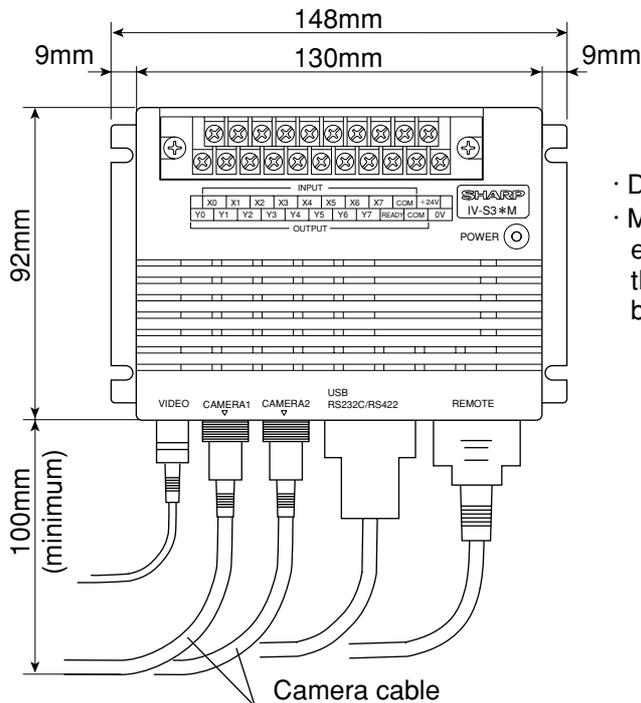
· Do not bend the camera cables repeatedly.
· Make sure the installation location allows enough space for the input/output wires going to the I/O terminal block and the power terminal block on the controller.

[2] Installation

To install the IV-S31M/S32M/S33M controller, secure the bottom of the housing on the mounting surface with the two main housing brackets (supplied with the controller.)
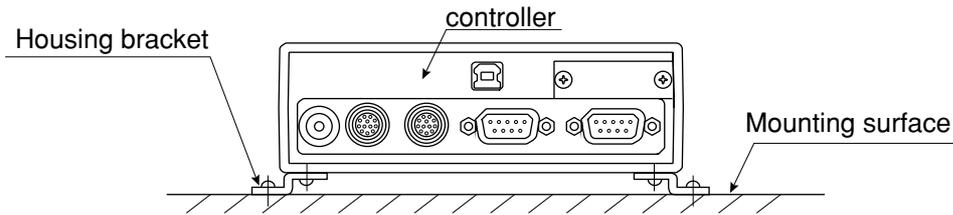
■ Mounting procedure

① Attach the two housing brackets on the bottom of the controller.
   Four screws (M 3 x 6) are supplied to attach the brackets.
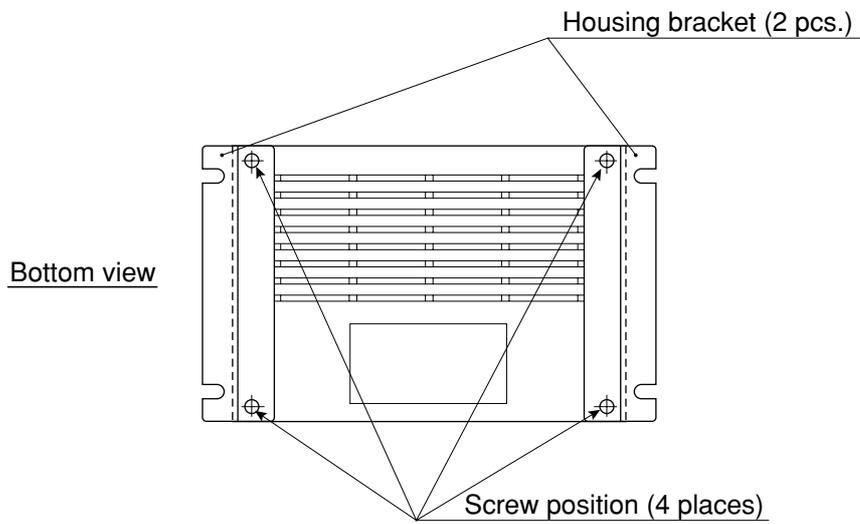
② Secure the housing on the mounting surface with the brackets.
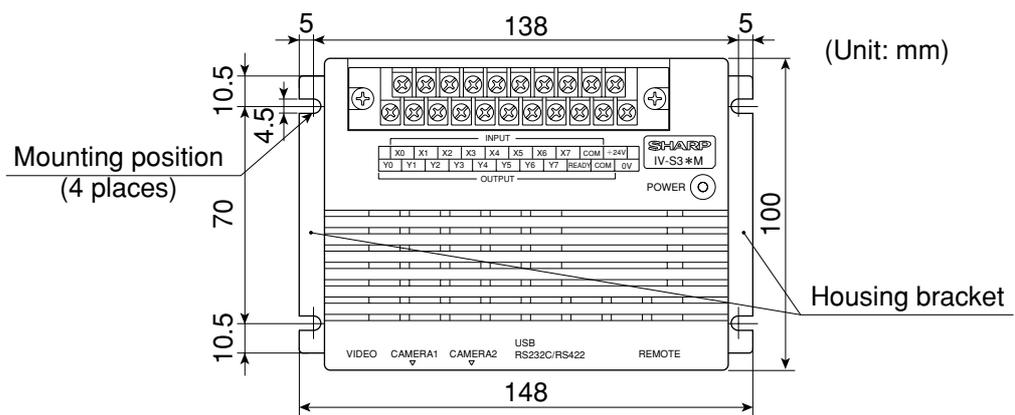
The external dimensions of the housing brackets and the controller are shown on the following page.

- External dimensions of the controller (IV-S31/S32M/S33M)

70

(Unit: mm)

25

CAMERA2   CAMERA1

100

100

100

+24V

0V

FG

IV-S30EA1
POWER ○

MODE
INT □■ EXT

CONTROLLER

70

70

25

25

70
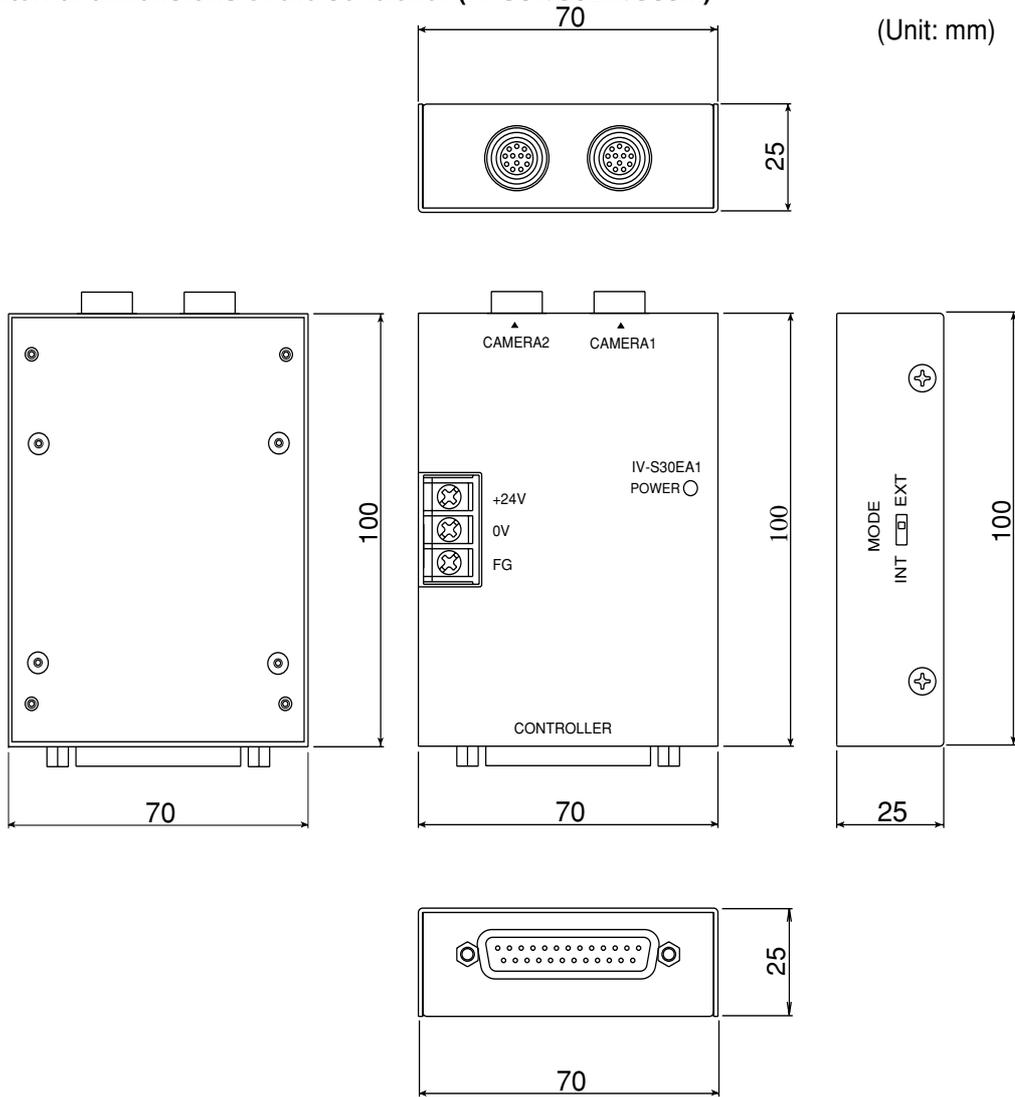
- External dimensions of housing bracket

(Unit: mm)

2 holes 3.2 mm in diameter
(for attaching the bracket to the controller)

1.6

5

81

5

11

23

5

10

10

5.7

4.5

10.5

70

10.5

91

Mounting position
(2 places: for securing the bracket to the mounting surface)
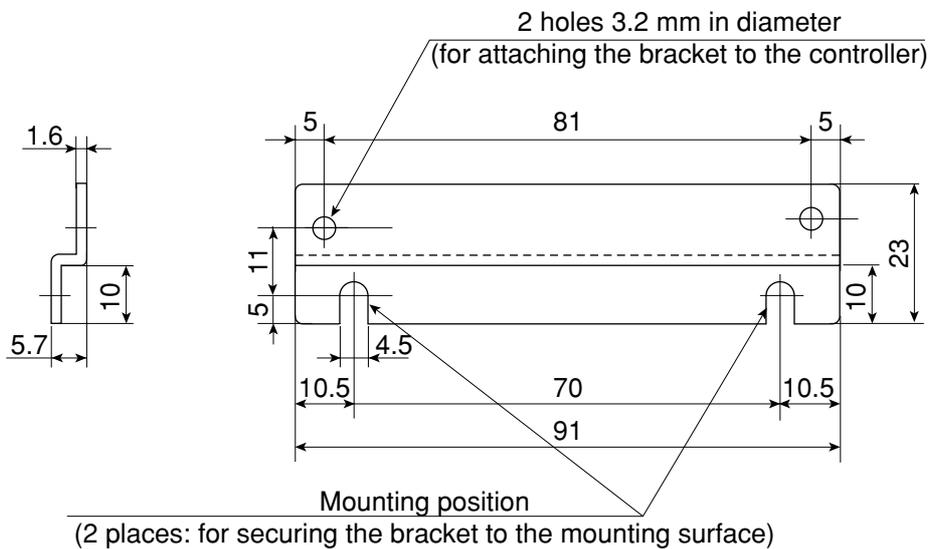
[3] **Connecting a power supply**

Connect a commercially available constant-voltage power supply to the power terminals (POWER: +24 V, 0 V) on the controller (IV-S31M/S32M/S33M). Use a 24 VDC ± 10%, 500 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.
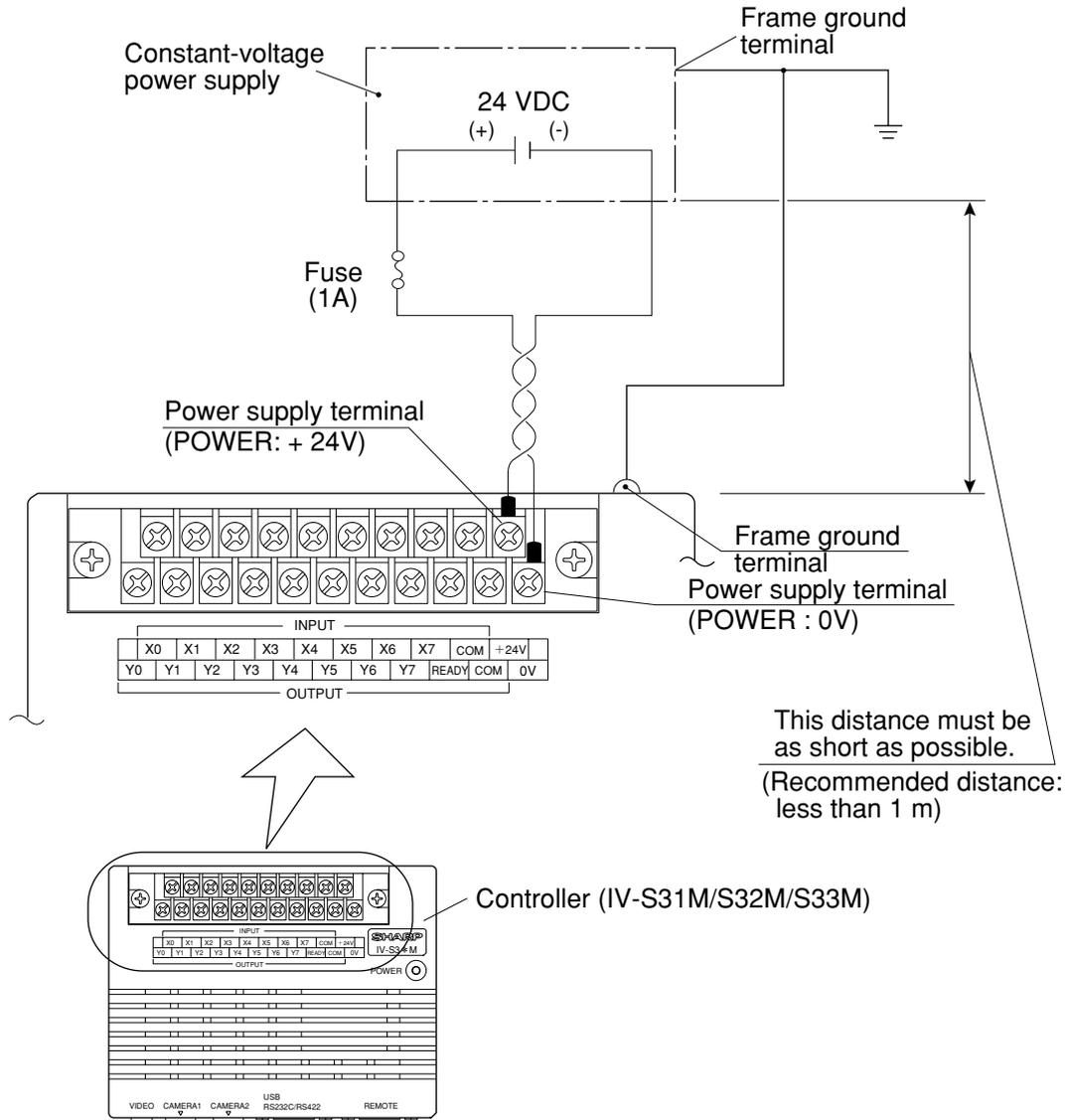
Note

To improve the noise resistance of the constant-voltage power supply connected to the controller (IV-S31M/S32M/S33M), observe the following precautions.
- Ground the FG terminal of the constant-voltage power supply according to the class 3 grounding.
- The power line between the controller and the constant-voltage power supply must be as short as possible. (Recommended distance: less than 1 m)
  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.

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

8 input terminals and 9 output terminals are available on the input/output terminal block on the controller (IV-S31M/S32M/S33M).
The input terminal block has INPUT terminals X0 to X7 and COM , and the output terminal block has OUTPUT terminals Y0 to Y7, READY and COM .

[Input/output terminal block on the controller]

Controller (IV-S31M/S32M/S33M)

Terminal block	Interrupt processing input (1 terminal)	External trigger (X0)
	Input (7 terminals)	-IV-S33M Object type change (X1 to 6): 6 terminals External input (X7): 1 terminals -IV-S32M Object type change (X1 to 5): 5 terminals External input (X6 and 7): 2 terminals -IV-S31M Object type change (X1 to 4): 4 terminals External input (X5 to 7): 3 terminals
	Common for input (1 terminal)	(+) or (-) cocmmon
	Output (9 terminals)	READY: 1 terminal Logical output set by user (Y0 to 7): 8 terminals
	Common for output (1 terminal)	(+) or (-)
	Power supply (2 terminals)	24 VDC: 1 terminal, 0 V: 1 terminal

(1) Input terminals (INPUT) X0 to X7

① IV-S31M/S32M

Input terminal	Input/output condition setting *1	Input details
X0	Measurement start input I/F = CCD trigger CCD sampling start = General-purpose serial interface signal or auto detect (edge + level)	External input
	Measurement start input I/F = Parallel + General-purpose serial interface signal + USB	Measurement start input
	Measurement start input I/F = CCD trigger CCD sampling start = Parallel	
X1 to 5	Measurement start input I/F = CCD trigger CCD sampling start = General-purpose serial interface signal or auto detect (edge + level)	External input
	Measurement start input I/F = Parallel + General-purpose serial + USB	Object type numbers *2 IV-S32M:0 to 31 IV-S31M:0 to 15 - X5 is used for external input on the IV-S31M
	Measurement start input I/F = CCD trigger CCD sampling start = Parallel	
X6	Parallel input X6 is used for external input, a register reference image signal, or to correct a total area judgement.	
X7	Parallel input X7 is used for external input, a change in the output camera signal, measurements with each camera, and for overlapping images.	

*1: For details about the settings on the [I/O CONDITIONS] menu, see "Setting the Input/Output Conditions" in the IV-S30 (IV-S31M/S32M) User's Manual (Function and operation).

*2: Object type numbers and X1 to X5 have the following relationships.

• IV-S32M

Object type	X5	X4	X3	X2	X1
00	OFF	OFF	OFF	OFF	OFF
01	OFF	OFF	OFF	OFF	ON
02	OFF	OFF	OFF	ON	OFF
03	OFF	OFF	OFF	ON	ON
04	OFF	OFF	ON	OFF	OFF
05	OFF	OFF	ON	OFF	ON
06	OFF	OFF	ON	ON	OFF
07	OFF	OFF	ON	ON	ON
08	OFF	ON	OFF	OFF	OFF
09	OFF	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON	OFF
11	OFF	ON	OFF	ON	ON
12	OFF	ON	ON	OFF	OFF
13	OFF	ON	ON	OFF	ON
14	OFF	ON	ON	ON	OFF
15	OFF	ON	ON	ON	ON

Object type	X5	X4	X3	X2	X1
16	ON	OFF	OFF	OFF	OFF
17	ON	OFF	OFF	OFF	ON
18	ON	OFF	OFF	ON	OFF
19	ON	OFF	OFF	ON	ON
20	ON	OFF	ON	OFF	OFF
21	ON	OFF	ON	OFF	ON
22	ON	OFF	ON	ON	OFF
23	ON	OFF	ON	ON	ON
24	ON	ON	OFF	OFF	OFF
25	ON	ON	OFF	OFF	ON
26	ON	ON	OFF	ON	OFF
27	ON	ON	OFF	ON	ON
28	ON	ON	ON	OFF	OFF
29	ON	ON	ON	OFF	ON
30	ON	ON	ON	ON	OFF
31	ON	ON	ON	ON	ON

• IV-S31M

Object type	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	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

② IV-S33M

Input terminal	Input/output condition setting *1	Input details
X0	Measurement start input I/F = CCD trigger CCD sampling start = General-purpose serial interface signal or auto detect (edge + level)	External input
	Measurement start input I/F = Parallel + General-purpose serial interface signal + USB	Measurement start input
	Measurement start input I/F = CCD trigger CCD sampling start = Parallel	
X1 to 5	Measurement start input I/F = CCD trigger CCD sampling start = General-purpose serial interface signal or auto detect (edge + level)	External input
	Measurement start input I/F = Parallel + General-purpose serial + USB	Object type numbers *2 IV-S33M:0 to 63
	Measurement start input I/F = CCD trigger CCD sampling start = Parallel	
X6	Parallel input X6 is select one of 64 object types.	
	Parallel input X6 is used for external input, a register reference image signal, or to correct a total area judgement.	
X7	Parallel input X7 is used for external input, a change in the output camera signal, measurements with each camera, and for overlapping images.	

*1: For details about the settings on the [I/O CONDITIONS] menu, see "Setting the Input/Output Conditions" in the IV-S30 (IV-S31M/S32M/S33M) User's Manual, Function and Operation.

*2: Object type numbers and X1 to X6 have the following relationships.

Object type	X6	X5	X4	X3	X2	X1	Object type	X6	X5	X4	X3	X2	X1
00	OFF	OFF	OFF	OFF	OFF	OFF	32	ON	OFF	OFF	OFF	OFF	OFF
01	OFF	OFF	OFF	OFF	OFF	ON	33	ON	OFF	OFF	OFF	OFF	ON
02	OFF	OFF	OFF	OFF	ON	OFF	34	ON	OFF	OFF	OFF	ON	OFF
03	OFF	OFF	OFF	OFF	ON	ON	35	ON	OFF	OFF	OFF	ON	ON
04	OFF	OFF	OFF	ON	OFF	OFF	36	ON	OFF	OFF	ON	OFF	OFF
05	OFF	OFF	OFF	ON	OFF	ON	37	ON	OFF	OFF	ON	OFF	ON
06	OFF	OFF	OFF	ON	ON	OFF	38	ON	OFF	OFF	ON	ON	OFF
07	OFF	OFF	OFF	ON	ON	ON	39	ON	OFF	OFF	ON	ON	ON
08	OFF	OFF	ON	OFF	OFF	OFF	40	ON	OFF	ON	OFF	OFF	OFF
09	OFF	OFF	ON	OFF	OFF	ON	41	ON	OFF	ON	OFF	OFF	ON
10	OFF	OFF	ON	OFF	ON	OFF	42	ON	OFF	ON	OFF	ON	OFF
11	OFF	OFF	ON	OFF	ON	ON	43	ON	OFF	ON	OFF	ON	ON
12	OFF	OFF	ON	ON	OFF	OFF	44	ON	OFF	ON	ON	OFF	OFF
13	OFF	OFF	ON	ON	OFF	ON	45	ON	OFF	ON	ON	OFF	ON
14	OFF	OFF	ON	ON	ON	OFF	46	ON	OFF	ON	ON	ON	OFF
15	OFF	OFF	ON	ON	ON	ON	47	ON	OFF	ON	ON	ON	ON
16	OFF	ON	OFF	OFF	OFF	OFF	48	ON	ON	OFF	OFF	OFF	OFF
17	OFF	ON	OFF	OFF	OFF	ON	49	ON	ON	OFF	OFF	OFF	ON
18	OFF	ON	OFF	OFF	ON	OFF	50	ON	ON	OFF	OFF	ON	OFF
19	OFF	ON	OFF	OFF	ON	ON	51	ON	ON	OFF	OFF	ON	ON
20	OFF	ON	OFF	ON	OFF	OFF	52	ON	ON	OFF	ON	OFF	OFF
21	OFF	ON	OFF	ON	OFF	ON	53	ON	ON	OFF	ON	OFF	ON
22	OFF	ON	OFF	ON	ON	OFF	54	ON	ON	OFF	ON	ON	OFF
23	OFF	ON	OFF	ON	ON	ON	55	ON	ON	OFF	ON	ON	ON
24	OFF	ON	ON	OFF	OFF	OFF	56	ON	ON	ON	OFF	OFF	OFF
25	OFF	ON	ON	OFF	OFF	ON	57	ON	ON	ON	OFF	OFF	ON
26	OFF	ON	ON	OFF	ON	OFF	58	ON	ON	ON	OFF	ON	OFF
27	OFF	ON	ON	OFF	ON	ON	59	ON	ON	ON	OFF	ON	ON
28	OFF	ON	ON	ON	OFF	OFF	60	ON	ON	ON	ON	OFF	OFF
29	OFF	ON	ON	ON	OFF	ON	61	ON	ON	ON	ON	OFF	ON
30	OFF	ON	ON	ON	ON	OFF	62	ON	ON	ON	ON	ON	OFF
31	OFF	ON	ON	ON	ON	ON	63	ON	ON	ON	ON	ON	ON

- When the parallel input X6 is not set to "64OBJ-CHG (select from 64 object types)," only X1 to X5 are available to specify one of 32 object types.

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

Y0 to Y7	Result of logical calculation output - Specify in the FINAL-OUTPUT on the [TYPE MEAS COND] menu.
READY	These signals will turn ON when the measurement start input is enabled. - For information about the timing chart and other details, see "Setting the Input/Output Conditions" in the IV-S30 User's Manual (Function and Operation).

(3) 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: 3 V or more
	Input current level	ON: 3 mA or less OFF: 0.9 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	100 mA DC
	Output type	Photo MOS open drain
	ON resistance	30 ohms or less
	Isolation method	Photo MOS isolation
Response time		3 ms or less (OFF to ON, ON to OFF)

(4) Wiring to the controller (IV-S31M/S32M/S33M)

5-20
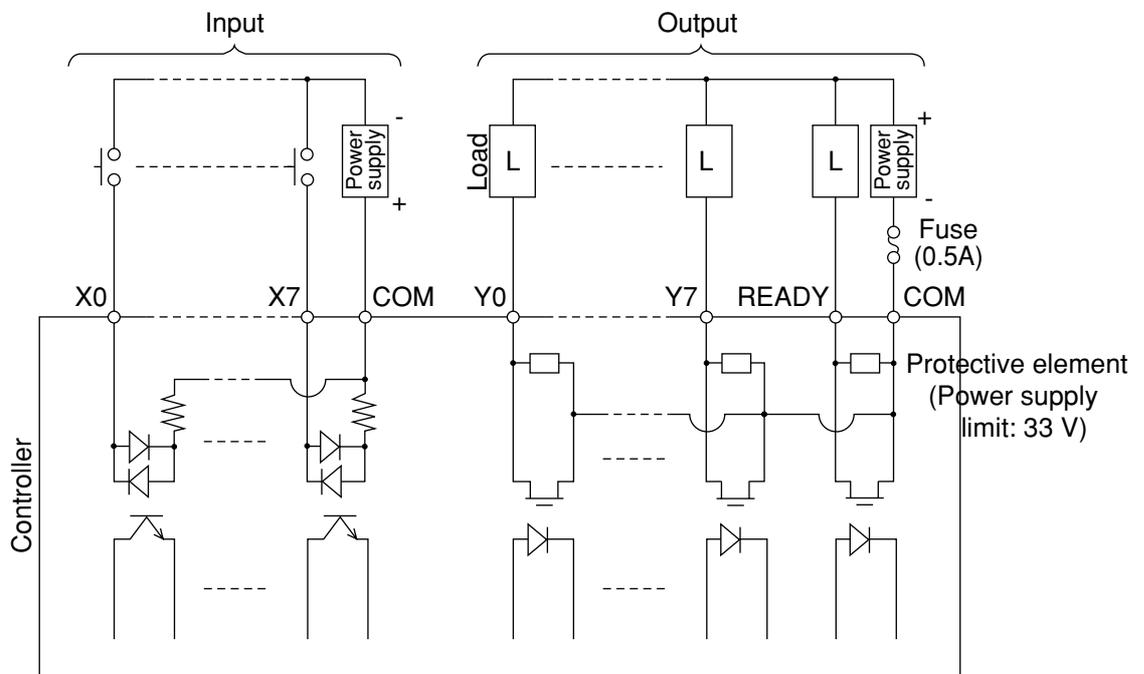
[5] Connection for communications with personal computer (general purpose serial I/F)

Connect a personal computer to the communication connector (RS232C/RS422) on the controller (IV-S31M/S32M/S33M).

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

Controller
(plan view)

Personal computer

Controller
(side view)

RS-232C/RS-422

Communication connector
(RS232C/RS422 : 9-pin D-sub female,
rock screw M2.6)
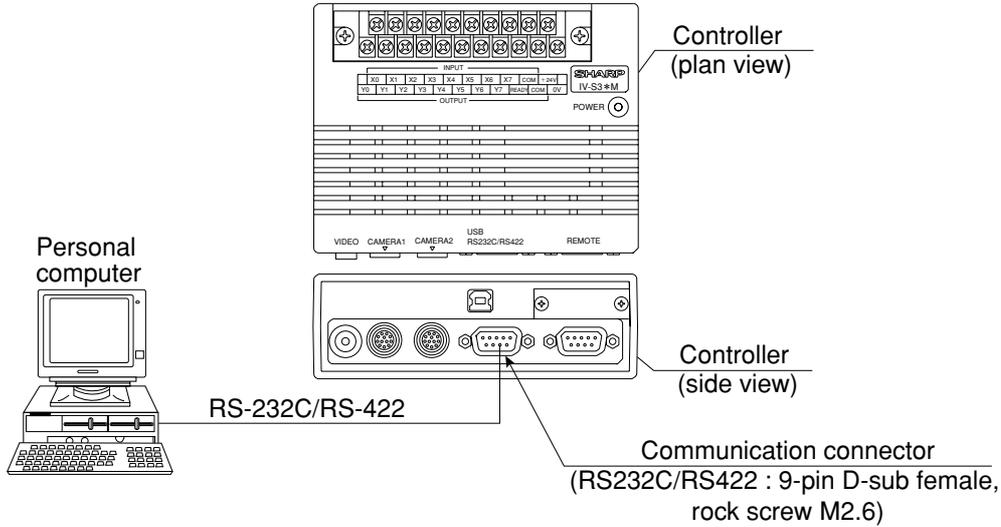
(1) When communicating through the RS-232C port
- The controller pin arrangement of the communication connector (for RS-232C)

5   1

(9-pin D-sub, female)

9   6
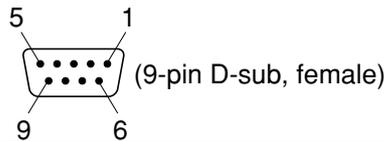
Communication standard	Pin No.	Signal name	Details	Direction
RS-232C	2	RD	Received data (personal computer ⇨ IV-S30)	Input
	3	SD	Transmitted data (IV-S30 ⇨ personal computer)	Output
	5	SG	Signal ground	−
Connector shield		FG	Frame ground	−

Personal computer

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

DOS/V, IBM-PC	PC98 series	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

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.

5-20

(2) When communicating through the RS-422
Specify the 4-wire or 2-wire RS-422 system on the [SET COMM PARMS] menu.

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

5 1

(9-pin D-sub female)

9 6
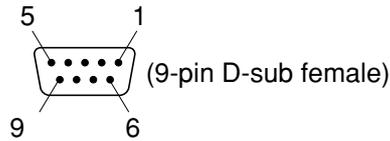
Communication standard	Pin No.	Signal name	Details	Direction
RS-422	4	TA	Transmitted data (Controller ⇨ Personal computer)	Output
	7	TB		
	8	RA	Received data (Personal computer ⇨ Controller)	Input
	9	RB		
Connector field		FG	Frame ground	—

5

① **4-wire system**

Personal computer

RS-232C/422 converter Z-101HE

Shielded twisted-pair cable

Controller (9-pin D-sub)

Signal name					Pin No.	Signal name	Function
FG	1	FG	SHIELD		Connector case	FG	Connector frame ground
TD	2	TD	RD(+)		4	TA	Transmitted data
RD	3	RD	RD(—)		7	TB	(Controller ⇨ Personal computer)
SG	7	SG	TD(+)		8	RA	Received data
			TD(—)		9	RB	(Personal computer ⇨Controller)

1	FL1	Memory protection 1
6	FL2	Memory protection 2

15 m or less (RS-232C)   1 km or less (RS-422)

② **2-wire system**

Personal computer

RS-232C/422 converter Z-101HE

Shielded twisted-pair cable

Controller (9-pin D-sub)

Signal name					Pin No.	Signal name	Function
FG	1	FG	SHIELD		Connector case	FG	Connector frame ground
TD	2	TD	RD(+)		4	TA	Transmitted data
RD	3	RD			7	TB	(Controller ⇨ Personal computer)
RS	4	RS	RD(—)		8	RA	Received data
SG	7	SG			9	RB	(Personal computer ⇨Controller)

1	FL1	Memory protection 1
6	FL2	Memory protection 2

15 m or less (RS-232C)   1 km or less (RS-422)

[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-S31M/S32M/S33M).
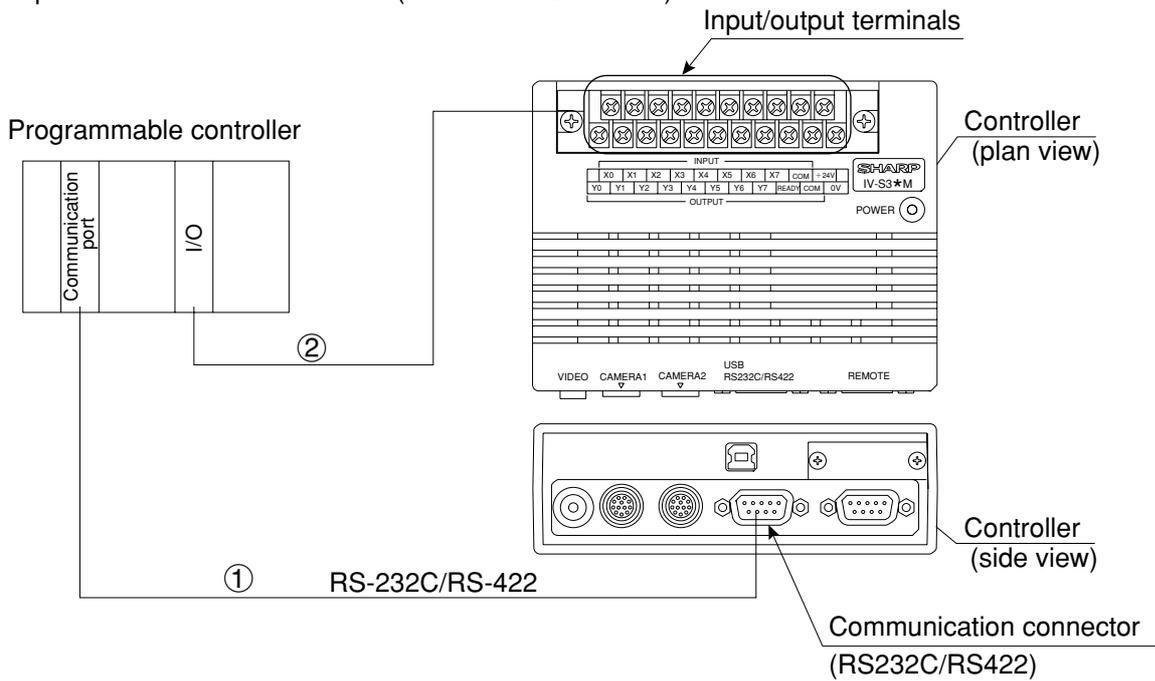
① Connect the computer link connector (RS-232C/RS-411) of a programmable controller to the communication connector (RS232C/RS422: 9-pin D-sub, female) on the controller.
- See "Computer Link" in the IV-S30 User's Manual (Function and Operation).
(The pin arrangement of the communication connector on the controller is shown on page 5-20 to 5-21.)
- In the case of RS-232C, the maximum communication cable length depends on the communication speed.

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

Conduct a communication test before using the devices for measurements.

② Connect the input/output terminals of the programmable controller to the input/output terminals on the controller.
- 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/C3/C4 camera

[1] Installing and connecting the IV-S30C1/C3

(1) Connections

Up to two IV-S30C1 standard cameras or IV-S30C3 high-speed cameras can be connected to the following controllers using camera cables.

Camera	Controller to connect	Cables to be used
IV-S30C1	IV-S31M, IV-S32M, IV-S33M	IV-S30KC3 (3 m), IV-S30KC5 (5 m), IV-S30KC7 (7 m),
IV-S30C3	IV-S33M	IV-S30KC3 (3 m), IV-S30KC5 (5 m)

Note 1: Do not connect the IV-S30C3 to the IV-S31M/S32M. The IV-S30C3 cannot be used with the IV-S30KC7.
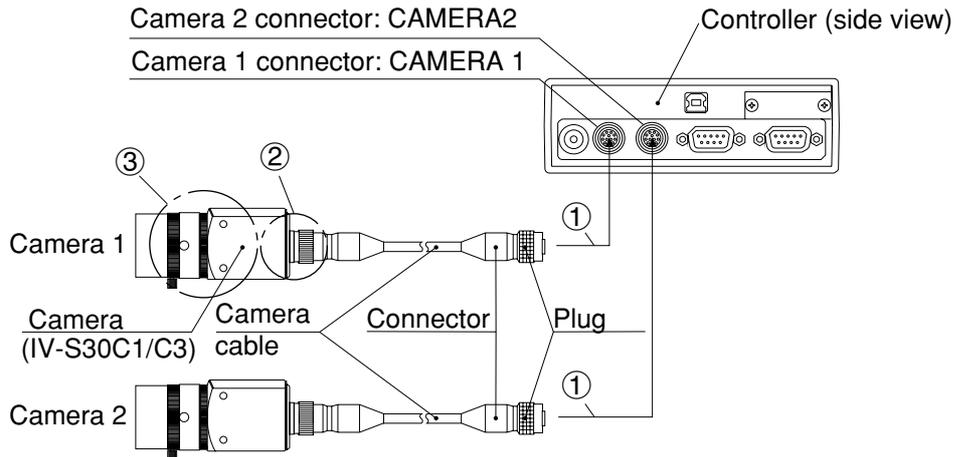
① Connect the camera cable(s) to the CAMERA 1 and CAMERA 2 connectors on the controller.
 - To connect them, match the keyed portion of the connectors and press in. When they are firmly connected, you will hear a click.
 - To unplug a connector, hold the plug housing and pull it straight out.
 - Any 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-S30 system.
  Note 2: Make sure to turn OFF the power before connecting or disconnecting the cameras.
  Note 3: If there is only one camera, make sure to connect it as system camera 1.
② Plug the other end of the camera cable into the IV-S30C1/C3, 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/C3 until it is secure.
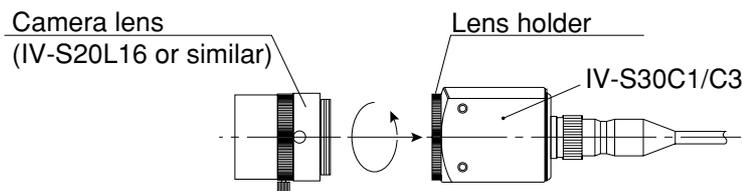
Remarks

 - You cannot use different types of cameras at the same time with the same controller (standard, high-speed and EIA cameras cannot be mixed). When an IV-S30C1 or IV-S30C3 is connected to the controller, the other cameras that can be connected to the controller are as follows:

Camera	Compatible second cameras
IV-S30C1	IV-S30C2 (Micro camera)
IV-S30C3	IV-S30C4 (Micro, high-speed camera)

(2) Installing the camera body

Attach the camera (IV-S30C1/C3) on the mounting surface with the camera angle bracket (supplied with the camera).

- Installation example 1

Camera front view   **Camera side view**

IV-S30C1/C3   Camera angle bracket   Camera lens
(IV-S20L16 or similar)

Mounting surface

- Installation example 2

Camera angle bracket

IV-S30C1/C3

Mounting surface

- Installation example 3

IV-S30C1/C3

Camera angle bracket

Mounting surface
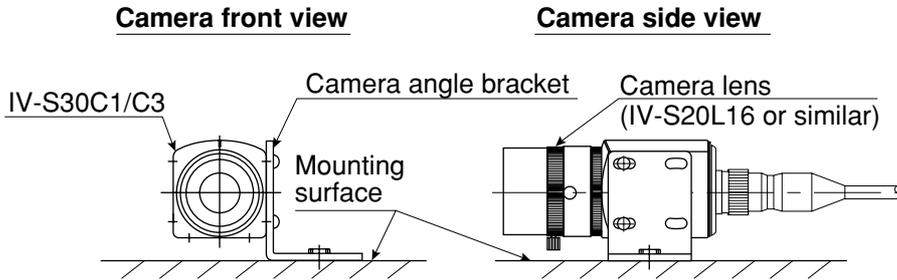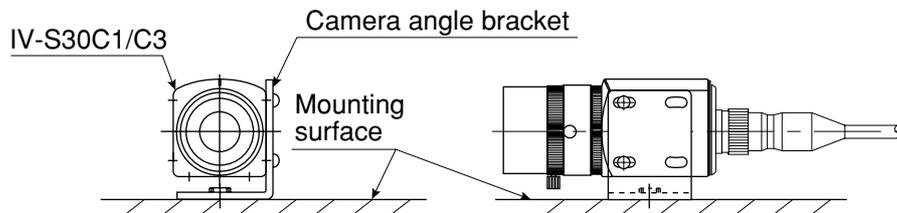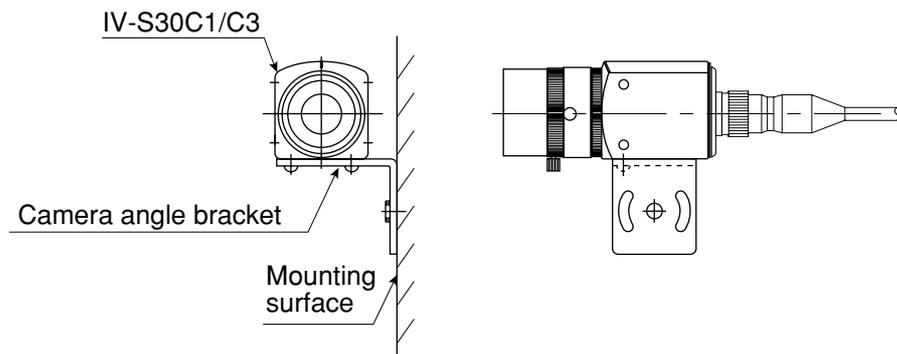
■ **Installation procedure**

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

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

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

- External dimensions when the IV-S20L16 camera lens and IV-S30KC3/KC5/KC7 camera cable are connected to the IV-S30C1/C3.

(Unit: mm)

2 M3 tapped holes

2 M3 tapped holes

2 M3 tapped holes

| IV-S30KC3 : 3000 |
| IV-S30KC5 : 5000 |
| IV-S30KC7 : 7000 |

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

*2 The IV-S30KC7 cannot be connected to the IV-S30C3.

5

- External dimensions of camera angle bracket

4 slotted holes wide
(for securing on the camera body)

(Unit: mm)

2 slotted holes 3.2 mm wide
(for attachment to the mounting surface)

1/4-20 UNC threaded hole
(for attachment to the mounting surface)

Note

- When the camera cable (IV-S30KC3/S30KC5/S30KC7) 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.

Camera cable

Bending radius: Min. 40 mm

5
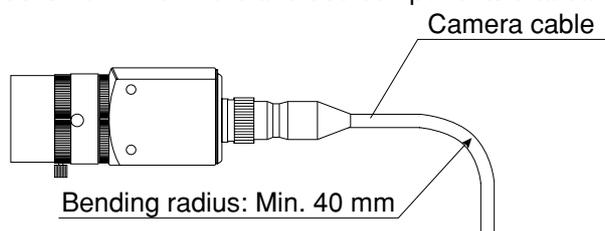
[2] Installing and connecting the IV-S30C2/C4

(1) Connections

Up to two IV-S30C2 micro cameras or IV-S30C4 micro, high-speed cameras can be connected to the following controllers using camera cables.

Camera	Controller to connect	Cables to be used
IV-S30C2	IV-S31M, IV-S32M, IV-S33M	IV-S30KC3 (3 m), IV-S30KC5 (5 m), IV-S30KC7 (7 m),
IV-S30C4	IV-S33M	IV-S30KC3 (3 m), IV-S30KC5 (5 m)

Note 1: Do not connect the IV-S30C4 to the IV-S31M/S32M. The IV-S30C4 cannot be used with the IV-S30KC7.
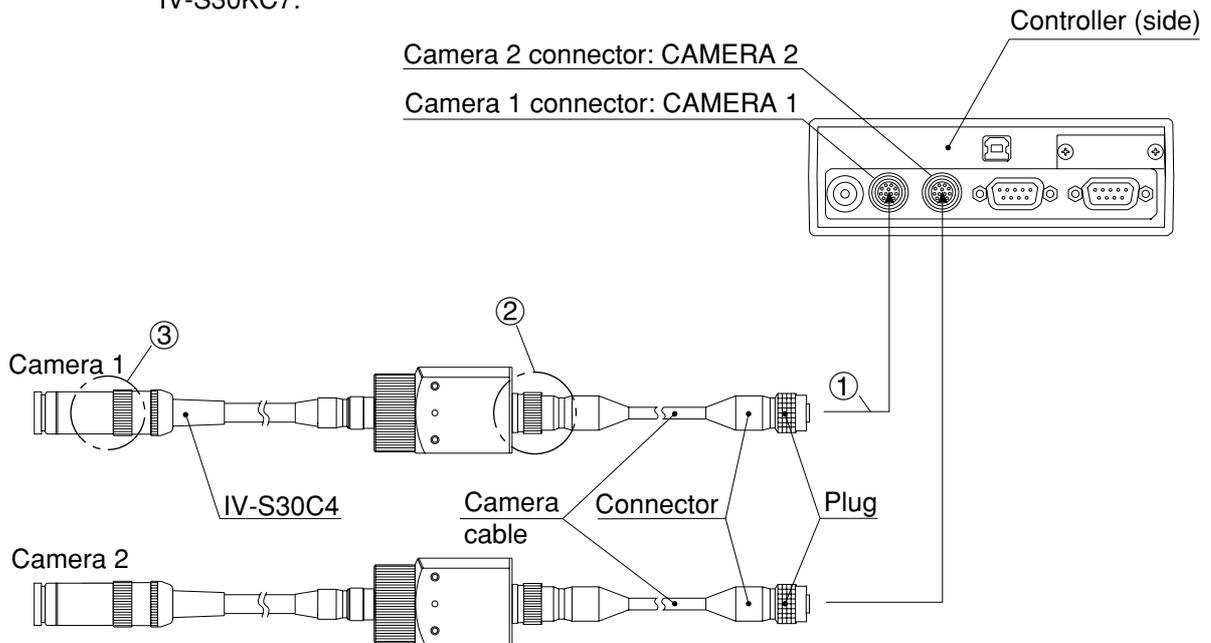
(Some parts of the external appearance of the IV-S30C2 are different from the IV-S30C4.)

① Connect the camera cable(s) to the CAMERA 1 and CAMERA 2 connectors on the controller.
  - 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-S30 system.

    Note 2: Make sure to turn OFF the power before connecting or disconnecting the cameras.

    Note 3: If there is only one camera, make sure to connect it as system camera 1.

(Remarks)

- You cannot use different types of cameras at the same time with the same controller (standard, high-speed and EIA cameras cannot be mixed). When an IV-S30C2 or IV-S30C4 is connected to the controller, the other cameras that can be connected to the controller are as follows:

Camera	Compatible second cameras
IV-S30C2	IV-S30C1 (standard camera)
IV-S30C4	IV-S30C3 (high-speed camera)

Connection and Installation Methods

② Plug the camera connector on the camera cable (camera conversion cable) into the cable connector on the IV-S30C2/C4 camera and screw it down to secure the connection.
③ Screw a commercially available lens into the camera head of the IV-S30C2/C4.

Lens
(commercially available)   Camera head
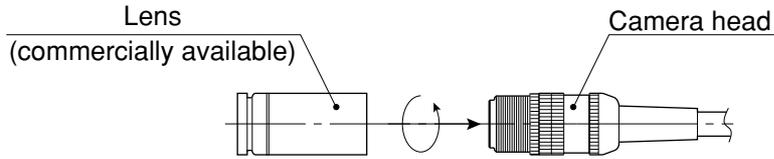
1. Screw the lens in until the camera image is focused.

5
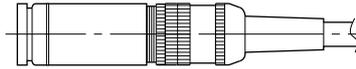
2. Secure the lens using the lens locking ring on the camera head

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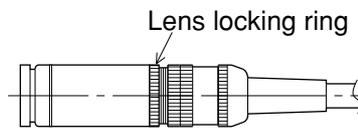
• External dimensions of the IV-S30C2 camera head   (Unit: mm)

M15.5×0.5 $\phi16$

$\phi17$

$*$ 7.4±0.1
3   22±0.1
35.6 $*7$
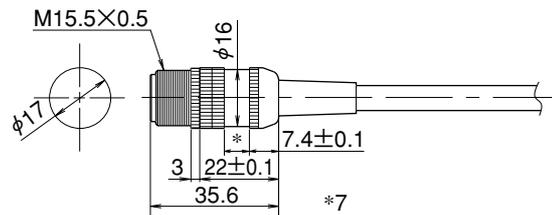
• External dimensions of the IV-S30C4 camera head

M15.5×0.5 $\phi16$

$\phi17$

$*$ 7.4±0.1
3   22±0.1
35.6 $*7$
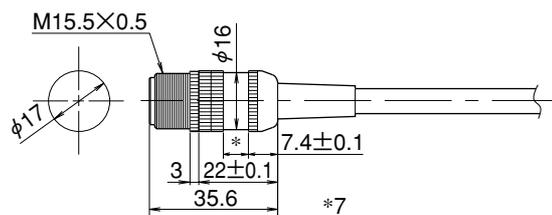
(2) Installation of the camera head
　① Put the camera head through the bracket (supplied with the IV-S30C2/C4) from the cable side
　　and slide the camera head into position.

Camera head bracket
(accessory)

Installed position of
the camera head

Camera head

Lens
(commercially available)
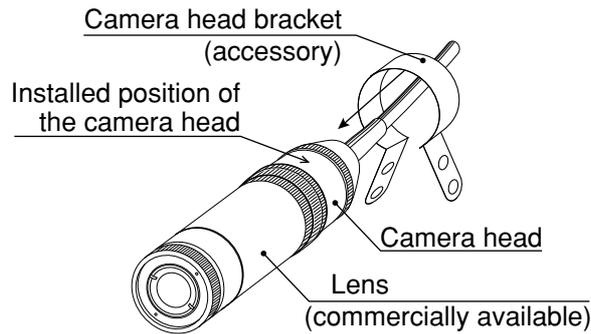
　② Secure the camera head bracket using the M3x6 screws that come with the IV-S30C2/C4.

Screws
(M3 x 6:
accessory)

Mounting hole
(φ3.4: For securing the
camera assembly in place)
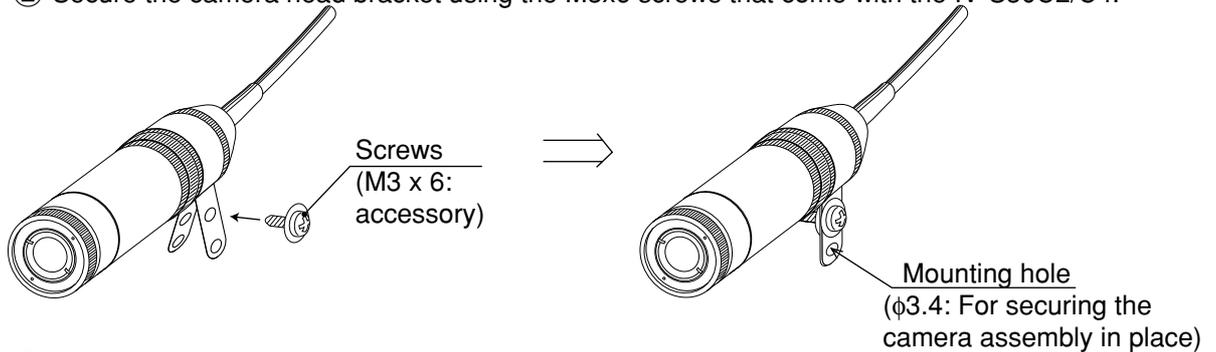
　③ Secure the camera head assembly in place using the mounting hole (ø3.4) on the camera head
　　bracket.

Front view

Side view

Installation surface

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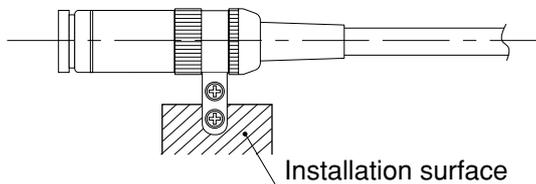
Note: The camera head bracket supplied with the camera is for simple installations and is not
　　vibration-damping. To meet specific needs, the user may have to make a specialized bracket.

• External dimensions of the camera head bracket

(Unit: mm)

M3 hole

φ15.9

31.4

φ3.4

φ3.4

φ3.4

20.8

27.9

0.4

6.5

7 to10

(Shape before installation)
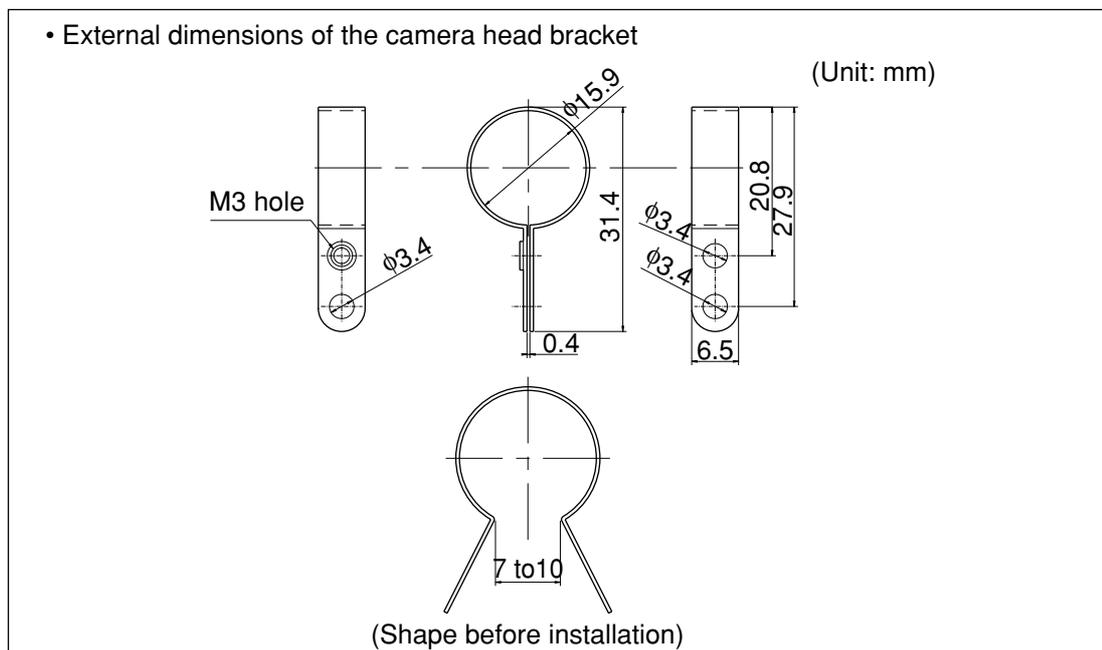
(3) Installation of the camera body

1. Attach the camera mounting bracket (comes with the IV-S30C2/C4) to the three M3 tapped holes (spacing: 20 mm) on the camera body using the M3×6 installation screws that come with the IV-S30C2/C4.
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]

Front view   Side view

Camera body   Camera mounting bracket   Camera body
                     (accessory)

                     Installation
                     surface   Camera mounting bracket

5
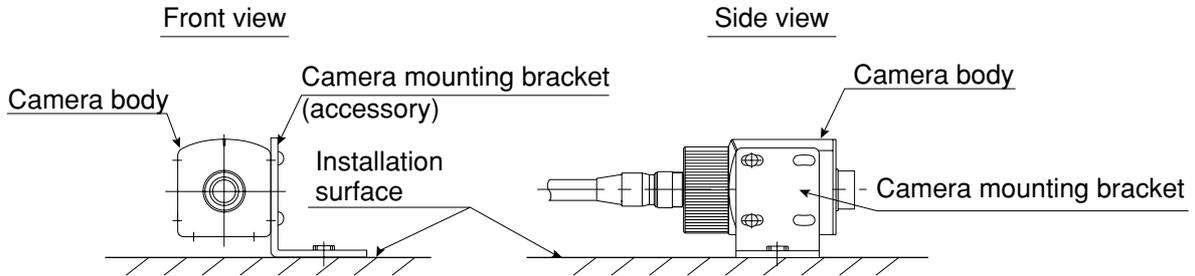
- External dimensions of the controller (IV-S30C2)   (Unit: mm)

28.5   28.5

20   32   20

44.7   30   6.5   44.7

2 M3 tapped holes   2 M3 tapped holes

44.7   28.5
5 20 5

2 M3 tapped holes

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

- External dimensions of the controller (IV-S30C4)

28.5   28.5

20   32   20

50   30   6.5   50

2 M3 tapped holes   2 M3 tapped holes

50   28.5
5 20 5

2 M3 tapped holes

* Attach the camera angle bracket to one of the tapped M3 holes 20 mm mounting

- External dimensions of camera angle bracket

4 slotted holes wide
(for securing on the camera body)

10° 10°

(Unit: mm)

20

25

39

5.5

22.5

28

2 slotted holes 3.2 mm wide
(for attachment to the mounting surface)

31

17

1/4-20 UNC threaded hole
(for attachment to the mounting surface)

20

28

3.2

60°

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.

Head cable

* Bending radius: Min. 40 mm

*

*
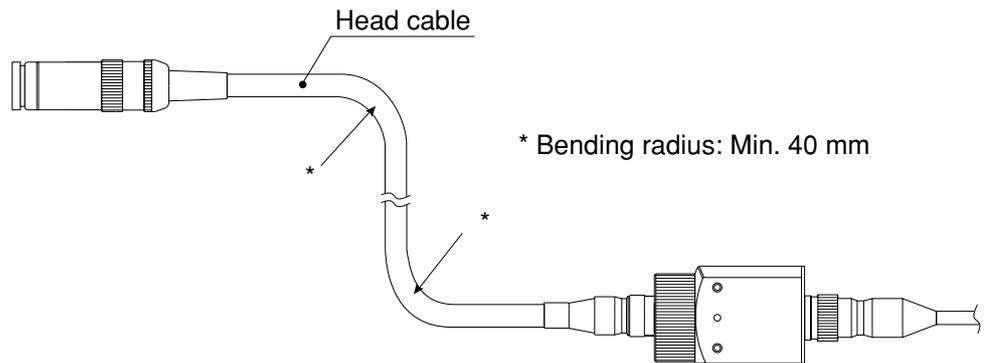
5-4 Installing, connecting, and wiring the IV-S30EA1 camera converter

[1] Connection to the IV-S33M controller

Connect the IV-S30EA1 camera converter to the IV-S33M controller using the main interface cable that comes with the camera converter.

Note: Do not connect the IV-S30EA1 to an IV-S31M/S32M controller.

Top view of the IV-S33M

Top view of the IV-S30EA1

Camera 1 connector: CAMERA 1

Camera 2 connector: CAMERA 2

Side view of the IV-S33M

Side view of the IV-S30EA1

Camera 1 connector

Camera 2 connector

Converter connector

Main interface cable (comes with the IV-S30EA1)
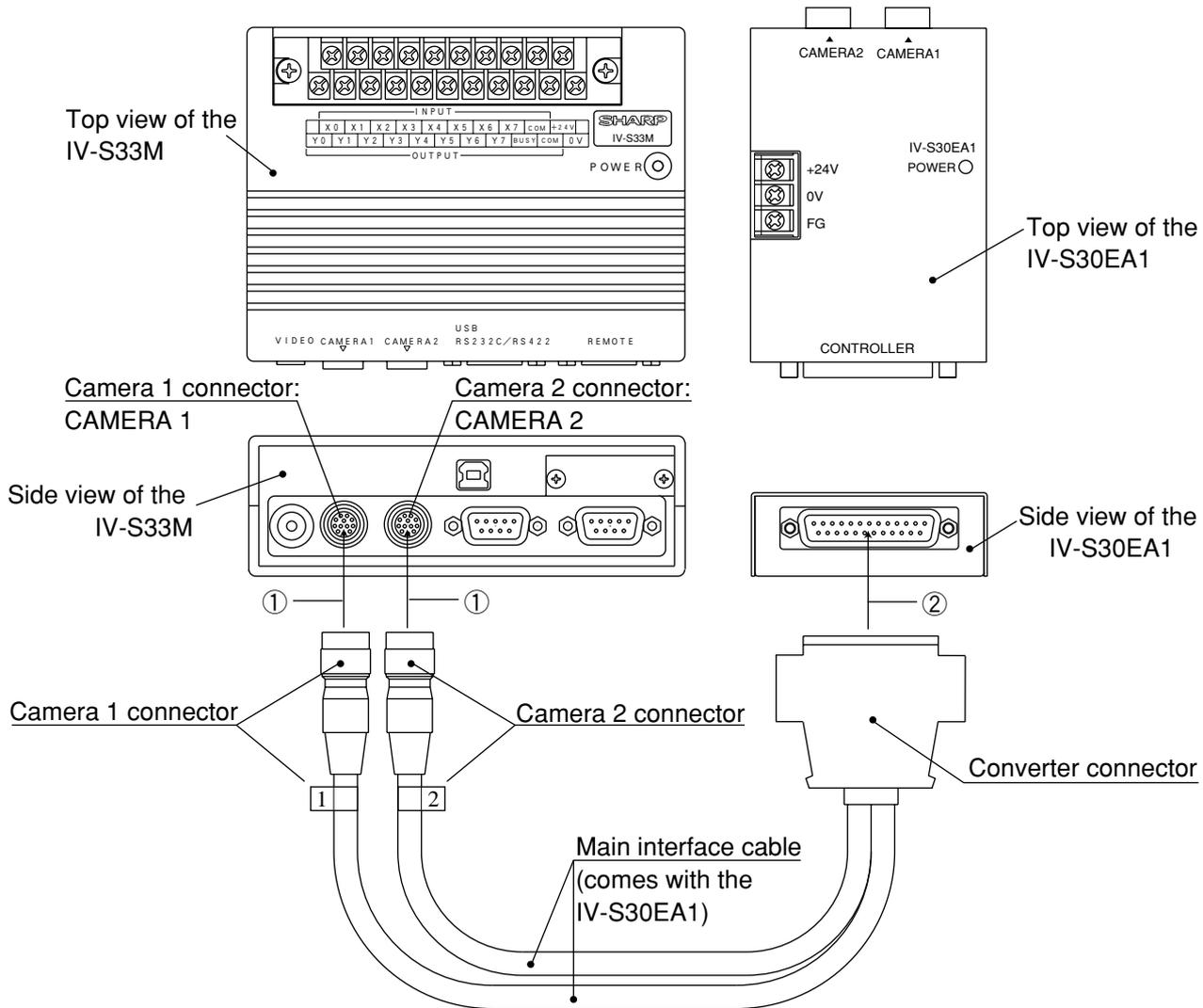
① Connect the camera 1 and 2 connectors on the main interface cable to the CAMERA 1 and CAMERA 2 connectors on the IV-S33M. Make sure the connector numbers match.
   Note: Make sure to turn OFF the power before connecting or disconnecting the cameras or connector.
   - To unplug a connector, hold the 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-S30 system.
② Connect the converter connector on the main interface cable to the controller connector on the IV-S30EA1.

• **External dimensions of the main interface cable.**

(Unit: mm)

45   250   45

54
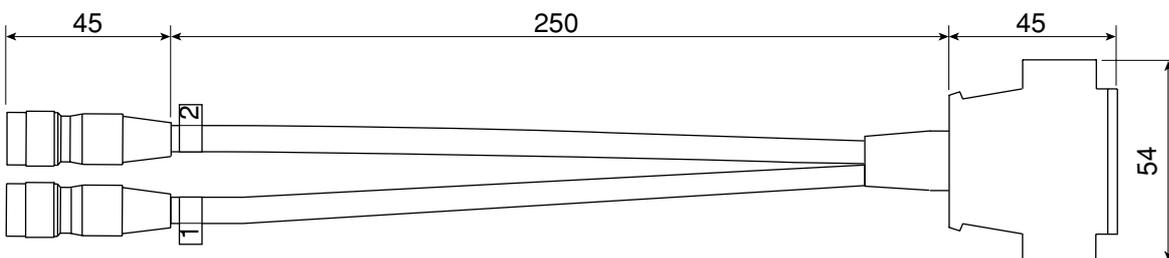
[2] Connection to an EIA camera

This section describes how to connect a commercially available camera that conforms to the EIA standards to the IV-S30EA1.

(1) Cameras that can be connected

The specifications of the EIA cameras that can be connected to the IV-S30EA1 and the cameras we recommend are as follows:

Item	Specifications
Number of scan lines	525
Scan method	2:1 interlace
Frequency	Horizontal 15.734 kHz, vertical 59.94 Hz
Image output	1.0 Vp-p (with a 75 ohm load)
Power supply	+12 VDC ±10%
Current consumption	300 mA maximum

• Recommended cameras

Model	Manufacturer
XC-75	Sony
CS8320B	Tokyo Electronics Industries

(2) Connecting between the IV-S30EA1 and an EIA camera

Connect the IV-S30EA1 to an EIA camera using the EIA camera cable.
Check the signals (pin assignment) against the figures below.
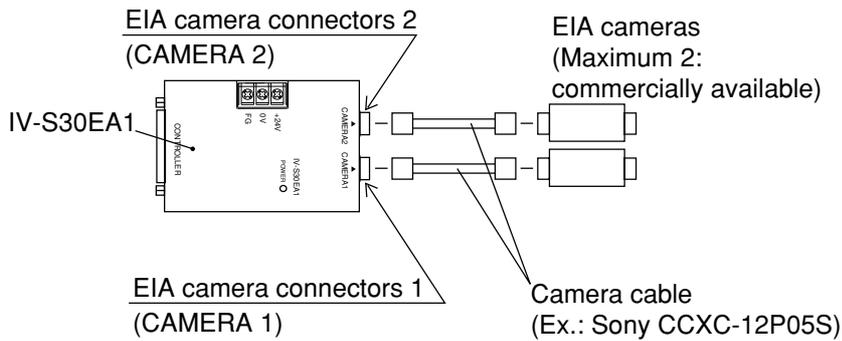
• EIA camera connector pin assignments for connectors 1 and 2 on the IV-S30EA1
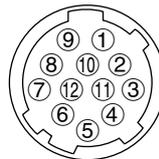
12-pin round connector (female): Made by Hirose Electric

Pin No.	Signal name	Signal type (input/output)	
		INT (internally synchronized mode)	EXT (externally synchronized mode)
1	GND	-	-
2	+12 V		
3	Image GND		
4	Image signal	Input	Input
5	HD GND	-	-
6	HD	Input	Output
7	VD	Input	Output
8	TRIG GND	-	-
9	TRG signal	High impedance state	Output
10	GND	-	-
11	-	Not connected	Not connected
12	VD GND	-	-

- When only one EIA camera is used, make sure to connect it to connector 1 (CAMERA1).

[3] Installing the IV-S30EA1

The bottom of the IV-S30EA1 camera converter should be installed by securing it on another surface with the two mounting brackets that come with the IV-S30EA1.

Mounting bracket   IV-S30EA1

Installation surface
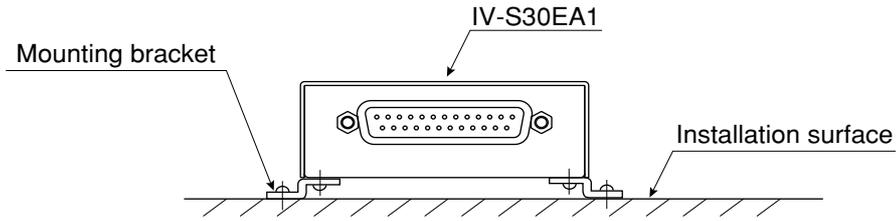
(1) Installation procedures

① Install the two mounting brackets on the bottom of the IV-S30EA1. Use the 4 screws (M3 x 6) that come with the IV-S30EA1.

2 mounting brackets

View from the bottom

Screw installation positions (4)
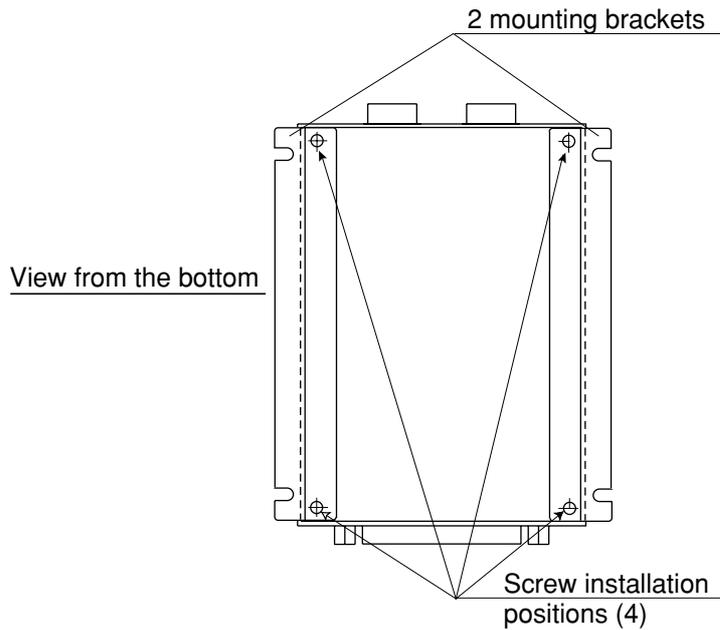
② Secure the unit on the installation surface using the mounting brackets.

5   79   5

(Unit: mm)

CAMERA2   CAMERA1

Installation positions (4)

15

70

+24V
0V
FG

IV-S30EA1
POWER ○

100

15

CONTROLLER

89
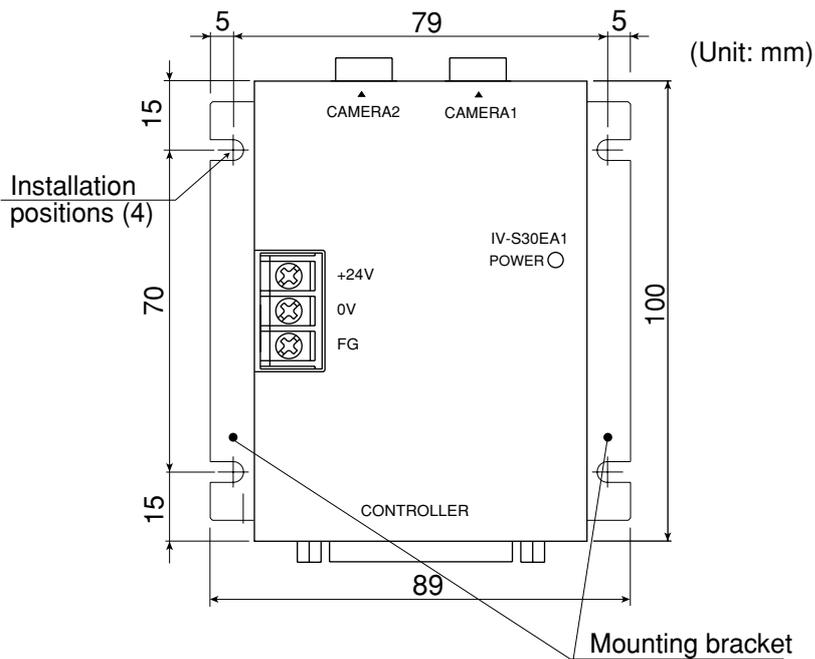
Mounting bracket

The external dimensions of the IV-S30EA1 and mounting brackets are shown on the next page.

5-34

- External dimensions of the IV-S30EA1

(Unit: mm)

70

25

CAMERA2   CAMERA1

+24V
0V
FG

IV-S30EA1
POWER ○

MODE
INT ⬛ EXT

100

100

100

70

70

25

CONTROLLER

25

70

5
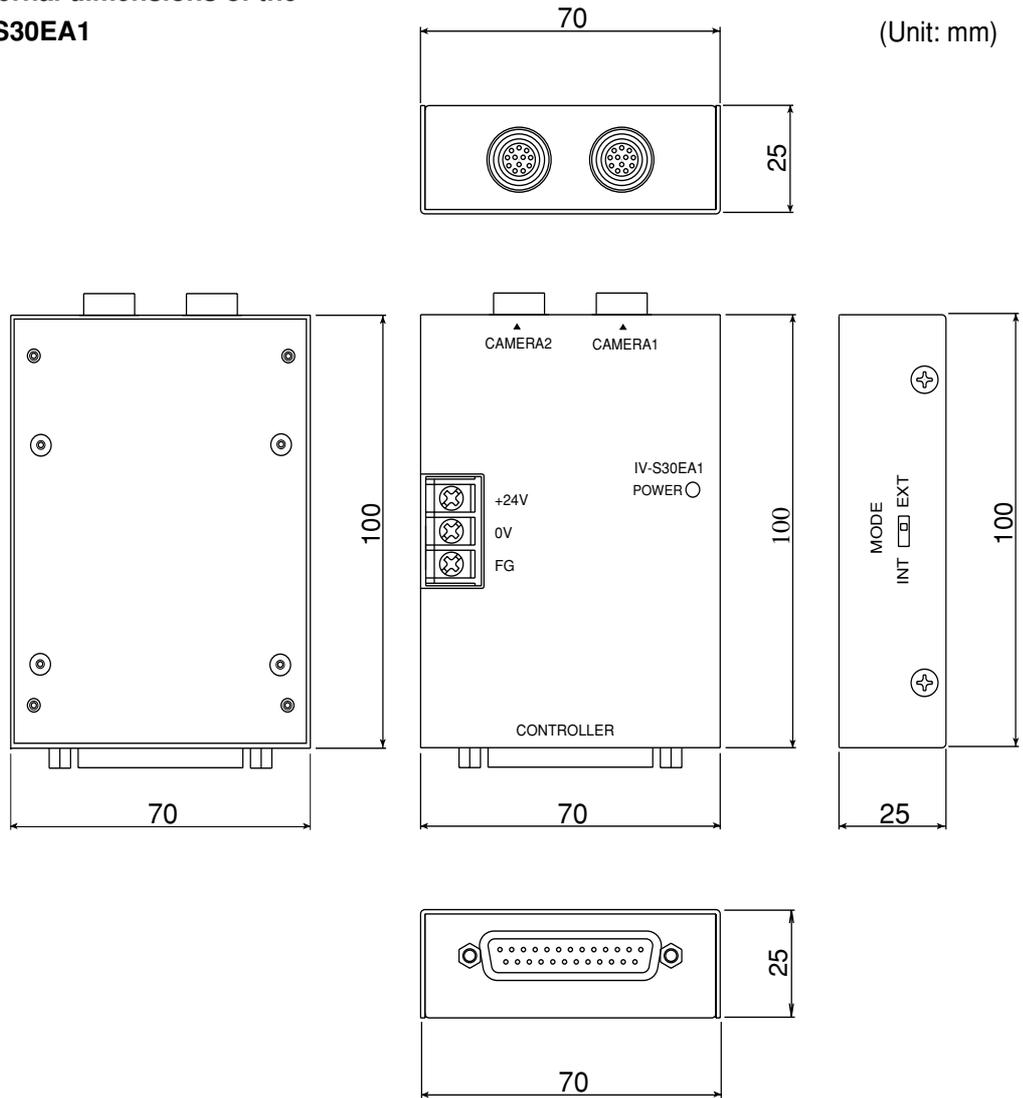
- External dimensions of main housing angle bracket

(Unit: mm)

2 holes 3.2 mm in diameter
(for attaching the bracket to the controller)

1.6

5

81

5

11

23

5

10

10

5.7

4.5

10.5

70

10.5

91

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

(2) Installation example

238

138   11   79

148   1   89

(Unit: mm)

IV-S33M
controller

CAMERA2   CAMERA1

INPUT

X0 X1 X2 X3 X4 X5 X6 X7 COM +24V
Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7 READY COM 0V

OUTPUT

SHARP
IV-S33M

POWER

IV-S30EA1
POWER

+24V
0V
FG

15

70

100

VIDEO CAMERA1 CAMERA2 USB
RS232C/RS422   REMOTE

CONTROLLER

IV-S30EA1

1   2

*Main interface cable

* The main interface cable should not be bent to a radius smaller than 40 mm.
  (External dimensions of the main interface cable ⇨ See page 5-32.)

5-36

[4] Wiring of the IV-S30EA1
■ Connecting a power supply

Connect a commercially available constant-voltage power supply to the power terminals (POWER: +24 V, 0 V) on the IV-S30EA1. Use a 24 VDC ± 10%, 500 mA or more constant-voltage power supply.
- Use an individual and dedicated power supply to supply power to the IV-S30EA1. 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.

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This distance must be as short as possible. (Recommended distance: less than 1 m)

Power supply terminal (POWER: + 24V)
Power supply terminal (POWER: 0V)

CAMERA2   CAMERA1

IV-S30EA1

IV-S30EA1
POWER ○

DC24V (+) (−)

+24V
0V
FG

Fuse (1A)
Frame ground terminal

Constant-voltage power supply

CONTROLLER
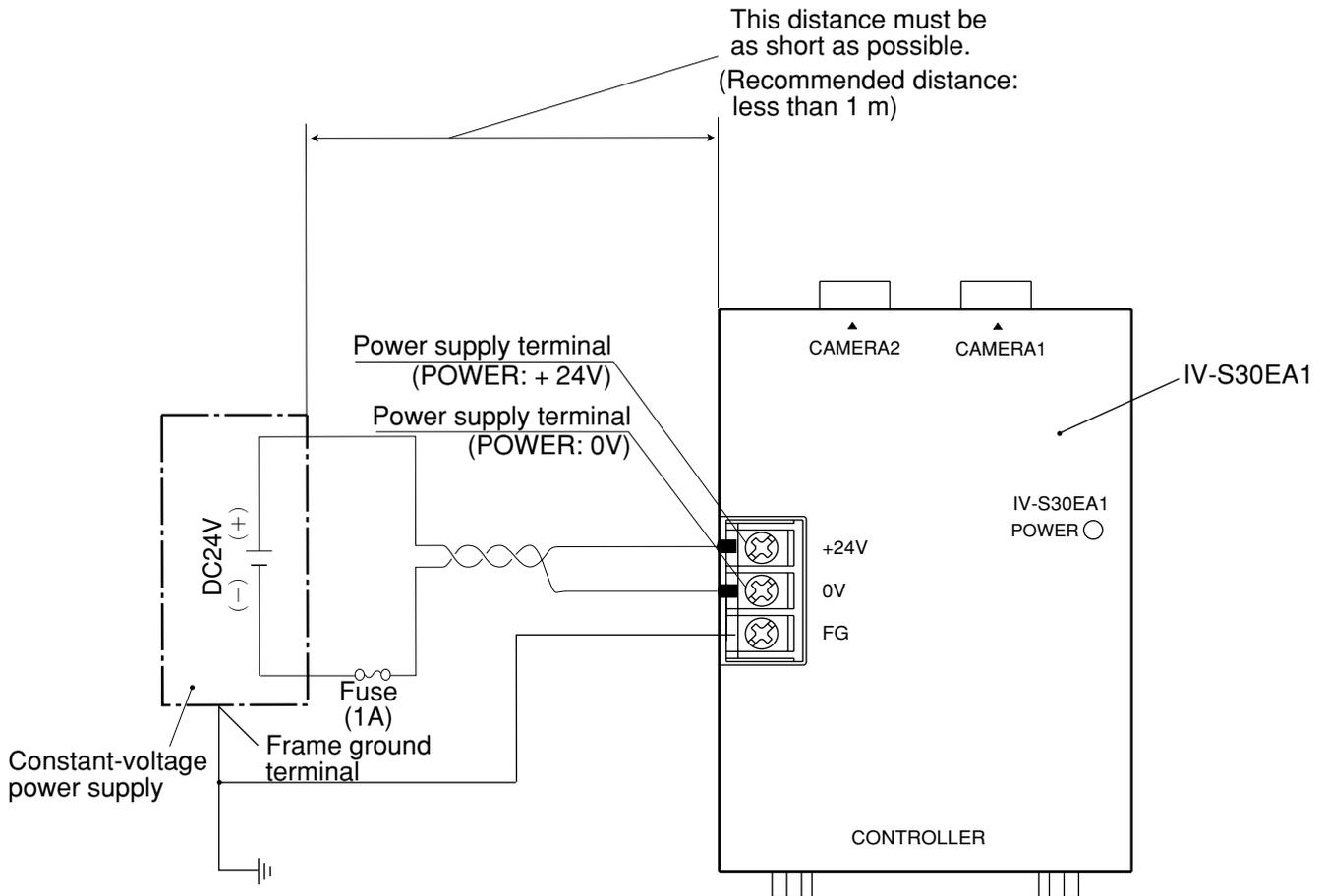
Note: To improve the noise resistance of the constant-voltage power supply connected to the IV-S30EA1, observe the following precautions.
- Ground the FG terminal of the constant-voltage power supply according to the class 3 grounding.
- The power line between the IV-S30EA1 and the constant-voltage power supply must be as short as possible. (Recommended distance: less than 1 m)
  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.

Chapter 6: Setting and Operating Outlines

6-1 Setting and operating procedures

The setting and operating procedures are outlined below.

① System design
- Measurement program (positional deviation measurement, degree of match inspection, etc.)
- Number of cameras, externally connected devices, system components
- Input/output (start measurement input, result output, object type change, etc.)
- Lighting equipment, illumination, shutter speed, lens, etc.

(Ref. chapter)
- 1-2 Measurement programs
- 3-1 Basic system configuration
- 3-2 System configuration examples
- 5-1 Installation conditions

② Installation/assembly
- Connection of cameras and monitor to the controller
- Installation of the controller and camera body
- Connection of a power supply, input/output terminals and external devices

5-2 to 5-4 Connection and installation and wiring methods

③ Turning ON the power supply (controller and monitor)

④ Menu selection
- Select either the standard menus or the simplified menus.

6-2 Standard menus and simplified menus

⑤ Environment settings
- Input/output conditions related to external devices (Method for starting measurements, communication conditions, etc.)
- Operating conditions (Method for capturing images and displaying the measurement results)

● **Simplified menus**
Chapter 7: Simplified Menu Operation
(See "7-3 Setting procedures" item.)

⑥ Setting the conditions for each object type

● **Standard menus**
- Specify object type No.
- Edit (copy and initialization)
- Setting measurement program conditions (measurement 0 to 3)
- Setting positional correction "YES/NO"
- Setting all of the system numerical calculations
- Setting final output conditions
- System/input/output settings

● **Simplified menus**
- Specify object type No.
- Enter the shutter speed
- Enter the measurement conditions
- Enter the evaluation conditions
- Enter the positional correction (Existence inspection)

● **Standard menus**
See the User's Manual (Function and Operation)

⑦ Operation

⑧ Test/inspection

User's Manual (Function and Operation)

⑨ Maintenance

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6-2 Standard menus and simplified menus

The IV-S30 has two types of main menu configurations: standard menus and simplified menue. The standard menus have all of the functions available which are presented to the operator. The simplified menus make it easy to set up position and existence inspections

```
                    ┌─── Standard menus ───┐
Menu selection ─────┤                      ┌─── Positioning
                    └─── Simplified menus ──┤
                                            └─── Existence inspection
```
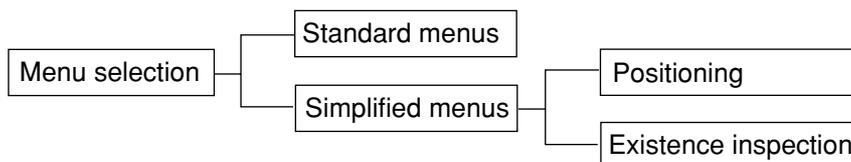
■ **Major differences between the standard menus and the simplified menus**

Item	Standard menus	Simplified menus
Number of menu layers	Three layers	Two layers
Positional deviation measurement (Positioning)	Number of registers: 8 1-point search, 2-point search, 1-point edge, 2-point edge 1-point search + 1-point edge	Number of registers: 1 1-point search, 2-point search
Area measurement by binary conversion (Existence inspection)	Number of registers: 16 Definable rectangular, circular, and elliptical areas. Enable mask window and noise filter.	Number of registers: 8 Only rectangular area is definable. Mask window and noise filter setting not possible.
Degree of match inspection	Yes	No
Lead inspection	Yes	No
BGA/CSP inspection	Yes (IV-S32M/S33M)	No
Object counting by binary conversion	Yes	No
Object identification (labeling) by binary conversion	Yes	No
Point measurement	Yes	No
Multiple position measurement	Yes	No
Multiple degree of match inspection	Yes	No
Distance and angle measurement	Yes	No
Positional correction	XY correction, angular correction	XY correction (existence inspection)
Register/display NG images	Yes (IV-S32M/S33M)	No
PC function	Yes	No
Numerical calculation function	Yes	No

(The rows from "Positional deviation measurement" through "Distance and angle measurement" are grouped under "Measurement program" on the left side.)

■ **Relationship of the data between the standard menus and the simplified menus**

The data entered in the simplified menus will be saved when the screen is changed to the standard menus. The data set up in the standard menus will be initialized when the screen is changed to the simplified menus (the settings will be lost). The table below describes the relation between the data entered in the standard menus and in the simplified menus.

Simplified menus				Standard menu		
Measurement details	Camera selection	Camera	Register number	Measurement number	Measuring program	Register number
Positioning	Camera 1	Camera 1	-	MEASUREMENT 0 CAMERA 1	Positional deviation measurement	0
	Camera 1 & 2	Camera 1	-	MEASUREMENT 0 CAMERA 1		
		Camera 2	-	MEASUREMENT 0 CAMERA 2		
Existence inspection (Deviation amount for XY correction)	Camera 1	Camera 1	-	MEASUREMENT 0 CAMERA 1	Positional deviation measurement (XY correction)	0
	Camera 1 & 2	Camera 1	-	MEASUREMENT 0 CAMERA 1		
		Camera 2	-	MEASUREMENT 0 CAMERA 2		
Existence inspection (Binary area)	Camera 1	Camera 1	0 to 7	MEASUREMENT 1 CAMERA 1	Area measurement after binary conversion	0 to 7
	Camera 1 & 2	Camera 1	0 to 7	MEASUREMENT 1 CAMERA 1		
		Camera 2	0 to 7	MEASUREMENT 1 CAMERA 2		

The object type numbers (IV-S31M: 0 to 15, IV-S32M: 0 to 31, IV-S33M: 0 to 63) are also shared by both types of menu configurations.

[1] Menu configuration

(1) Standard menu configuration

First layer (MAIN OPS MENU)	Second layer (Upper and lower, two window style)		Third layer
	Upper screen	Lower screen	

```
MAIN OPS MENU
EVALUATION          SYSTEM COND          /O CONDITIONS
COND CHANGE                              SET COMM PARAM
PC MONITOR          TYPE RUN COND        COMPUTER LINK
NG-IMG-DSP                               GAIN-OFFSET

                    TYPE MEAS COND       IMG PRE-PROCESS      ADJ. IMAGE BRIGHT
                    (each object type)                        CHANGE LIGHT LEVEL
                                                              COMPARE IMAGES
                                                              MASK BINARY IMAGE

                                         MEASUREMENT 0        GRAY-SCALE COND
                                         CAMERA 1             EDGE DETECT COND
                                         MEASUREMENT 0        BINARY AREA COND
                                         CAMERA 2             EVALUATION COND
                                         POSITION              (including serial
                                         CORRECTION           output settings)
                                         MEASUREMENT          DISTANCE&ANGLE
                                         1 to 4               COND
                                                              NUMERIC CALC COND
                                         TITLE registration   OUTPUT COND

                                                              FINAL CALC COND
                                                              FINAL OUTPUT COND
                                         I/O for each object type   CCD TRIGGER COND
                                         SYSTEM for each      LIGHT LEVEL COND
                                         object type
```

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(2) Simplified menu configuration (positioning)

First layer (MAIN OPS MENU)	Second layer (Upper and lower, two window style)	
	Upper screen	Lower screen

```
MAIN OPS MENU          SYSTEM COND          SET COMM PARAM
                                            COMPUTER LINK
MEASUREMENT
RESULT                 TYPE RUN COND

EVALUATION
COND SETTING           POSITIONING
                       CONDITIONS
OBJ TYPE
SETTING

SHUTTER SPEED
```
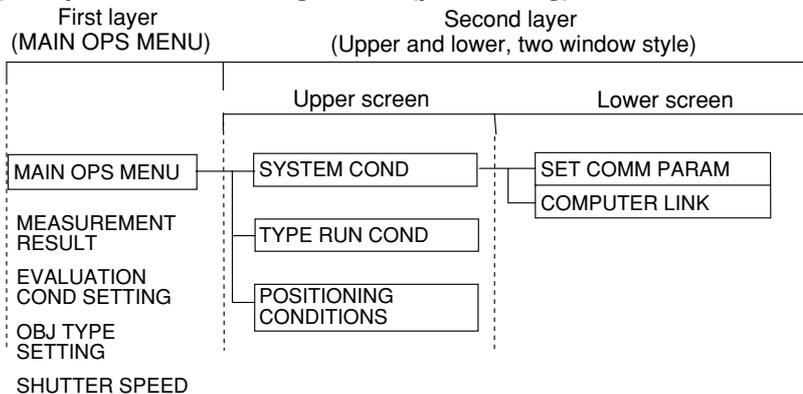
(3) Simplified menu configuration (existence inspection)

First layer (MAIN OPS MENU)	Second layer (Upper and lower, two window style)	
	Upper screen	Lower screen

```
MAIN OPS MENU          SYSTEM COND          SET COMM PARAM
                                            COMPUTER LINK
MEASUREMENT
RESULT                 TYPE RUN COND

EVALUATION
COND SETTING           EXISTENCE
                       INSPECTION COND
OBJ TYPE
SETTING                POSITIONAL
                       CORRECTION COND
SHUTTER SPEED
```
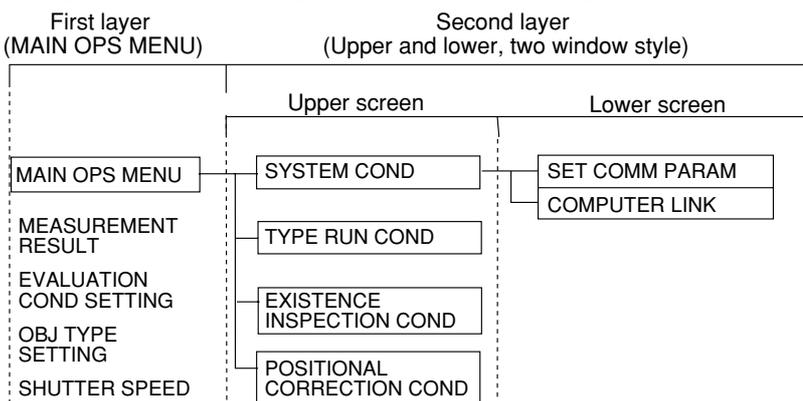
[2] Method for selecting the menu configuration

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

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

Power ON

[SELECT MENU]

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

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

[SIMPLIFIED MENU]

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



OPS-MENU
```

1. Move the cursor to the item you want to set with the up and down keys, and press the SET key.
2. Move the cursor to the item you want to specify with the left and right keys, and press the SET key.
3. Move the cursor to the OPS-MENU item with the up and down keys, and press the SET key.
⇨ The [MAIN OPS MENU] screen will appear.

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

```
(TYPE00)                          F.IMG  C1 H
                                       VX.XX
MEAS 0000ms  2000-08-01 10:30
MEASURE0 CAM1 NO




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

Camera 1: Use only CAMERA 1
Camera 1& 2: Use both CAMERA 1 and CAMERA 2

When the [①MEAS OBJ] is set to [EXISTENCE], [③ XY CORRECTION] item is displayed. Select "YES" to execute an XY correction.

Positioning (CAMERA 1 & 2)
```
(TYPE00)                          F.IMG  C1 H
                                       VX.XX
MEAS 0000ms 2000-08-01 10:30
MEASURE 0  CAM1 POSITIONING

00 × 08 × 16 × 24 × 32 × 40 × 48 × 56 ×
01 × 09 × 17 × 25 × 33 × 41 × 49 × 57 ×
02 × 10 × 18 × 26 × 34 × 42 × 50 × 58 ×
03 × 11 × 19 × 27 × 35 × 43 × 51 × 59 × *
04 × 12 × 20 × 28 × 36 × 44 × 52 × 60 ×
05 × 13 × 21 × 29 × 37 × 45 × 53 × 61 ×
06 × 14 × 22 × 30 × 38 × 46 × 54 × 62 ×
07 × 15 × 23 × 31 × 39 × 47 × 55 × 63 ×

X0~7 ████████ Y0~7 ████████  READY█
CHG-TYPE POSI-COND POSI-EVAL.         SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```

Existence inspection (CAMERA 1 & 2, XY correction: YES)
```
(TYPE00)                          F.IMG  C1 H
                                       VX.XX
MEAS 0000ms 2000-08-01 10:30
MEASUREMENT POSITION CORRECTION

00 × 08 × 16 × 24 × 32 × 40 × 48 × 56 ×
01 × 09 × 17 × 25 × 33 × 41 × 49 × 57 ×
02 × 10 × 18 × 26 × 34 × 42 × 50 × 58 ×
03 × 11 × 19 × 27 × 35 × 43 × 51 × 59 × *
04 × 12 × 20 × 28 × 36 × 44 × 52 × 60 ×
05 × 13 × 21 × 29 × 37 × 45 × 53 × 61 ×
06 × 14 × 22 × 30 × 38 × 46 × 54 × 62 ×
07 × 15 × 23 × 31 × 39 × 47 × 55 × 63 ×

X0~7 ████████ Y0~7 ████████  READY█
CHG-TYPE AUX-COND AUX-EVAL. EXIST-COND EXIST-EVAL. SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```

* For the IV-S33M

- For details about the method for using the simplified menus, see Chapter 7, "Simplified Menu Operation."
- For details about the method for using the standard menus, see the User's Manual (Function and Operation).

Notes

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

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

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

```
[SYSTEM COND]
①I/O CONDITIONS   (TO NEXT SUB-MENU)
②COMM.SET         (TO NEXT SUB-MENU)
③COMPUTER LINK    (TO NEXT SUB-MENU)
④INITIALIZATION  ALL-INIT  INIT-RAM
⑤STD→SELECT MENU EXEC
```
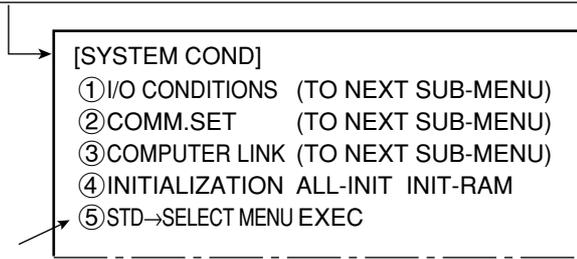
1. Move the cursor to the "⑤STD → SELECT MENU" item on the [SYSTEM COND] menu, and press the SET key.
2. Select the "EXEC" item, and press the SET key. The [SELECT MENU] screen will appear.

```
[SELECT MENU]
①STANDARD MENU      (STD RUN-MENU)
②SIMPLIFIED MENU    (SEL EASY MENU)
```
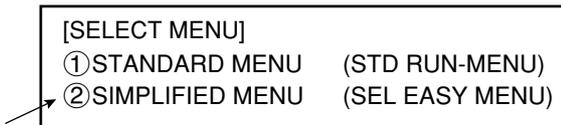
1. Move the cursor to the "②SIMPLIFIED MENU" item with the up and down keys, and press the SET key.
   ⇨ The [SIMPLIFIED MENU] screen will appear.
2. As described on the previous page, select each item that you want to specify, and press the SET key.

(**Notes**)

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

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

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

```
[SYSTEM COND]
①SERIAL OUTPUT NO  PC-LINK  SERIAL
②COMM.SET         (TO NEXT SUB-MENU)
③COMPUTER LINK    (TO NEXT SUB-MENU)
④INITIALIZATION   ALL-INIT  INIT-RAM
⑤SIMPLE MENU→STD  EXEC
```
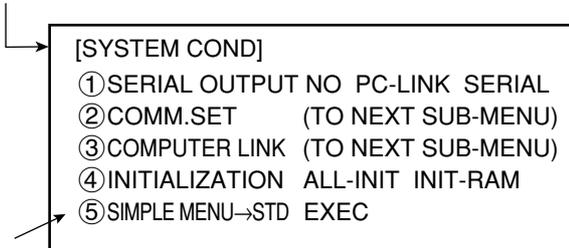
1. Move the cursor to the "⑤ SIMPLE MENU → STD" item on the [SYSTEM COND] menu, and press the SET key.
2. Select the "EXEC" item, and press the SET key. The [SELECT MENU] screen will appear.

```
[SELECT MENU]
①STANDARD MENU      (STD RUN-MENU)
②SIMPLIFIED MENU    (SEL EASY MENU)
```
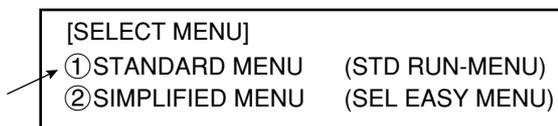
1. Move the cursor to the "①STANDARD MENU" item with the up and down keys, and press the SET key.
   ⇨ The [MAIN OPS MENU] screen with the standard menus will appear.

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

(**Notes**)

- Make sure to SAVE the system configuration data after you change from the simplified menus to standard menus configuration. Otherwise, your selection of the standard menus configuration will be ignored the next time you turn ON the power.
- The items that you selected for display on the simplified menus will be saved when the screen configuration is changed to the standard menus. (See page 6-2.)

6

6-3 Power on setting menu

Follow the procedure described below when turning ON the power to the IV-S31M/S32M/S33M controller, and the [POWER ON SETTING] menu will be displayed on the monitor.
1. Turn ON the power to the controller, while holding down the ESC key.
2. Keep pressing the ESC key down for approx. 9 sec., after turning ON the power and the menu will be displayed.

```
[POWER ON SETTING]
① MAIN OPS MENU   UNLOCK   LOCK
② DISPLAY MODE    JAPANESE   ENGLISH
③ OPERATION
```
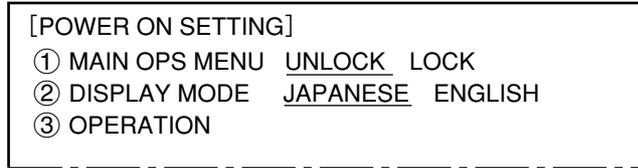
[1] Operations menu lock

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

■ **Operation procedure**
1. On the [POWER ON SETTING] menu, move the cursor to item ①MAIN OPS MENU with the up and down keys, and press the SET key.
2. Move the cursor to UNLOCK or LOCK with the left and right keys, and press the SET key.
3. Move the cursor to item ③OPERATION with the up and down keys, and press the SET key. Press the SET key once more.
⇨ The IV-S30 saves the settings in the flash memory and the screen will return to the SELECT MENU.

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

■ **Display when the MAIN OPS MENU is locked**

```
(TYPE00)                              T.IMG C1 L
                                      LOCK FULL VX.X
OK
MEAS  XXXXXXms
MEASURE 0  CAM1  POSI-DEVIATION
```
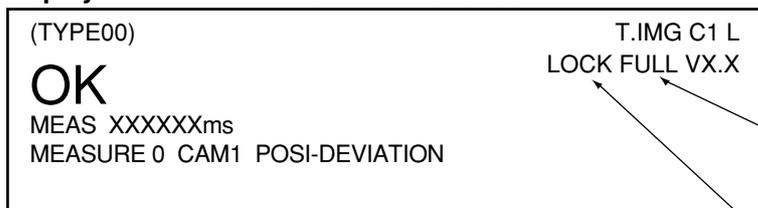
This is only displayed when using the IV-S33M

"LOCK" will be displayed on the MAIN OPS MENU

[2] Change the Japanese or English display mode

The language used on the screen scan be set to Japanese or English. Select the [POWER ON SETTING] menu.

■ **Operation procedure**
1. Move the cursor to item ②DISPLAY MODE with the up and down keys, and press the SET key.
2. Move the cursor to JAPANESE or ENGLISH with the left and right keys.
3. Move the cursor to item ③OPERATION with the up and down keys, and press the SET key. Press the SET key once more.
⇨ The screan will return to the MAIN OPS MENU.

6-4 Camera setting

The cameras that can be connected to IV-S31M/S32M/S33M controllers are as follows:

Controller	Connectable cameras
IV-S31M	IV-S30C1 Standard camera
IV-S32M	IV-S30C2 Micro camera
IV-S33M * 1	IV-S30C1 Standard camera IV-S30C2 Micro camera
	IV-S30C3 High-speed camera IV-S30C4 Micro, high-speed camera
	EIA camera (commercially available)

* You cannot use different types of cameras at the same time with the same controller (standard, high-speed and EIA cameras cannot be mixed).

[1] For the IV-S31M/S32M

Only IV-S30C1/C2 standard cameras can be connected to the IV-S31M/S32M controllers. These controllers do not have settings for the type of camera connected to it.

[2] For the IV-S33M

An IV-S30C1/C2 standard camera, IV-S30C3/C4 high-speed camera, or commercially available EIA cameras can be connected to the IV-S33M. Select the camera type (camera synchronization, image capture mode) in the "CAMERA TYPE" item on the [SYSTEM COND] menu to match the type of camera you have connected.

Camera connected		IV-S30C1 (standard) IV-S30C2 (micro)	IV-S30C3 (high-speed) IV-S30C4 (micro and high-speed)	EIA camera (commercial- ly available)
CAMERA TYPE (SYSTEM COND)	Camera selection	Standard	High-speed	EIA
	Camera synchronization ⇨ See (2) below	---	---	Externally or internally synchronized
	Image capture mode ⇨ See (1) below	---	Full or half, full + half	Full or half

- For details about finding the setting screens above, see page 7-31 for the simple menu and read the "Camera settings" section of the IV-S30 (IV-S31M/S32M/S33M) User's Manual, Function and Operation for details about the standard menu.

(1) Image capture mode

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

Image capture mode	Details
Full	Capture all of the lines in the image
Half	Capture the odds lines in the image
Full + half * 2	In the partial image mode, the measurement target lines are in full mode and the others are in half mode

* 2 "Full + half" mode can only be selected when it is a high-speed camera.
- For a comparison of the image capture times, see page 7-32.

(2) Camera synchronization

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

① Internal and external synchronization details

1. Internal synchronization

This mode uses the CCD image capture timing inside the camera, and captures images automatically.

- To send a captured image to the IV-S33M, first the IV-S33M must send a trigger to the camera. Then the camera will wait until the first line from its CCD is being read to begin the capture and image transmission. Due to this process (camera synchronization time + monitor output synchronization time), the shutter time may fluctuate (maximun: 33.3 + 16.6 ms).
- When two cameras are connected, camera 1 and camera 2 cannot both open their shutters at the same time. Therefore, there will be a difference in shutter timing as described above.

2. External synchronization

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

• **External synchronization and internal synchronization processing**

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

• **Shutter speeds of the recommended cameras**

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

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

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

Item	Setting details		Reference
	For internal synchronization	For external synchronization	
EIA camera	Set to "Internal Synchronization" mode	Set to "External Synchronization" mode	*
IV-S30EA1 mode switch (MODE)	INT	EXT	Page 4-4
IV-S33M camera setting (system condition)	Camera Selection: EIA Camera Synchronization: Internal Synchronization	Camera Selection: EIA Camera Synchronization: External Synchronization	Page 7-31

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

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

③ Timing chart
  ■ Internal synchronization

Trigger input

Monitor output vertical synchronization

Wait for monitor to output vertical synchronization signal (maximum 16.6 ms)

Camera reading top line

Waiting for camera to read the top line (maximum 33.3 ms)

Shutter open

Wait time (maximum 49.9 ms)

Image data transfer (CCD→VRAM)

Image data transfer (VRAM→SDRAM)

■ External synchronization

Trigger input

Shutter open

Exposure time

Image data transfer (CCD→VRAM)

Image data transfer (VRAM→SDRAM)

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

6

Chapter 7: Simplified Menu Operation

7-1 Operation screen

When the simplified menus are selected, supply power to the controller (IV-S31M/S32M/S33M), and the MAIN OPS MENU (startup screen) will be displayed on the monitor. (For details about the settings on the simplified menus, see page 6-4.)

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

■ The operation screen for "Positioning"

```
①→ (TYPE00)                              F.IMG C1 L ● ←③
②→ OK                                   LOCK FULL VX.XX ■ ←④
⑥→ MEAS XXXXms 2000-08-01 10:30
⑤→ MEASURE 0 CAM1 POSITIONING


    Display contents

    - Object type selection

⑦→  - Shutter speed

    - Measurement results

    - Evaluation conditions



    X0~7 □□□□□□□□ Y0~7 □□□□□□□□  READY □
⑧→ CHG-TYPE  POSI-COND  POSI-EVAL.          SEL-CAMERA
    OPS-CND  SYS-CND ADJ-CONTRAST  SAVE  SHUTTER
```
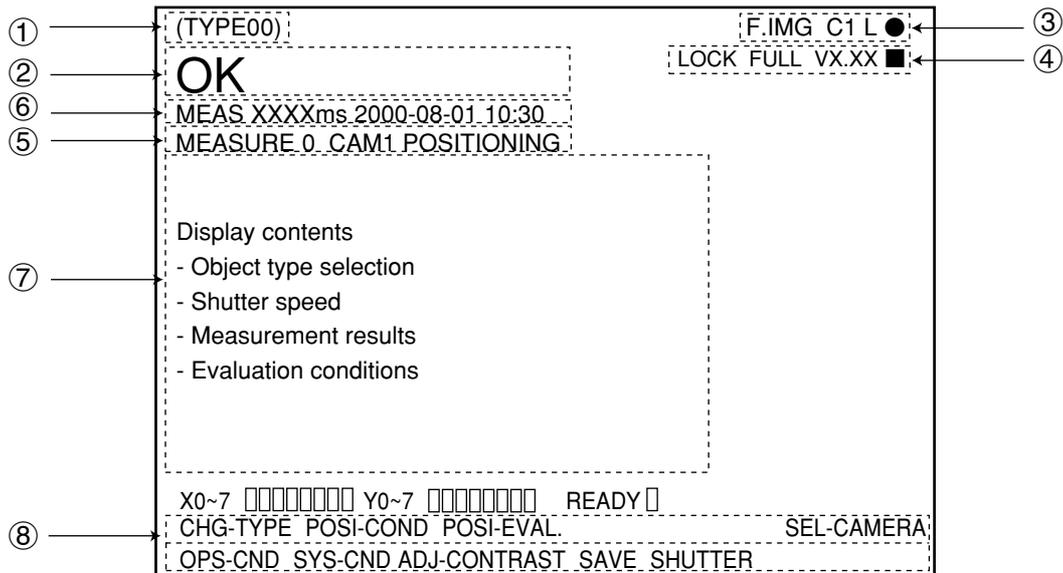
■ The operation screen for an "Existence inspection"

```
①→ (TYPE00)                              F.IMG C1 L ● ←③
②→ OK                                   LOCK FULL VX.XX ■ ←④
⑥→ MEAS XXXXms 2000-08-01 10:30
⑤→ MEASUREMENT 1 EXISTENCE


    Display contents

    - Object type selection

⑦→  - Shutter speed

    - Measurement results

    - Evaluation conditions



    X0~7 □□□□□□□□ Y0~7 □□□□□□□□  READY □
⑧→ CHG-TYPE             EXIST-COND  EXIST-EVAL.  SEL-CAMERA
    OPS-CND  SYS-CND ADJ-CONTRAST  SAVE  SHUTTER
```

7
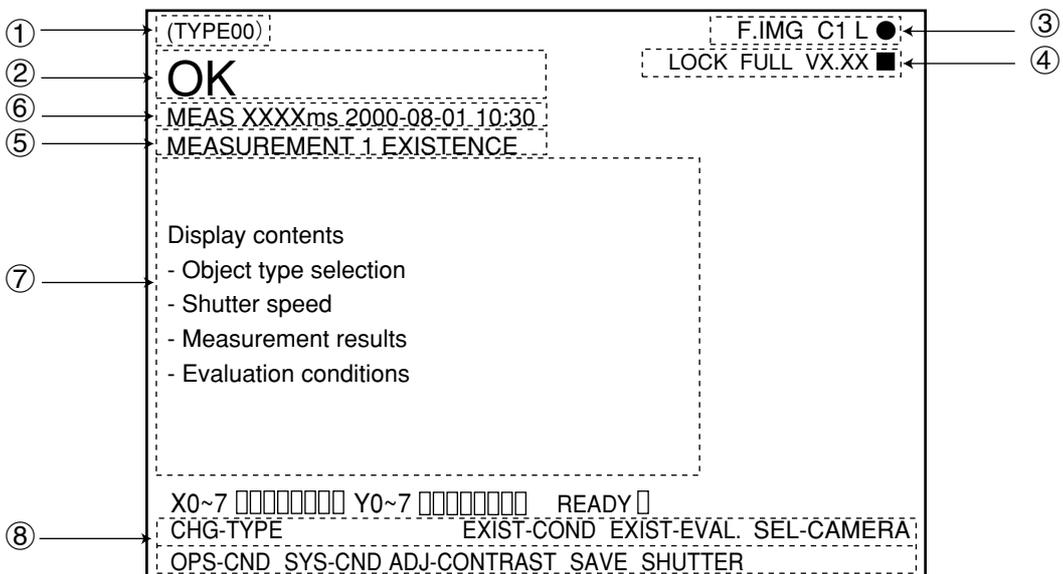
① Object type No. (00 to 15: IV-S31M, 00 to 31: IV-S32M, 00 to 63 : IV-S33M)

② Final evaluation result

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

③ F C1 L ●

    Actively operating: Flashing
    Image brightness: H = Original brightness of captured image
        L = Brightness reduced to half that in the captured image
    Output monitor status: C1 = Camera 1, C2 = Camera 2
    Image display mode: F = Freeze mode
        T = Through mode (raw image)

④ LOCK FULL VX.X ■

    Flashes during communications
    System program version number
    Image scanning mode (this is only displayed on the IV-S33M)
    : FULL = full mode, HALF = half mode, F + H = full and half mode
    Lock the MAIN OPS MENU (operation screen)
    ("LOCK" is not displayed while the screen is unlocked. See page 6-6.)

⑤ Measurement No. (0 to 2), Camera No. (1 or 2), and the measurement to be carried out
    POSITIONING: MEAS 0 CAM 1 or MEAS 0 CAM 2
    POS-CORRECT: MEAS 0 CAM 1 or MEAS 0 CAM 2
    EXISTENCE: MEAS 1 CAM 1 or MEAS 2 CAM 2

⑥ Measuring time
- The screen shows the measuring time determined by the following (from measurement start to measurement end).

←————————— Actual measuring time —————————→
(Only when changing the type)

Type change time	CCD exposure time (Shutter speed)	CCD image capture time	Image processing time	Measurement result display time
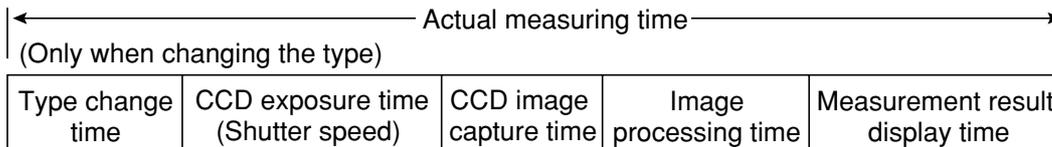
- The measuring time does not include the serial communication time.
- To decrease the measuring time:
  1. Increase the shutter speed (page 7-12),
  2. Change the CCD image capture mode (CAPTURE AN IMAGE) to PARTIAL-IMG (see page 7-7), and
  3. Set the result displays (MESSAGE DISPLAY, PATTERN DISPLAY, SHOW BINARY IMG) to "NO" (see page 7-8 to 7-10).

⑦ Measurement result
- After you save* the specified conditions, the settings for the "Measured result screen" and "Image brightness: H/L" on the MAIN OPS MENU (operation screen) will be kept in memory, even when the power is turned OFF and ON again.

* To store the data, select "SAVE" on the menu bar.

⑧ Menu bar

Menu bar	Description	Positioning	Existence inspection (with correction)	Existence inspection (without correction)	Reference pages
CHG-TYPE	Change or register an object type.	●	●	●	7-11
POSI-COND	Go to the positioning condition setting screen.	●			7-14 to 7-16
POSI-EVAL	Set the positioning evaluation conditions	●			7-17
AUX-COND	Go to the position correction condition setting screen used in the existence inspection mode.			●	7-23
AUX-EVAL.	Specify the position correction evaluation conditions used in the existence inspection mode.			●	7-24
EXIST-COND	Go to the setting screen for specifying the existence inspection conditions.		●	●	7-18 to 7-22
EXIST-EVAL.	Specify the existence inspection evaluation conditions.		●	●	7-22
SEL-CAMERA	Switch the setting and the monitor display image between Camera1 and Camera 2 by pressing the SET key.	●	●	●	7-5
OPS-CND	Go to the OPS SET MENU setup screen.	●	●	●	7-7 to 7-10
SYS-CND	Go to the SYSTEM COND setup screen.	●	●	●	7-27 to 7-30
ADJ-CONTRAST	Change the image brightness between "L" and "H," by pressing the SET key.	●	●	●	7-4
SAVE	Store the evaluation and measurement conditions, such as reference images, in the flash memory.	●	●	●	7-26
SHUTTER	Specify the shutter speed.	●	●	●	7-12

[Image display area]

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

7

7-3
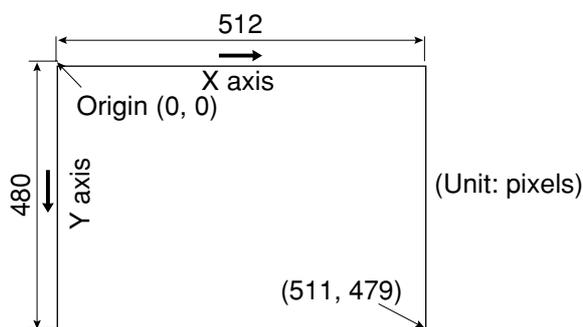
7-2 Image display

[1] Image display modes

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

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

■ **Changing operation**

To change the image display mode between "freeze" and "through," use the SEL key on the remote keypad (IV-S30RK1).

[MAIN OPS MENU]

```
(TYPE00)              F.IMG C1 H
                               VX.X
OK
MEAS XXXXXXms
MEASURE1CAM1 POSITIONING

            In "Freeze" mode
```

[Setting screen]

```
                        T.IMG C1 H
①REGISTER NO.   0(0~7) NO YES  VX.X



            In "Through" mode
```

7
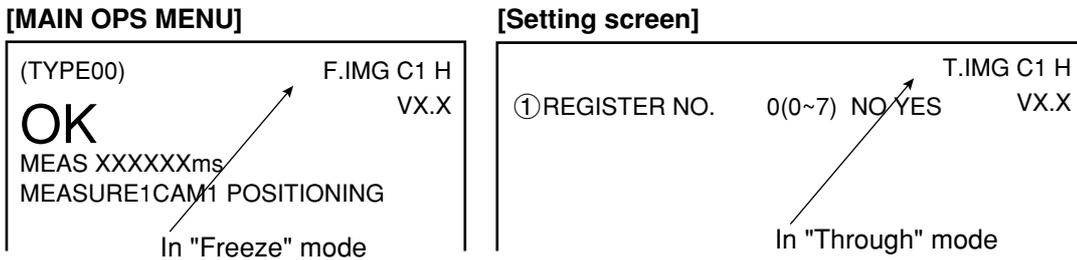
> **Notes**

> - **To register a reference image for gray scale searches**
> If these operations are started in the through mode, the message "CHANGE TO FREEZE MODE" will be displayed. Before starting these operations, change to the image F mode (freeze display mode).

[2] Adjustment of image brightness

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

- Purpose

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

- Status display

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

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

■ **How to change the contrast**

On the MAIN OPS MENU: Move the cursor to the "ADJ-CONTRAST" item using the left and right keys, and press the SET key.

On the contrast setting screen: Use the TRG/BRT key on the remote keypad to set the contrast (IV-S30RK1).

[3] Changing cameras

When two cameras have been connected to the controller, select the camera whose image will be displayed on the monitor.
You can display images from two cameras at the same time by selecting "CAM1&2" in the "② SELECT CAMERA" column on the [SIMPLIFIED MENU].

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



OPS-MENU
```
———— Use both Camera 1 and Camera 2.
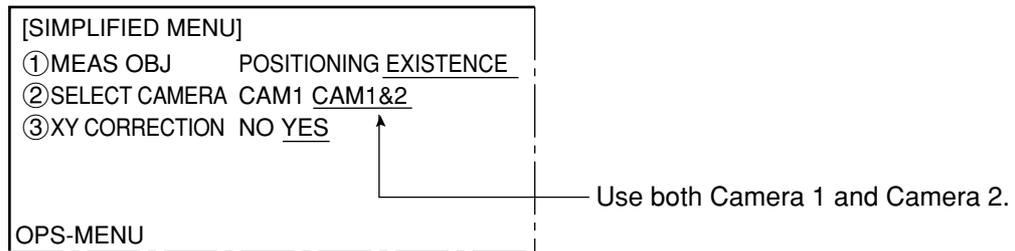
■ **How to change cameras**

Move the cursor to the "SEL-CAMERA" item using the left and right keys on the MAIN OPS MENU, and press the SET key.

C1: Camera 1
C2: Camera 2

```
[MAIN OPS MENU]

(TYPE00)                        F.IMG C1 H
                                VX.X
OK
MEAS  XXXXXXms
MEASUREMENT 1 EXISTENCE
```
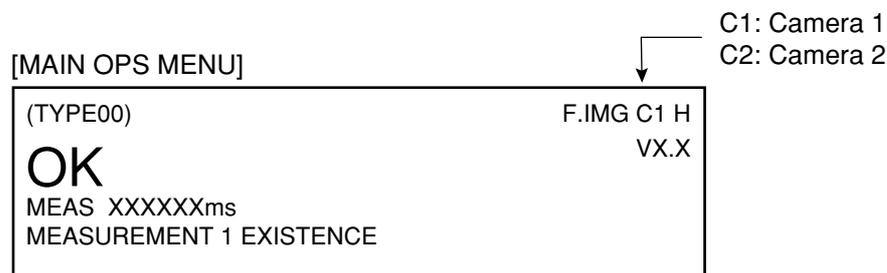
The camera number that you specify on this menu will also be used for setting the measurement and evaluation conditions.

7-3 Setting functions that are different with each controller

The setting functions which depend on the individual controllers (IV-S31M/S32M/S33M) on the simplified menu are as follows:

Item	IV-S31M	IV-S32M	IV-S33M	Reference page (item)
Number of object types that can be registered	16	32	64	7-11 (Operation screen)
Camera setting	-	-	○	7-31, 7-32 (camera selection, image capture mode, camera synchronize)
Timer setting	-	○	○	7-27, 7-30 (system conditions)

(-: Unavailable, O: Available)

- For details about the standard menu, see the "IV-S30 User's Manual, Function and Operation, Ver. 2.0."

7-4 Setting procedures

The flow charts shown below outline the setting procedures on the simplified menus.

Positioning	(Reference pages)
① **Menu selection** - Select "SIMPLIFIED MENU." - Select "POSITIONING." - Specify the camera number to use.	6-2 to 5
② **Camera settings (when the IV-S33M is used)** - Select camera - Image capture mode	7-31
③ **Setting the communication conditions** - The presence or absence of serial output. - Specify the communication parameters. - Specify the computer link settings.	7-27 and 28 Only when using serial communica-tio.
④ **Select a method for capturing images.**	7-7
⑤ **Specify the display details on the MAIN OPS MENU.** - The presence or absence of the message display. - The presence or absence of the pattern display. - Enable or disable the binary image display.	7-8 to 10
⑥ **Specify the object type.**	7-11
⑦ **Select a camera.** - When CAM 1 is selected, the SEL-CAMERA item is not displayed.	7-5
⑧ **Specify the shutter speed.**	7-12
⑨ **Specify the measurement conditions for positioning.** - Select either a 1-point or 2-point search. - Specify a reference image area. - Specify a search area.	7-13 to 16
⑩ **Specify the evaluation conditions for positioning**	7-17
⑪ **Save the data.**	7-26
⑫ **Start the measurement operation**	7-25 and 26
⑬ **Save the data.**	7-26
⑭ **Start the measurement operation.**	7-25 and 26

Existence inspection	(Reference pages)
① **Menu selection** - Select "SIMPLIFIED MENU." - Select "POSITIONING." - Specify the camera number to use. - Select whether or not to make an XY correction.	6-2 to 5
② **Camera settings (when the IV-S33M is used)** - Select camera - Image capture mode	7-31
③ **Setting the communication conditions** - The presence or absence of serial output. - Specify the communication parameters. - Specify the computer link settings.	7-27 and 28 Only when using serial communica-tio.
④ **Select a method for capturing images.**	7-7
⑤ **Specify the display details on the MAIN OPS MENU.** - The presence or absence of the message display. - The presence or absence of the pattern display. - Enable or disable the binary image display.	7-8 to 10
⑥ **Specify the object type.**	7-11
⑦ **Select a camera.** - When CAM 1 is selected, the SEL-CAMERA item is not displayed.	7-5
⑧ **Specify the shutter speed.**	7-12

Without correction / **With correction**

⑨ **Specify the measurement conditions for position correction.** - Select yes or not on the register line. - Specify a reference image area. - Specify a search area.	7-23
⑩ **Specify the evaluation conditions for position correction**	7-24
⑪ **Specify the measurement conditions for existence inspection.** - Enter a register number - Specify a measurement area. - Enter a threshold value.	7-18 to 22
⑫ **Specify the evaluation conditions for an existence inspection.**	7-22

7-5 Setting the operation conditions

[1] Image capture

Specify the range of lines which will be captured during operation.

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

```
[TYPE RUN COND]
①CAPTURE IMG      PARTIAL-IMG WHOLE-IMG NO
②MESSAGE DISPLAY  YES(NUMERIC) YES(NO NUMERIC) NO
③PATTERN DISPLAY  YES NO
④SHOW BINARY IMG  YES NO
```

① CAPTURE AN IMAGE	Description
PARTIAL-IMG (partial image)	- An image consisting of only the specified line, required for inspection or measurement, will be captured. - The number of lines is determined by the mesurement window setting. - The processing time of a partial image is shorter than in the WHOLE-IMG mode.
WHOLE-IMG (whole image)	- A whole image will be captured, irrespective of the window settings for inspection or measurement. - This mode is used to monitor portions of an image outside the window set up for inspection or measurement. Note: When the IV-S33M is used and "FULL+HALF" is selected for the image capture mode (see page 7-31), it will process the whole area in the full mode.
NO (no image)	- No image will be captured during operation. Measurements will be carried out with an image currently being displayed. - This mode is only used to carry out measurements on an image transmitted from a personal computer to the IV-S30.

■ **Operation procedure**

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

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

・When "WHOLE-IMG" is specified ── IV-S33M ── 16.7 ms (high-speed camera and full mode)
　　　　　　　　　　　　　　　　── 8.3 ms (high-speed camera and half mode)
　　　　　　　　　　　　　　　　── 33.3 ms (standard camera)
　　　　　　　　　　── IV-S31M/S32M ── 33.3 ms (standard camera)

Whole image reading

480 lines (approx. 33 ms)
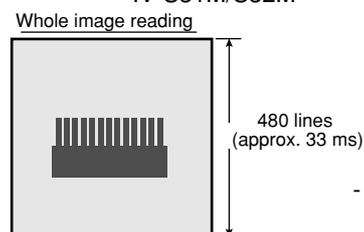
- Image capture mode (full/half mode)
  ⇨See page 7-31

・When "PARTIAL-IMG" is specified: (When 240 scan lines is specified)

　　── IV-S33M ── 8.3 ms (high-speed camera and full mode)*
　　　　　　　　── 4.2 ms (high-speed camera and half mode)*
　　　　　　　　── 12.5 ms (high-speed camera and full + half mode)*
　　　　　　　　── 16.6 ms (standard camera)
　── IV-S31M/S32M ── 16.6 ms (standard camera)

Partial image reading

240 lines (approx. 8 ms)
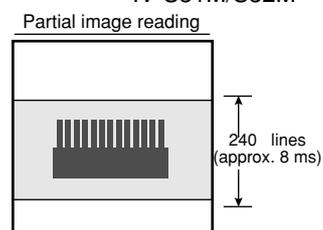
* The image capture time may vary with the position of the partial image. (In the example shown above, the maximum variation is 0.4 ms)

7

[2] Message display

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

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

```
[TYPE RUN COND]
①CAPTURE IMG      PARTIAL-IMG WHOLE-IMG NO
②MESSAGE DISPLAY  YES(NUMERIC) YES(NO NUMERIC) NO
③PATTERN DISPLAY  YES NO
④SHOW BINARY IMG  YES NO
```
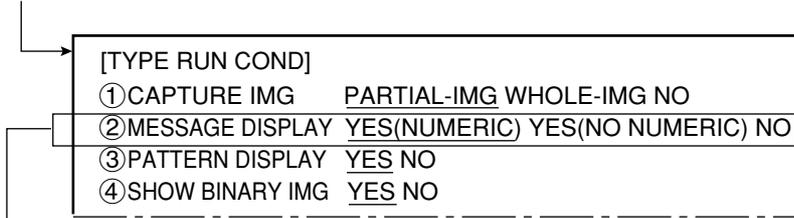
② MESSAGE DISPLAY	Description
YES (NUMERIC)	All information will be displayed.
YES (NO NUMERIC)	Information other than the numerical results will be displayed.
NO	No messages will be displayed.

Selecting "NO" reduces the processing time.

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

■ **Operation procedure**

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

■ **Display examples**

- When the message display mode has been set to YES (NUMERIC)

```
(TYPE00)                          F.IMG C1 L
                                       VX.XX
OK
MEAS XXXXms 2000-08-01 10:30
MEASURE 0  CAM1 POSITIONING

①X COORD.(MDL0) 000.0~511.0  X0=353.0   OK
②Y COORD.(MDL0) 000.0~479.0  Y0=120.0   OK
③MATCH LVL(MDL0) -10000~+10000 M0=+09620 OK
④X COORD.(MDL1) 000.0~511.0  X1=452.0   OK
⑤Y COORD.(MDL1) 000.0~479.0  Y1=420.0   OK
⑥MATCH LVL(MDL1) -10000~+10000 M1=+09524 OK


X0~7 □□□□□□□□ Y0~7 ■□□□□□□□   READY □
CHG-TYPE  POSI-COND  POSI-EVAL.       SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```
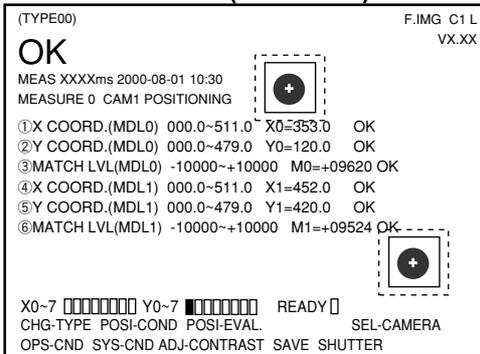
- When the message display mode has been set to YES (NO NUMERIC)

```
(TYPE00)                          F.IMG C1 L
                                       VX.XX
OK
MEAS XXXXms 2000-08-01 10:30
MEASURE 0  CAM1 POSITIONING




X0~7 □□□□□□□□ Y0~7 ■□□□□□□□   READY □
CHG-TYPE  POSI-COND  POSI-EVAL.       SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```

- When the message display mode has been set to NO

Press the SET key. →

Press the ESC key. ←

```
CHG-TYPE  POSI-COND  POSI-EVAL.       SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```
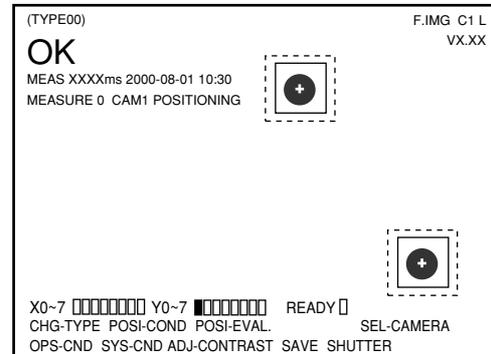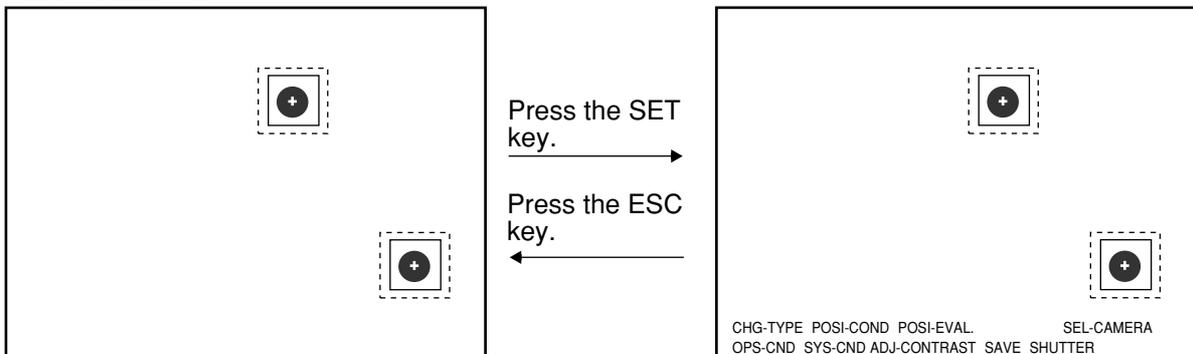
[3] Pattern display

Select "YES or NO," to determine whether to display windows and other markings over the working image displayed on the MAIN OPS MENU.

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

```
[TYPE RUN COND]
①CAPTURE IMG      PARTIAL-IMG WHOLE-IMG NO
②MESSAGE DISPLAY  YES(NUMERIC) YES(NO NUMERIC) NO
③PATTERN DISPLAY  YES NO
④SHOW BINARY IMG  YES NO
```
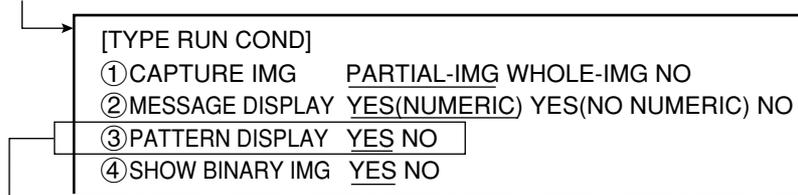
③ PATTERN DISPLAY	Description
YES	Patterns will be displayed on the [MAIN OPS MENU.]
NO	Patterns will not be displayed on the [MAIN OPS MENU.]

### ■ Operation procedure

1. On the [TYPE RUN COND], move the cursor to the item "③ PATTERN DISPLAY" item with the up and down keys, and press the SET key.
2. Move the cursor to "YES" or "NO" with the right and left keys, and press the SET key.

■ Display examples

- When the pattern display mode has been set to YES.

```
(TYPE00)                                    F.IMG  C1 L
                                                 VX.XX
OK
MEAS XXXXms 2000-08-01 10:30
MEASURE 0  CAM1 POSITIONING          ┌ + ┐

①X COORD.(MDL0) 000.0~511.0    X0=353.0    OK
②Y COORD.(MDL0) 000.0~479.0    Y0=120.0    OK
③MATCH LVL(MDL0) -10000~+10000 M0=+09620   OK
④X COORD.(MDL1) 000.0~511.0    X1=452.0    OK
⑤Y COORD.(MDL1) 000.0~479.0    Y1=420.0    OK
⑥MATCH LVL(MDL1) -10000~+10000 M1=+09524   OK
                                     ┌ + ┐

X0~7 □□□□□□□□ Y0~7 ■□□□□□□□   READY □
CHG-TYPE POSI-COND POSI-EVAL.        SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```

- When the pattern display mode has been set to NO.

```
(TYPE00)                                    F.IMG  C1 L
                                                 VX.XX
OK
MEAS XXXXms 2000-08-01 10:30
MEASURE 0  CAM1 POSITIONING            ●

①X COORD.(MDL0) 000.0~511.0    X0=353.0    OK
②Y COORD.(MDL0) 000.0~479.0    Y0=120.0    OK
③MATCH LVL(MDL0) -10000~+10000 M0=+09620   OK
④X COORD.(MDL1) 000.0~511.0    X1=452.0    OK
⑤Y COORD.(MDL1) 000.0~479.0    Y1=420.0    OK
⑥MATCH LVL(MDL1) -10000~+10000 M1=+09524   OK
                                          ●

X0~7 □□□□□□□□ Y0~7 ■□□□□□□□   READY □
CHG-TYPE POSI-COND POSI-EVAL.        SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```

7

[4] Binary image display

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

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

```
[TYPE RUN COND]
①CAPTURE IMG      PARTIAL-IMG WHOLE-IMG NO
②MESSAGE DISPLAY  YES(NUMERIC) YES(NO NUMERIC) NO
③PATTERN DISPLAY  YES NO
④SHOW BINARY IMG  YES NO
```

④ SHOW BINARY IMG	Description
YES	A binary image will be displayed on the MAIN OPS MENU.
NO	A binary image will not be displayed on the MAIN OPS MENU.

The line "④SHOW BINARY IMG" will only be displayed when "③PATTERN DISPLAY" is set to "YES."

■ Operation procedure

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

■ Display examples

- When "show binary image" has been set to YES

```
(TYPE00)                               F.IMG  C1 L
OK                                        VX.XX
MEAS XXXXms 2000-08-01 10:30
MEASUREMENT 1 EXISTENCE

①REG00      000000~245760   A00=018190    OK
②REG01      000000~245760   A01=
③REG02      000000~245760   A02=
④REG03      000000~245760   A03=
⑤REG04      000000~245760   A04=
⑥REG05      000000~245760   A05=
⑦REG06      000000~245760   A06=
⑧REG07      000000~245760   A07=

X0~7 □□□□□□□□ Y0~7 ■□□□□□□□   READY □
CHG-TYPE                      EXIST-COND EXIST-EVAL. SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```

- When "show binary image" has been set to NO

```
(TYPE00)                               F.IMG  C1 L
OK                                        VX.XX
MEAS XXXXms 2000-08-01 10:30
MEASUREMENT 1 EXISTENCE

①REG00      000000~245760   A00=018190    OK
②REG01      000000~245760   A01=
③REG02      000000~245760   A02=
④REG03      000000~245760   A03=
⑤REG04      000000~245760   A04=
⑥REG05      000000~245760   A05=
⑦REG06      000000~245760   A06=
⑧REG07      000000~245760   A07=

X0~7 □□□□□□□□ Y0~7 ■□□□□□□□   READY □
CHG-TYPE                      EXIST-COND EXIST-EVAL. SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```

7-6 Setting object types

Specify the type of object to be measured. A number of object types can be registered (16 types (0 to 15) on the IV-S31M, 32 types (0 to 31) on the IV-S32M and 64 types (0 to 63) on the IV-S33M).

■ Setting procedure

1. Move the cursor to the "CHG-TYPE" item on the MAIN OPS MENU using the left and right keys and then press the SET key.

⇨ The object type setting list will be displayed.

```
(TYPE00)                                    F.IMG  C1 L
                                                    VX.XX
                                    Object type No. (00 to 63)
MEAS XXXXms  2000-08-01 10:30
MEASURE0 CAM1 POSITIONING       O: Registered  ×: Not registered

00 ×  08 ×  16 ×  24 ×  32 ×  40 ×  48 ×  56 ×  ⌉
01 ×  09 ×  17 ×  25 ×  33 ×  41 ×  49 ×  57 ×  │
02 ×  10 ×  18 ×  26 ×  34 ×  42 ×  50 ×  58 ×  │
03 ×  11 ×  19 ×  27 ×  35 ×  43 ×  51 ×  59 ×  │
04 ×  12 ×  20 ×  28 ×  36 ×  44 ×  52 ×  60 ×  │
05 ×  13 ×  21 ×  29 ×  37 ×  45 ×  53 ×  61 ×  │
06 ×  14 ×  22 ×  30 ×  38 ×  46 ×  54 ×  62 ×  │
07 ×  15 ×  23 ×  31 ×  39 ×  47 ×  55 ×  63 ×  ⌋

X0~7 □□□□□□□□ Y0~7 □□□□□□□□  READY □
 CHG-TYPE  POSI-COND  POSI-EVAL.
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```

When the IV-S33M is used
⌈ When the IV-S31M is used 00 to 15 ⌉
⌊ When the IV-S32M is used 00 to 31 ⌋

2. Move the cursor to the object number that you want to set up using the up and down keys, and press the SET key.

⇨ The object type conditions can then be specified. (○: Registered, ×: Not registered)

⌈ When the IV-S33M is used, "Object type number 00 Yes/No" will be ⌉
⌊ displayed. Select "Yes" by pressing the left and right cursor keys. ⌋

— E.g.) The registered conditions for object type 00

```
(TYPE00)                                    F.IMG  C1 L
                                                    VX.XX

MEAS XXXXms  2000-08-01 10:30
MEASURE0 CAM1 POSITIONING
 00 ○  08 ×  16 ×  24 ×  32 ×  40 ×  48 ×  56 ×
 01 ×  09 ×  17 ×  25 ×  33 ×  41 ×  49 ×  57 ×
 02 ×  10 ×  18 ×  26 ×  34 ×  42 ×  50 ×  58 ×
```

- The object type currently selected by the cursor will be the place where the measurement and evaluation conditions are stored and the operation will be executed.
- After setting up the object type, if you press the SET key again, the settings will be ignored.

7-7 Setting the shutter speed

- The shutter speed can be set independently for each object type.
- Since the shutter speed can be set continuously in the range of 1/30 to 1/10,000 of a second, very fine adjustment is possible.
- If you want to measure moving objects and increase the image processing speed, set the shutter speed to around 1/1000 or 1/2000 seconds. However, if you use a faster shutter speed than you need, very bright lights will be necessary, and bright lighting is not economical.
- For details about the relationship between the brightness of objects (objects to be measured) and the shutter speed, see section "5-1 [2] Illumination and shutter speed."

[Example]

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

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

The object is blurred across the screen.
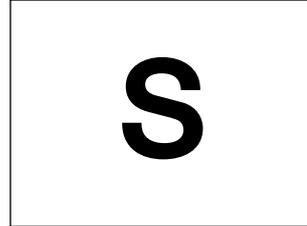
The object is frozen on the screen.

■ **Setting procedure**

1. Move the cursor to the SHUTTER item on the MAIN OPS MENU using the left and right keys, and press the SET key.
   ⇨ The shutter speed will be displayed.
2. Press the SET key.
3. Press the SET key again, and move the cursor to the digit you want, using the left and right keys.

   1/ 00060

   This cursor will move to the left and right.

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

```
(TYPE00)                                    F.IMG  C1 L
                                                VX.XX

MEAS XXXXms  2000-08-01 10:30
MEASURE0 CAM1 POSITIONING

  ①SHUTTER SPEED      1/00060(1/30~1/10000)




X0~7 □□□□□□□□ Y0~7 □□□□□□□□   READY □
CHG-TYPE  POSI-COND  POSI-EVAL.
OPS-CND  SYS-CND  ADJ-CONTRAST  SAVE  SHUTTER
```
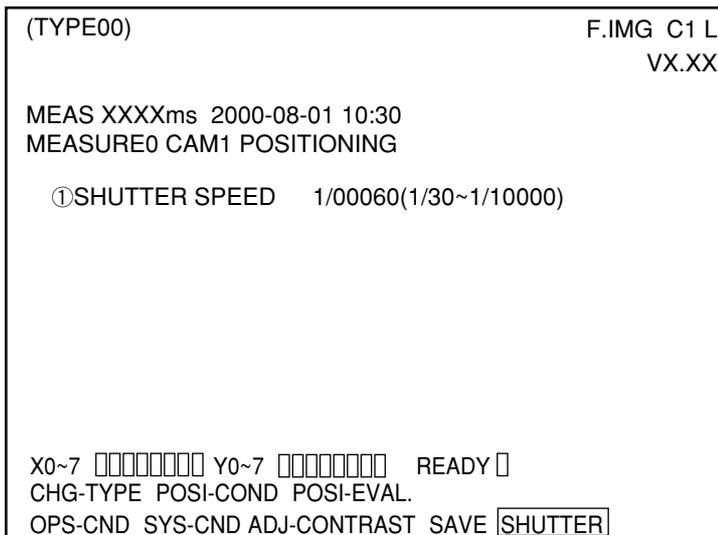
7. To complete the setting of the shutter speed, press the ESC key.

7-8 Setting the positioning conditions

In the positioning function, you can measure the absolute position of the workpiece using a gray search, and also the degree of match between the measured image and the reference image.
It is also possible to evaluate whether the measurement result is within the OK range.
The gray scale search has two search modes: a 1-point search (measuring one point) and a 2-point search (measuring two points).

(1) 1-point search

When a reference image is registered

When operating

The image detected using the gray scale search = Measured image (model 0) (X0, Y0)

Search area (model 0)

Register a reference image (model 0).

Search area (model 0)
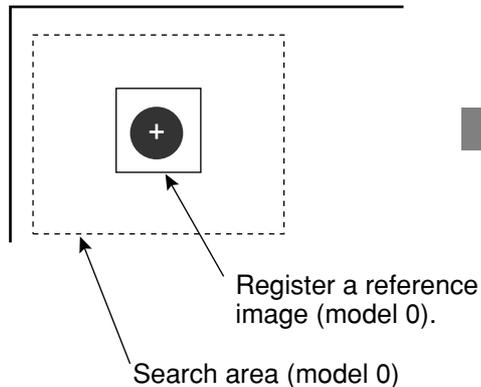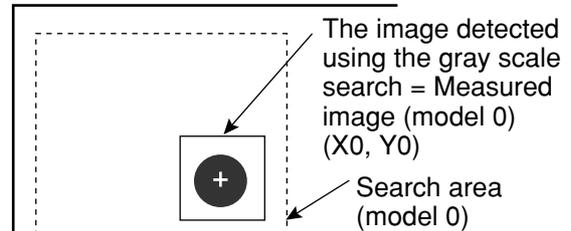
[Measured result]
- Center coordinates of the measured image
  X0 = 0 to 511.0 Y0 = 0 to 479.0
- Degree of match between the reference image and the measured image
  M0 = - 10000 to + 10000

(2) 2-point search

When a reference image is registered

When operating

Register a reference image (model 0).

Search area (model 0)

Register a reference image (model 1).

Search area (model 1)

The image detected using the gray scale search = Measured image (model 0) (X0, Y0)

Search area (model 0)

Search area (model 1)

The image detected using the gray scale search = Measured image (model 1) (X1, Y1)
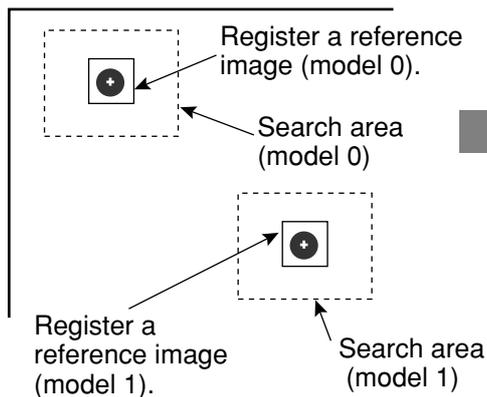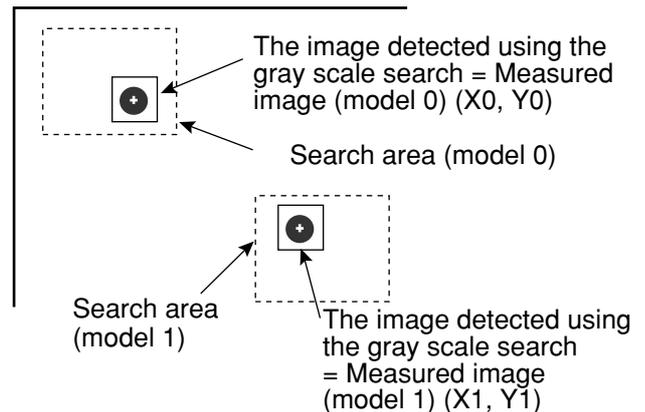
[Measured result]
- Range of center coordinates of the measured image
  Model 0 X0 = 0 to 511.0 Y0 = 0 to 479.0
  Model 1 X1 = 0 to 511.0 Y1 = 0 to 479.0
- Range of degree of match between the reference image and the measured image
  Model 0 M0 = - 10000 to + 10000
  Model 1 M1 = - 10000 to + 10000

* The degree of match refers to the level of sameness in the corresponding pixels when comparing the reference image and the image of the measured object.
E.g.: + 09640 ⇨ 96.4 %

● Gray scale search conditions
Pixel contraction: Search the image in units of 4 pixels.
                         (This is equal to a pixel contraction setting of "2" in the CONTR. PIXEL line on the standard menu.)
Detection precision: In units of pixels
                         (This equals the "STANDARD" detection precision setting in the DTECT PRECISION line on the standard menu.)
Detection coordinate: The center of the rectangular window

[1] Setting the measurement conditions

Set the reference image area and the search area using rectangular windows.

■ **Setting procedure**

1. Move the cursor to the "POSI-COND" item on the menu bar of the MAIN OPS MENU, and press the SET key.
   ⇨ The screen will change to the measurement condition setting screen.

F.IMG C1 H ──── Press the TRG/BRT key on the remote keypad, and the brightness of the screen will change between L and H.

──── Indicates that Camera 1 is selected. (Camera 2: C 2)

──── Press the SEL key, and the screen will switch between the F.IMG (freeze mode) and the T.IMG (through mode).

① REG   NO 1P-SCH 2P-SCH

OPS-MENU

7

(**Note**)

- Before setting the measurement conditions, make sure to select camera type (when the IV-S33M is used: page 7-31), set the object type (page 7-11), and select camera (page 7-5).

2. Press the SEL key.
   ⇨ The image will be displayed. The indicator in the upper right corner of the screen will change from F (freeze) to T (through).

   When the image is so bright that the menu display is difficult to see, press the TRG/BRT key to reduce the brightness of the image. The indicator in the upper right corner of the screen will change from "H" to "L."

3. To display the image of the object measured clearly, adjust the focus and iris opening of the camera lens.
4. Move the cursor to the "① REG" line, and press the SET key. Then, move the cursor to the "1P-SCH" or "2P-SCH" item, and press the SET key.
   ⇨ The image window and search window will be displayed in the center of the screen.

T.IMG C1 L

Image window

Search window

Object 1

Object 2

① REG   NO 1P-SCH 2P-SCH

OPS-MENU

5. Press the SEL key to change the screen to the freeze mode.
   ⇨ The indicator in the upper right corner of the screen will change from T to F.
     - To register reference images, you must make sure to display the freeze screen.

6. Press the ESC key to display all of the measurement condition items.

```
                                                      F.IMG C1 L
①REG                    NO  1P-SCH  2P-SCH
②REF IMG ARE(MDL0)     MOVE UP.L(224,208) LO.R(287,281) CONTRAST SR
                        REG DISP
③SEARCH ARE(MDL0)      MOVE UP.L(216,200) LO.R(295,279)
④REF IMG ARE(MDL1)     MOVE UP.L(224,208) LO.R(287,281) CONTRAST SR
                        REG DISP
⑤SEARCH ARE(MDL1)      MOVE UP.L(216,200) LO.R(295,279)




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



                                    ⬤
                                    +


 OPS-MENU
```

CONTRAST SEARCH is only
 displayed on the IV-S33M

Display when "2P-SHC" (2-point
search) is selected

   - If the menu overlaps the object to be measured, so that further image condition setting is
     difficult, press the ESC key. Only one item will be displayed at a time. (You can move the
     cursor to each item and display each of them in order on the screen, using the up and down
     keys. The following illustration shows only one item being displayed.)

7. Move the cursor to the "② REF. IMG ARE (MDL 0)" item, and press the SET key.
8. Surround the object to be measured with the image window (solid line).
     - Move the cursor to the "MOVE," "UP.L," or "LO. R," label and press the SET key.

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

After the window position has been finalized, press the SET key.

```
                                                      F.IMG C1 L




              Image window
                   ↘
                ┌─────┐       ┌ ─ ─ ─ ┐
                │ ⬤  │       │       │
                │ +   │       │       │    ← Search window
                └─────┘       └ ─ ─ ─ ┘
                     ↖
                  Object 1              ⬤



 ②REF IMG ARE(MDL0)  MOVE UP.L(110,218) LO.R(174,277) REG DISP
 OPS-MENU
```

7-15
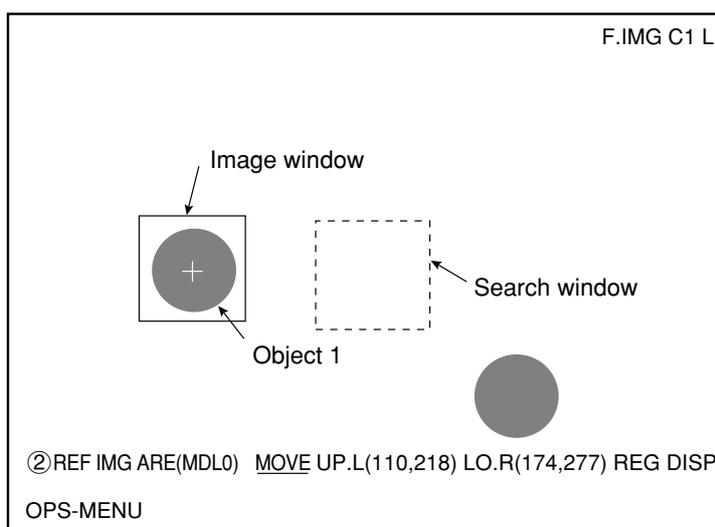
9. After the image window position has been set, move the cursor to the "REG." item using the left and right keys, and press the SET key.
    ⇨The image will be registered in the memory and displayed in lower right corner of the screen.
    - Move the cursor to the "DISP" item using the left and right keys, and press the SET key. Then, the stored image will be displayed in the lower right corner of the screen. After checking the image, press the ESC key.

②REF IMG ARE(MDL0) <u>MOVE UP</u>.L(110,218) LO.R(174,277) CONTRAST SR
                                REG DISP
OPS-MENU

Cheak the stored image. (DISP)
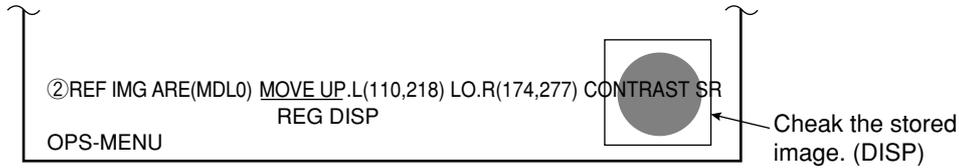
10. Press the ESC key and move the cursor to the "③ SEARCH ARE (MDL 0)" item. Then, press the SET key.
11. Create a search window to be used as the search area (area to be used for a gray scale search).
    - The procedure for creating the search area is the same as described for the image window in step 8.

F.IMG C1 L

Image window

Search window

Object 1

③SEARCH ARE(MDL0)   <u>MOVE</u> UP.L(043,162) LO.R(305,311)

OPS-MENU
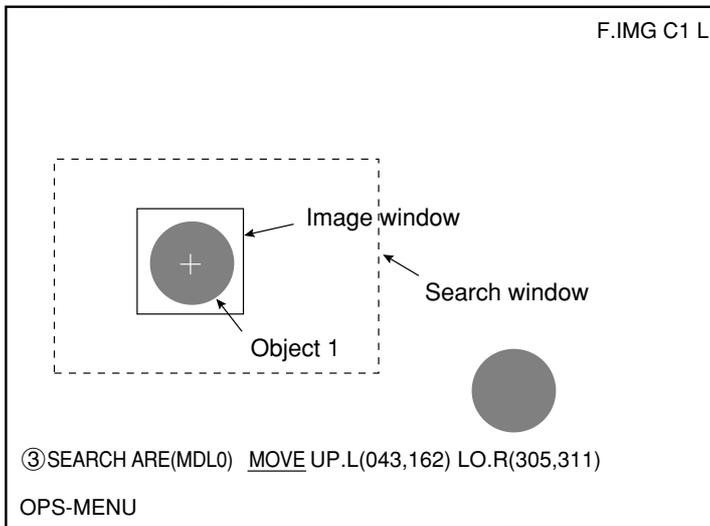
12. Press the ESC key.
13. When a 2-point search is selected in the "① REG" line, set items "④ REF. IMG ARE (MDL 1)" and "⑤ SEARCH ARE (MDL 1)" by following the same procedures described in steps 7 to 12.
14. Press the ESC key to display all of the measurement condition items.

①REG   NO 1P-SCH <u>2P-SCH</u>   F.IMG C1 L
②REF IMG ARE(MDL0) MOVE UP.L(110,218) LO.R(174,277) CONTRAST SR
                                REG DISP
③SEARCH ARE(MDL0)   MOVE UP.L(043,162) LO.R(305,311)
④REF IMG ARE(MDL1) MOVE UP.L(301,288) LO.R(364,350) CONTRAST SR
                                REG DISP
⑤SEARCH ARE(MDL1)   MOVE UP.L(241,262) LO.R(461,394)

These lines will only be displayed when a 2-point search is selected.

運転
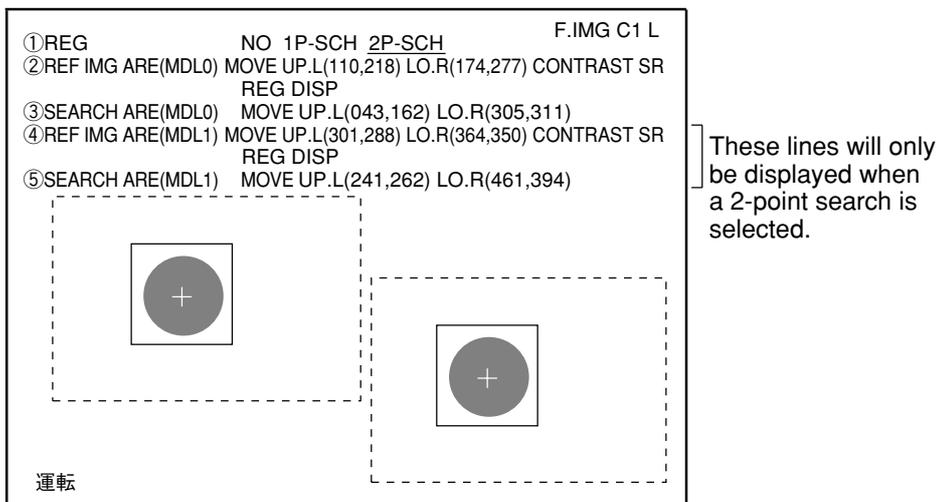
15. Move the cursor to the "OPS-MENU" item using the up and down keys, and press the SET key.
    ⇨ The screen will return to the MAIN OPS MENU. That completes the setting of the measurement conditions.

[2] Setting the position evaluation conditions

Set the X and Y coordinates for the image to be measured, and the OK range that will be used for the degree of match.

■ Setting procedure

1. Move the cursor to the "POSI-EVAL." item on the MAIN OPS MENU using the left and right keys, and press the SET key.
   ⇨ The position evaluation conditions will be displayed.

```
(TYPE00)                                      F.IMG  C1 L
                                                   VX.XX


MEAS XXXXms 2000-08-01 10:30
MEASURE 0  CAM1 POSITIONING

①X COORD.(MDL0)  000.0~511.0        X0=
②Y COORD.(MDL0)  000.0~479.0        Y0=
③MATCH LVL(MDL0)  -10000~+10000     M0=
④X COORD.(MDL1)  000.0~511.0        X1=
⑤Y COORD.(MDL1)  000.0~479.0        Y1=
⑥MATCH LVL(MDL1)  -10000~+10000     M1=




X0~7 □□□□□□□□ Y0~7 □□□□□□□□    READY □
CHG-TYPE POSI-COND POSI-EVAL.              SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST  SAVE  SHUTTER
```

2. Move the cursor to the item you want to set or change using the up and down keys, and press the SET key.
3. Move the cursor to the minimum and maximum values using the left and right keys, and press the SET key
4. Move the cursor to each digit using the left and right keys, and increase or decrease the value using the up and down keys. Then, press the SET key.
5. Press the ESC key.
6. Press the ESC key again. That completes the setting of the position evaluation conditions.

7

7-9 Setting the existence inspection conditions

The existence inspection function lets you determine whether or not a workpiece is present by measuring the area after binary conversion.

Each object type can have up to 16 areas registered for it (8 each for Camera 1 and 8 more for Camera 2).

You can correct the measuring area's X and Y specifications for conversion into binary, using the correction values supplied by the gray search function.

In addition, you can evaluate whether the measurement result is within the OK range.

(1) When the XY correction function is set to "NO"

Measurement area

Workpiece (white area is measured)

A0 A1 A2 A3

A4 A5 A6 A7
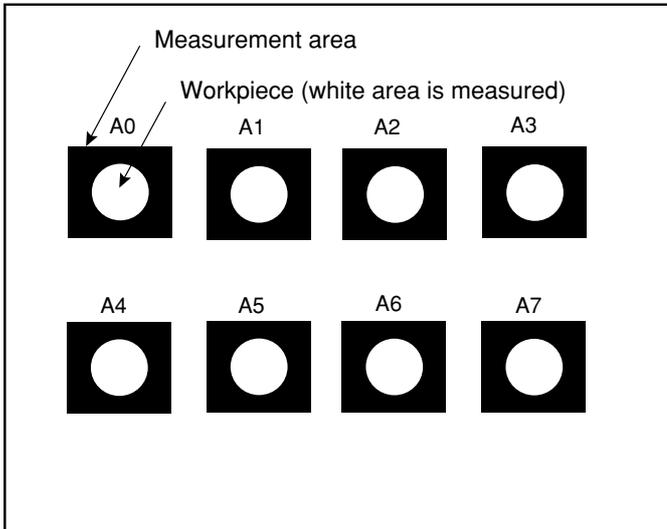
[Measurement result]
- The area of each workpiece
  A0 to A7 = 0 to 245760

(2) When the XY correction function is set to "YES"

When a reference image is registered

Register the reference image to be used for making corrections.

Search area

Specify the area to measure.

When operating

The position in which the image is first registered

The position detected by the gray scale search (X0, Y0)

Search area

The position in which the image is first registered

Use a gray scale search to detect the amount that the image is out of place, and shift the measurement area by that amount.
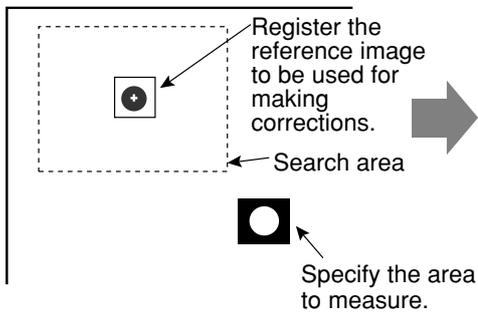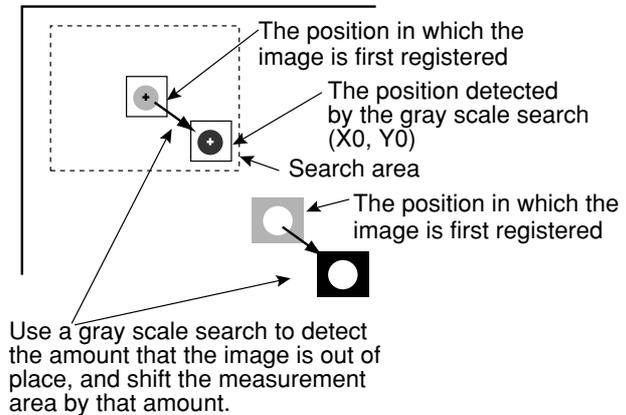
[Measured result]
- Center coordinates of the measured image that needs to be corrected
  X0 = 0 to 511.0 Y0 = 0 to 479.0
- Degree of match between the reference image and the measured image M0 = - 10000 to + 10000
- The area of the workpiece (white area is measured)
  A0 to A7 = 0 to 245760

[1] Setting the measurement conditions

Define the binary measurement area using a rectangular window.

■ Setting procedure

1. Move the cursor to the "EXIST-COND" item on the menu bar of the MAIN OPS MENU, and press the SET key.
   ⇨ The screen will change to the measurement condition setting screen.

```
                                    F.IMG C1 H          Repeatedly pressing the
                                                        TRG/BRT key on the remote
                                                        keypad will toggle the brightness
                                                        of the screen between H and L.

                                                        Indicates Camera 1.

                                                        Repeatedly pressing the SEL key
                                                        will switch the screen back and
                                                        forth between the F.IMG (freeze
                                                        mode) and the T.IMG (through
                                                        mode).

  ①REGISTER NO.     0(0~7) NO YES

  OPS-MENU
```

Note

- Before setting the measurement conditions, make sure to select camera type (when the IV-S33M is used: page 7-31), set the object type (page 7-11) and select camera (page 7-5).

2. Press the SEL key.
   ⇨ The image will be displayed. The indicator in the upper right corner of the screen will change from F (freeze) to T (through).

   When the image is so bright that the menu display is difficult to see, press the TRG/BRT key to reduce the brightness of the image. The indicator in the upper right corner of the screen will change from "H" to "L."

3. To display the image of the object measured clearly, adjust the focus and iris opening of the camera lens.
4. Move the cursor to the "①REGISTER NO." line, and press the SET key. Select a register No. (0 to 7) using the up and down keys, and move the cursor to "YES" using the left and right keys. Then, press the SET key.
   ⇨ The measurement window will be displayed in the center of the screen.
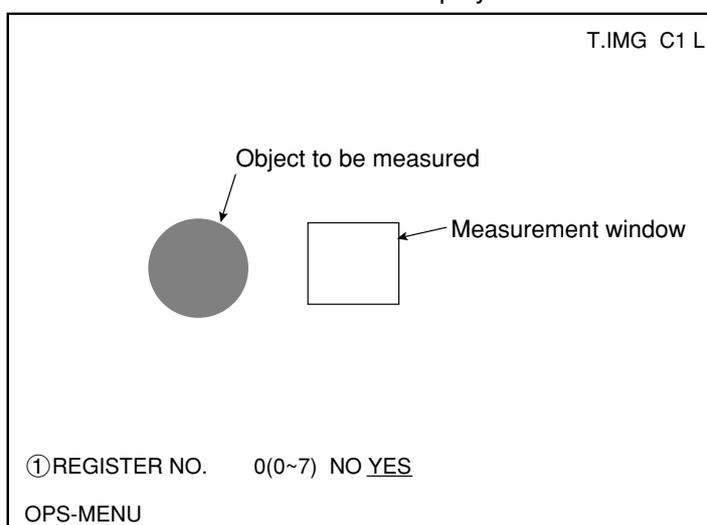
```
                                                T.IMG  C1 L



                      Object to be measured



                                               Measurement window


  ①REGISTER NO.     0(0~7)  NO YES

  OPS-MENU
```

5. Press the SEL key to change the screen to the freeze mode.
   ⇨ The indicator in the upper right corner of the screen will change from T to F.
   - To set a threshold for a binary area, make sure the machine is displaying the freeze screen.
6. Press the ESC key to display all of the measurement condition items.

```
                                                    F.IMG C1 L
 ①REGISTER NO.    0(0~7)  NO YES
 ②MEAS AREA       MOVE UP.L(224,208) LO.R(287,271)
 ③THRESHOLD       U.LM255  L.LM100(0~255)
 ④INVERT B/W      NO YES




                 ⬤        ▢




   OPS-MENU
```
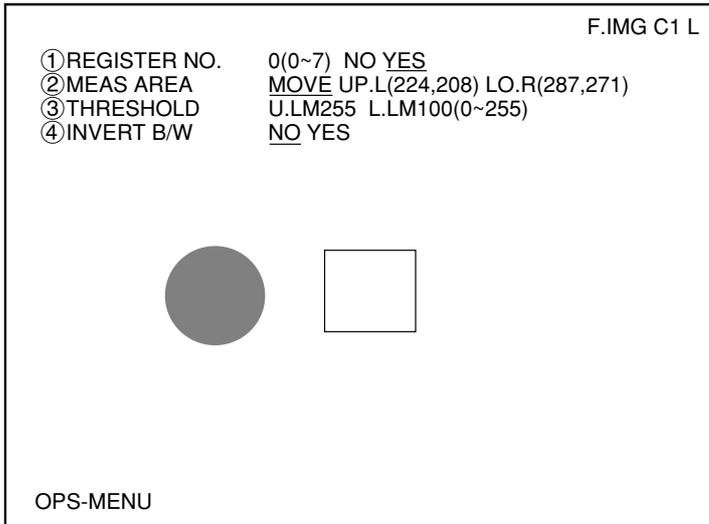
   - If the menu overlaps the object to be measured, so that further image condition setting is
     difficult, press the ESC key. Only one item "①" will be displayed at a time. (You can move the
     cursor to each item and display each of them in order on the screen, using the up and down
     keys. The following illustration shows only one item being displayed.)
7. Move the cursor to the "② MEAS AREA" item, and press the SET key.
8. Place a measurement window around the object to be measured (solid line).
   - Move the cursor to the "MOVE," "UP.L" or "LO.R," and press the set key.

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

   -After the window position has been finalized, press the SET key.

```
        ┌─────────┐
        │  ⬤      │ ◄── Measurement window
        │         │
        └─────────┘
              ◄── Object to be measured


   ②MEAS AREA      MOVE UP.L(107,208) LO.R(198,295)

   OPS-MENU
```
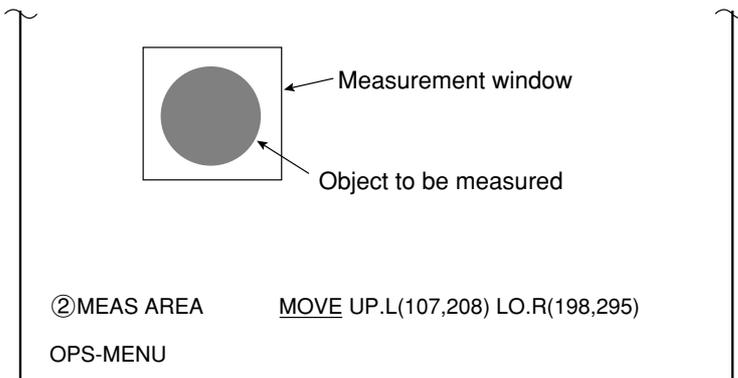
 9. After the measurement window position is satisfactory, press the SET key.
10. Move the cursor to the "③ THRESHOLD" item using the up and down keys, and press the SET
    key.

```
   ③THRESHOLD       U.LM255  L.LM100(0~255)

   OPS-MENU
```
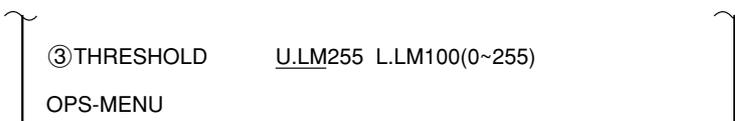
11. Move the cursor to the "U.LM" or "L.LM" items and then press the SET key.
12. Move the cursor to each digit using the left and right keys, and increase or decrease the values
    using the up and down keys. Then, press the SET key.

■ Threshold value setting

The IV-S30 treats the "areas darker than the lower limit value" or "brighter than the upper limit value" as "black." It treats that the areas between the upper limit value and lower limit value as "white." However, if the white-black reverse function is enabled, conversion to white/black will be reversed. Normally, if you want to use only one threshold value for binary conversion, set the upper limit value to "255." Then you only need to adjust the lower limit value to a threshold value that works for your application.

Threshold value B

Binary conversion
(Upper limit = 255, lower limit = A)

Threshold value A

(Captured image)

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

(Threshold value)
(Upper limit = 255, lower limit = A)

Binary conversion
(upper limit = A, lower limit = B)

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

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

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.

White   Black

Inspection image

255
Lower limit threshold
White
0   Horizontal coordinate of the dotted line

The size of the white area changes depending on the threshold value setting.

As the value increases, the black part grows larger.

Stable range *

As the value decreases, the white part grows larger.

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.]

7

13. Move the cursor to the "④ INVERT B/W" item using the up and down keys, and press the SET key.

④INVERT B/W   NO YES

OPS-MENU

14. Move the cursor to "NO" or "YES" using the left and right keys, and press the SET key.
   - Since only the number of white pixels can be measured, select "YES" if the object is black.

Measurement window
Object to be measured

Inversion: NO

Inversion: YES

15. Press the ESC key to display all of the measurement condition items.

```
                                          F.IMG C1 L
  ①REGISTER NO.    0(0~7)  NO YES
  ②MEAS AREA       MOVE UP.L(107,208) LO.R(198,295)
  ③THRESHOLD       U.LM255  L.LM100(0~255)
  ④INVERT B/W      NO YES




  OPS-MENU
```
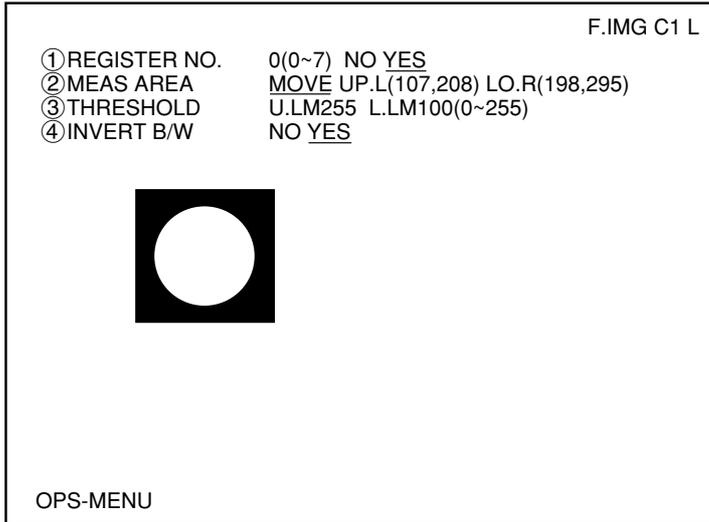
16. Move the cursor to the "OPS-MENU" item using the up and down keys, and press the SET key.
   ⇨ The screen will return to the MAIN OPS MENU. That completes the setting of the
      measurement conditions.

7

[2] Setting the evaluation conditions

Set the OK range for a measured area.

■ Operating procedure

1. Move the cursor to the "EXIST-EVAL." item on the MAIN OPS MENU using the left and right
   keys, and press the SET key.
   ⇨ The evaluation conditions will be displayed.

```
  (TYPE00)                             F.IMG  C1  L
                                            VX.XX


  MEAS XXXXms 2000-08-01 10:30
  MEASUREMENT1 EXISTENCE

  ①REG00      000000~245760  A00=
  ②REG01      000000~245760  A01=
  ③REG02      000000~245760  A02=
  ④REG03      000000~245760  A03=
  ⑤REG04      000000~245760  A04=
  ⑥REG05      000000~245760  A05=
  ⑦REG06      000000~245760  A06=
  ⑧REG07      000000~245760  A07=


  X0~7 □□□□□□□□ Y0~7 □□□□□□□□    READY □
  CHG-TYPE               EXIST-COND EXIST-EVAL. SEL-CAMERA
  OPS-CND SYS-CND ADJ-CONTRAST  SAVE  SHUTTER
```

2. Move the cursor to the item you want to set using the up and down keys, and press the SET key.
3. Move the cursor to the minimum and maximum value entries using the left and right keys, and
   press the SET key
4. Move the cursor to each digit using the left and right keys, and increase or decrease the values
   using the up and down keys. Then, press the SET key.
5. Press the ESC key.
6. Press the ESC key again. That completes the setting of the evaluation conditions.

[3] Setting the measurement conditions for correcting a position

When the "③ XY CORRECTION" item is set to "YES" on the [SIMPLIFIED MENU] screen, when the position of the object to be measured is not correct, the correct area can still be measured by correcting the position.

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


OPS-MENU
```

Select "YES" to run the XY correction function.

■ Operating procedure

1. Move the cursor to the "AUX-COND" item on the menu bar of the MAIN OPS MENU, and press the SET key.
   ⇨ The screen will change to the measurement condition setting screen.

```
                                    F.IMG C1 H



①REG            NO  YES
OPS-MENU
```
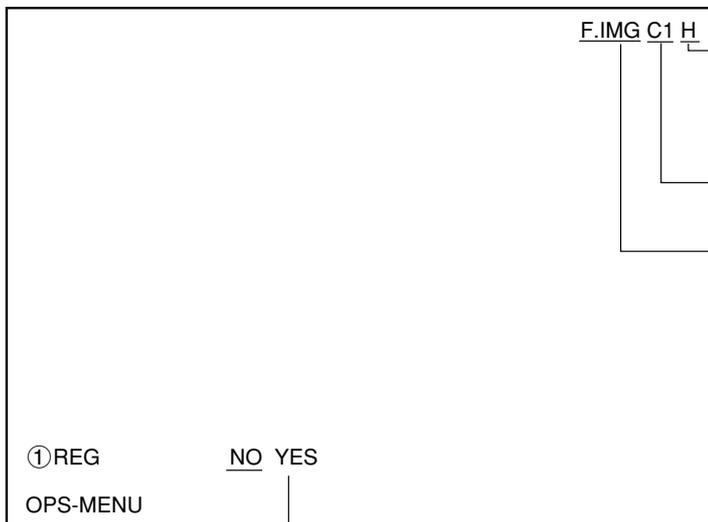
Repeatedly pressing the TRG/BRT key on the remote keypad will toggle the brightness of the screen between H and L.

Indicates Camera 1. (Camera 2: C 2)

Repeatedly pressing the SEL key will switch the screen back and forth between the F.IMG (freeze mode) and the T.IMG (through mode).

When "YES" is selected, a 1-point search is enabled.

The following procedures are the same as the 1-point search made for positioning. (See page 7-14 to 7-16.)

> **Notes**
>
> - Before setting the measurement conditions, make sure to select camera type (when the IV-S33M is selected : page 7-31), set the object type (page 7-11) and select camera (page 7-5). Select the same object type No. and Camera No. as were used for the existence inspection condition settings.

[4] Setting the evaluation conditions for correcting a position

Set the X and Y coordinates of the image used for making the correction, and the OK range that will be used for determining the degree of match.

■ **Operating procedure**

1. Move the cursor to the "AUX-EVAL" item on the MAIN OPS MENU using the left and right keys, and press the SET key.
   ⇨ The evaluation conditions will be displayed.

```
(TYPE00)                                    F.IMG  C1  L
                                                 VX.XX


 MEAS XXXXms 2000-08-01 10:30
 MEASURE0 CAM1 POSITION CORRECTION

 ①X COORD.  (MDL0) 000.0~511.0      X0=
 ②Y COORD.  (MDL0) 000.0~479.0      Y0=
 ③MATCH LVL (MDL0) -10000~+10000    M0=





 X0~7 □□□□□□□□  Y0~7 □□□□□□□□   READY □
 CHG-TYPE AUX-COND AUX-EVAL. EXIST-COND EXIST-EVAL. SEL-CAMERA
 OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```

2. Move the cursor to the item you want to set using the up and down keys, and press the SET key.
3. Move the cursor to the minimum and maximum value entries using the left and right keys, and press the SET key
4. Move the cursor to each digit using the left and right keys, and increase or decrease the values using the up and down keys.
5. Press the ESC key.
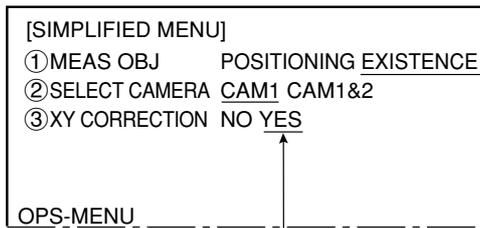6. Press the ESC key again. That completes the setting of the evaluation conditions.

7

7-10 Measurement triggering

[1] Trigger measurement

The IV-S30 has three methods for triggering measurements, as shown below.
① Using the TRG/BRT key on the remote keypad
② Triggered by an input terminal (IV-S31M : X0 toX4, IV-S32M : X0 to X5, IV-S33M : X0 to X6)
③ Triggered by a message on the general-purpose serial communication port

(1) Using the TRG/BRT key
1. Select the object type No. that you want to measure on the MAIN OPS MENU.
2. Press the TRG/BRT key to start the measurement function. The result will be displayed on the monitor.

■ A display example of positioning

```
(TYPE00)                              F.IMG  C1 L
                                           VX.XX
OK
MEAS XXXXms 2000-08-01 10:30
MEASURE 0  CAM1 POSITIONING

①X COORD.(MDL0)  250.0~260.0 X0=253.0  OK
②Y COORD.(MDL0)  210.0~230.0 Y0=220.0  OK
③MATCH LVL(MDL0) -10000~+10000 M0=+09620   OK
④X COORD.(MDL1)  150.0~160.0  X1=156.0 OK
⑤Y COORD.(MDL1)  055.0~058.0  Y1=056.0 OK
⑥MATCH LVL(MDL1) -10000~+10000 M1=+09524   OK




X0~7 □□□□□□□□ Y0~7 ■□□□□□□□   READY □
CHG-TYPE POSI-COND  POSI-EVAL.          SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST  SAVE  SHUTTER
```

■ A display example of an existence inspection

```
(TYPE00)                              F.IMG  C1 L
                                           VX.XX
OK
MEAS XXXXms 2000-08-01 10:30
MEASUREMENT 1 EXISTENCE

①REG00      001600~001650   A00=001619 OK
②REG01      000000~245760   A01=
③REG02      002600~027000   A02=026720  OK
④REG03      000000~245760   A03=
⑤REG04      000000~245760   A04=
⑥REG05      000000~245760   A05=
⑦REG06      000000~245760   A06=
⑧REG07      000000~245760   A07=


X0~7 □□□□□□□□ Y0~7 ■□□□□□□□   READY □
CHG-TYPE                   EXIST-COND EXIST-EVAL. SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST  SAVE  SHUTTER
```

(2) Triggered by an input terminal
When the measurement start input (input terminal: X0) on the MAIN OPS MENU changes from OFF to ON, the IV-S30 will start the measurement function. Specify the object type No. that will be measured on input terminals, (IV-S31M : X1 to X4, IV-S32M : X1 to X5, IV-S33M : X1 to X6)

(3) Triggered by a message on the general-purpose serial communication port
In this method, the IV-S30 and a personal computer communicate with each other using commands and responses.
- Specify the communication setting parameters by referring to the "② COMM. SET" item on the [SYSTEM COND] menu. ⇨See page 7-27
- For details about the communication commands, see the IV-S30 User's Manual (Function and Operation).

[2] Result output
The IV-S30 has three methods for outputting results, as shown below.
① Output on the output terminals (Y0, Y1)
② Output over the general-purpose serial communication port
③ Output using a programmable controller computer link

(1) Output on the output terminals
The IV-S30 outputs the measured result to the output terminal.
Y0: Final output result
This will be ON when the results of all the items are OK. (This is equivalent to the auxiliary relay C112.)
Y1: Measurement execution error
This will be ON when a measurement processing error occurs. (This is equivalent to the auxiliary relay C118.)
For details about the auxiliary relays C112 and C118, see the IV-S30 User's manual (Function and Operation).

(2) Output over the general-purpose serial communication port
With this method, the IV-S30 and a personal computer communicate with each other using commands and responses.
- Specify the serial port parameters in the items "①SERIAL OUTPUT" and "②COMM. SET" on the [SYSTEM COND] menu. ⇨See page 7-27.
- For details about the communication commands, see the IV-S30 User's Manual (Function and Operation).

(3) Output using a programmable controller computer link
With this method, the IV-S30 and a programmable controller communicate with each other using the computer link.
- Specify the computer link setting parameters in the items "①SERIAL OUTPUT," "②COMM. SET" and "③COMPUTER LINK" on the [SYSTEM COND] menu. ⇨See pages 7-27 and 7-28.
- For details about the computer link, see the IV-S30 User's Manual (Function and Operation).

7-11 Saving data
All the data entered on the condition setting menus, such as the measurement conditions and evaluation conditions, are saved in the IV-S30 flash memory.
■ **Operating procedure**
1. On the [MAIN OPS MENU], move the cursor to "SAVE" using the left and right keys, and press the SET key.
⇨ The following message will be displayed on the upper part of the screen.

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

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

```
                        SAVING
        REFERENCE IMG    ■■
        SYSTEM I/O       ■
        OBJECT TYPE COND ■■■■■■■■■■□□□□□
```
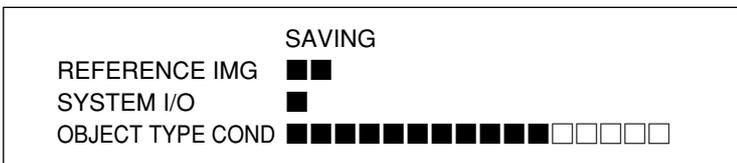
When the data has been saved in the IV-S30 flash memory, the display will change from "SAVING" to "COMPLETE SAVE."

7-12 Specify the system conditions

This section describes how to set the communication conditions and system time.

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

```
[SYSTEM COND]                                    F.IMG C1 H
①SERIAL OUTPUT NO    PC-LINK   SERIAL
②COMM.SET             (TO NEXT SUB-MENU)
③COMPUTER LINK        (TO NEXT SUB-MENU)
④INITIALIZATION       ALL-INIT   INIT-RAM
⑤SIMPLE→SEL MENU      EXEC
⑥SELF DIAGNOSTICS     EXEC
⑦TIME                 2000Y 08M 01D 10H 30M
⑧CAMERA TYPE          (TO NEXT SUB-MENU)

OPS-MENU
```
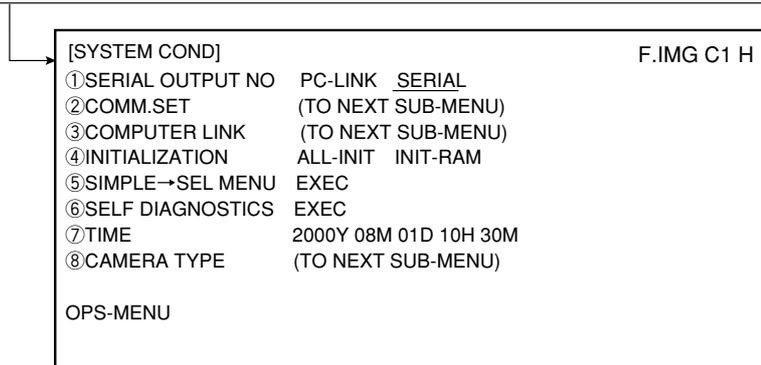
Menu	Setting details	Reference pages
① SERIAL OUTPUT	Use the serial output menu for setting the communication parameters for the computer link or for the general-purpose serial communication port.	7-26
② COMM. SET	When you select this item, the [SET COMM PARMS] menu will be displayed on the lower screen. You can specify the communication conditions.	7-27
③ COMPUTER LINK	When you select this item, the [COMPUTER LINK] menu will be displayed on the lower screen. You can specify the computer link communication conditions.	7-28
④ INITIALIZATION	Initializes the flash memory and the RAM (Initialize all).	7-29
⑤ SIMPLE MENU ⇨ STD	The screen will change to the menu selection screen (select the simplified or standard menus).	6-5
⑥ SELF DIAGNOSTICS	Checks whether or not the IV-S30's hardware is operating normally.	7-30
⑦ TIME	Set the time when IV-S32M/S33M is used.	7-30
⑧ CAMERA TYPE	When the IV-S33M is used, select the camera type that is connected (high-speed, standard, or EIA).	7-31

[1] Communication setting

When you want to use general-purpose serial communication or computer link communication, you must set the communication conditions.
- Specify each item so that it will match the communication parameters of the target machine that you will communicate with.

Move the cursor to the "② COMM. SET" item on the [SYSTEM COND] menu, and press the SET key.

```
[SYSTEM COND]
①SERIAL OUTPUT NO  PC-LINK  SERIAL
②COMM.SET          (TO NEXT SUB-MENU)
③COMPUTER LINK     (TO NEXT SUB-MENU)


[SET COMM PARMS]
①COMM.STANDARD   RS232C   RS422(4-W 2-W)
②BAUDRATE(kbps)   2.4  4.8  9.6  19.2  38.4  57.6  115.2
③NO. OF DATA BITS   7  8BITS
④PARITY CHECK     EVEN  ODD   NO
⑤NO. OF STOP BITS   1   2BITS
⑥STATION NO.       00(0~7F)
OPS-MENU  RETURN  LOCK
```
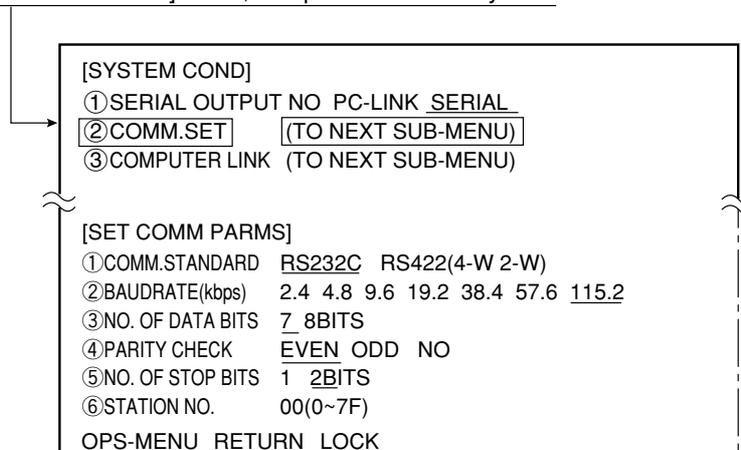
- For details about general-purpose serial port communications and computer link communications, see the IV-S30 User's Manual (Function and Operation).

[2] Specify the computer link conditions

When you want to use computer link communications, you must specify the communication conditions. On the [SYSTEM COND] menu, move the cursor to item "③ COMPUTER LINK" and press the SET key.

```
[SYSTEM COND]
①SERIAL OUTPUT NO  PC-LINK  SERIAL
②COMM.SET        (TO NEXT SUB-MENU)
③COMPUTER LINK  (TO NEXT SUB-MENU)
```

```
[COMPUTER LINK]
①PC MANUFACTURER SHARP(COMM.PORT LINK-MDL) MITSUBISHI OMRON
②STATION NO.    01
③WRITE TOP ADRS 09000
④CONTROL PROC. FORM1 FORM4
⑤BLK WRT COMMAND WW  QW


OPS-MENU  RETURN  LOCK
```

7
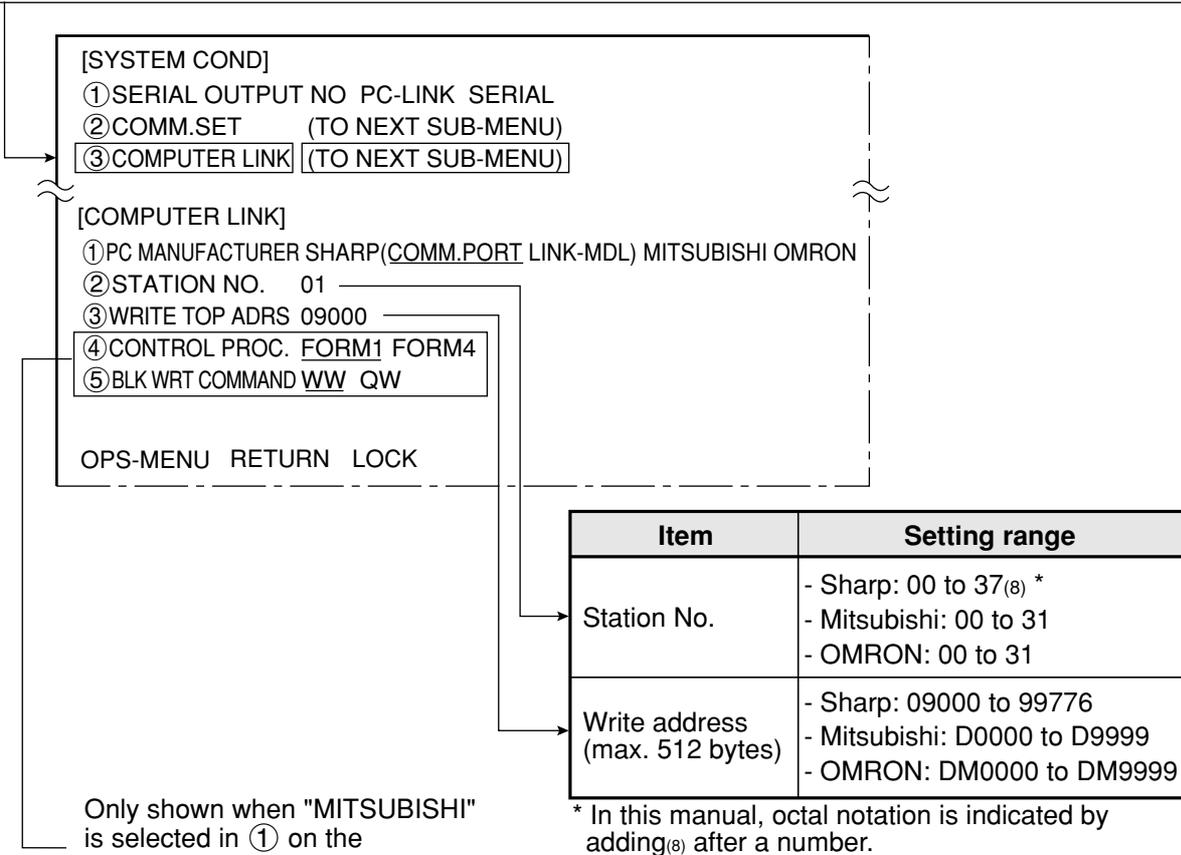
Only shown when "MITSUBISHI" is selected in ① on the [COMPUTER LINK] menu.

Item	Setting range
Station No.	- Sharp: 00 to 37(8) * - Mitsubishi: 00 to 31 - OMRON: 00 to 31
Write address (max. 512 bytes)	- Sharp: 09000 to 99776 - Mitsubishi: D0000 to D9999 - OMRON: DM0000 to DM9999

* In this manual, octal notation is indicated by adding(8) after a number.

Menu	Setting details
④ CONTROL PROC.	Select either FORM 1 or 4 for the control procedure. FORM 1 — No line terminator FORM 4 — With line terminators: CR + LF - In version 2.01, only FORM 1 was available.
⑤ BLK WRT COMMAND	Select either WW or QW for the block write command. WW — Data writing address range: D0000 to D1023 QW — Data writing address range: D000000 to D008191 - In version 2.01, only WW was available.

- If "SHARP" or "OMRON" is selected, items ④ and ⑤ will not be displayed.

- For details about computer link communications, see the IV-S30 User's Manual (Function and Operation).

[3] Initialization

If you initialize the IV-S30, the specified measurement conditions, evaluation conditions, operation conditions, and system conditions will be reset to their initial condition.
The system time data will not be initialized.
The IV-S30 has two initialization modes: "Initialize all" and "Initialize RAM."

Initialization	Details
ALL-INIT (Initialize all)	Initializes the data in both the flash memory and RAM. Returns the settings to the factory default settings (the same as when the machine was delivered). When the power is turned ON again after this initialization method is selected, the data will be initialized.
INIT-RAM (Initialize RAM)	Initializes the RAM data. When power is turned ON after this initialization method is selected, the data that you had stored in flash memory will be retrieved and displayed.

■ Operating procedure

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

```
[SYSTEM COND]
①SERIAL OUTPUT NO  PC-LINK  SERIAL
②COMM.SET          (TO NEXT SUB-MENU)
③COMPUTER LINK     (TO NEXT SUB-MENU)
④INITIALIZATION    ALL-INIT  INIT-RAM
⑤SIMPLE MENU→STD   EXEC
```

1. Move the cursor to the "④ INITIALIZATION" item using the up and down keys, and press the SET key.
2. Select either "ALL-INIT" or "INIT-RAM" using the left and right keys.
3. Press the SET key.
   ➪ The following message will be displayed.

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

4. Press the SET key again. (Press the ESC key to abort the initialization.)
   ➪ Initialization will start, and the progress of the initialization will be displayed on the bottom of the screen.

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

When initialization is complete, the message "INITIALIZING" will change to "COMPLETE INIT."
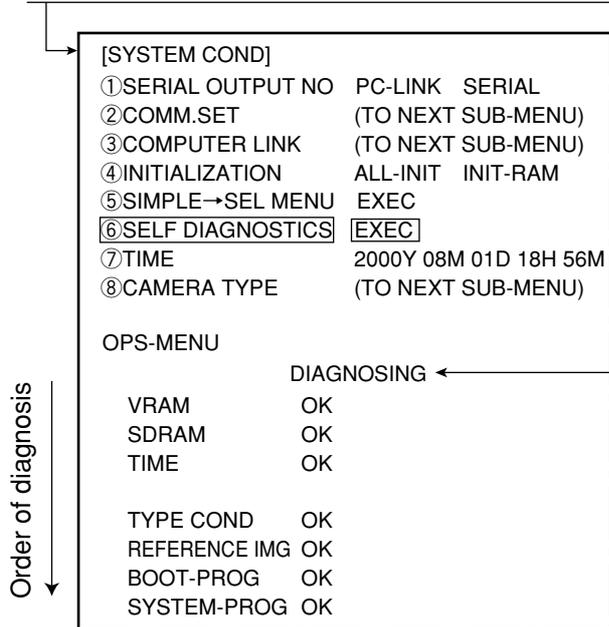
7

[4] Self-diagnosis

The IV-S31M/S32M/S33M controller can check all of its own hardware, to ensure that it is operating normally.

(1) Diagnostic items and methods

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

(2) Operating procedure

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

7

```
[SYSTEM COND]
①SERIAL OUTPUT NO   PC-LINK   SERIAL
②COMM.SET           (TO NEXT SUB-MENU)
③COMPUTER LINK      (TO NEXT SUB-MENU)
④INITIALIZATION     ALL-INIT   INIT-RAM
⑤SIMPLE→SEL MENU    EXEC
⑥SELF DIAGNOSTICS   EXEC
⑦TIME               2000Y 08M 01D 18H 56M
⑧CAMERA TYPE        (TO NEXT SUB-MENU)

OPS-MENU
                 DIAGNOSING

  VRAM          OK
  SDRAM         OK
  TIME          OK

  TYPE COND     OK
  REFERENCE IMG OK
  BOOT-PROG     OK
  SYSTEM-PROG   OK
```

Order of diagnosis

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

After the diagnosis is complete, the message will change to "COMPLETE DIAGNOSIS."

If any abnormality occurs, consult our service center.

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

Set the time displayed on the monitor for the IV-S32M/S33M.

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

```
[SYSTEM COND]
①SERIAL OUTPUT NO   PC-LINK   SERIAL
②COMM.SET           (TO NEXT SUB-MENU)
③COMPUTER LINK      (TO NEXT SUB-MENU)
④INITIALIZATION     ALL-INIT   INIT-RAM
⑤SIMPLE→SEL MENU    EXEC
⑥SELF DIAGNOSTICS   EXEC
⑦TIME               2000Y 08M 01D 18H 56M
⑧CAMERA TYPE        (TO NEXT SUB-MENU)

  OPS-MENU
```
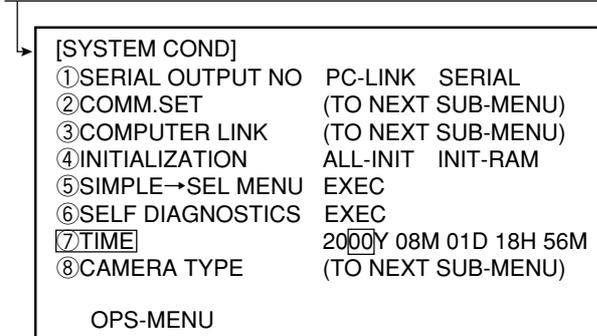
1. Move the cursor to the "⑦TIME" item using the up and down keys, and press the SET key.
2. Move the cursor to "SEC.," "MIN.," "D," "M," and "Y" using the left and right keys, and enter the correct value at each location using the up and down keys.
   Y = 1999 to 2098
   M = 01 to 12
   D = 01 to 31
   H = 00 to 23
   MIN. = 00 to 59
3. Press the SET key. The time will be set and the system will start using the new time.

[6] Camera setting (IV-S33M)

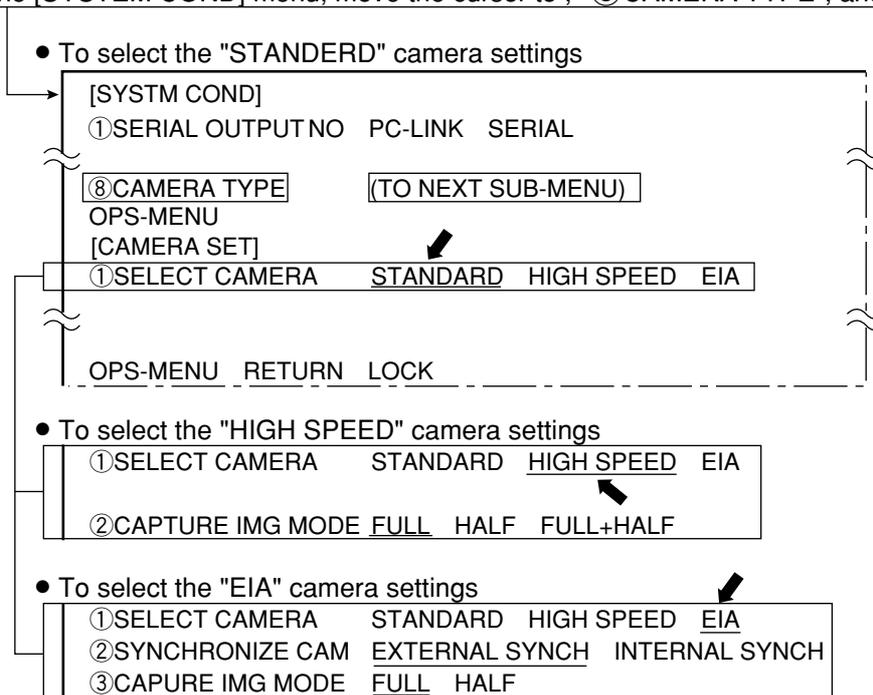Select the camera type (standard, high-speed, or EIA) that is connected to the controller.

Camera selection	Details
Standard	Select when SHARP's standard camera (IV-S30C1/S30C2) is connected to the IV-S33M.
High-speed	Select when SHARP's high-speed camera (IV-S30C3/S30C4) is connected to the IV-S33M.
EIA	Select when a commercially available EIA camera (Sony XC-75 or similar) is connected to the IV-S33M. In this case, you also have to set the camera synchronization mode (External or Internal).

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

⇨ On the [SYSTEM COND] menu, move the cursor to , "⑧CAMERA TYPE", and press the SET key.

● To select the "STANDERD" camera settings

```
[SYSTM COND]
①SERIAL OUTPUT NO  PC-LINK  SERIAL


⑧CAMERA TYPE        (TO NEXT SUB-MENU)
OPS-MENU
[CAMERA SET]
①SELECT CAMERA    STANDARD  HIGH SPEED  EIA


OPS-MENU  RETURN  LOCK
```

● To select the "HIGH SPEED" camera settings

```
①SELECT CAMERA      STANDARD  HIGH SPEED  EIA

②CAPTURE IMG MODE FULL  HALF  FULL+HALF
```

● To select the "EIA" camera settings

```
①SELECT CAMERA      STANDARD  HIGH SPEED  EIA
②SYNCHRONIZE CAM  EXTERNAL SYNCH  INTERNAL SYNCH
③CAPURE IMG MODE  FULL  HALF
```

- When "HIGH SPEED" or "EIA" is selected, choose the image capture mode.

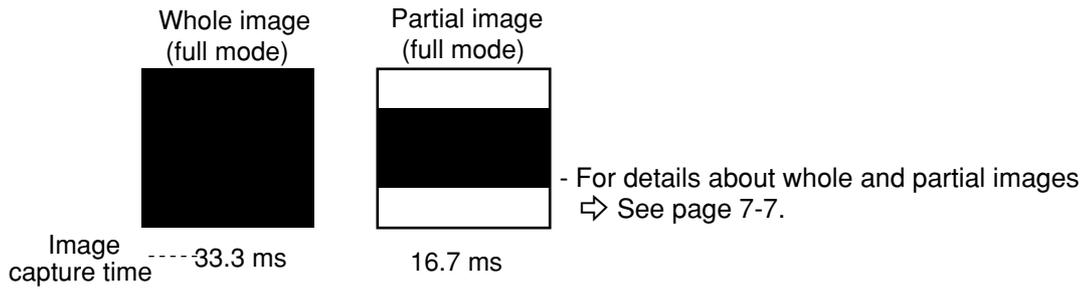| Image capture mode	Details
Full	Scan all the lines in the image
Half	Scan only the odd lines in the image
Full + half *	In the partial image mode, the measurement target lines are scanned in full mode and the others are scanned in half mode

* The "Full + half" mode can only be selected when the camera type is set to "HIGH SPEED"
For more image capture time and processing details, see the next page.
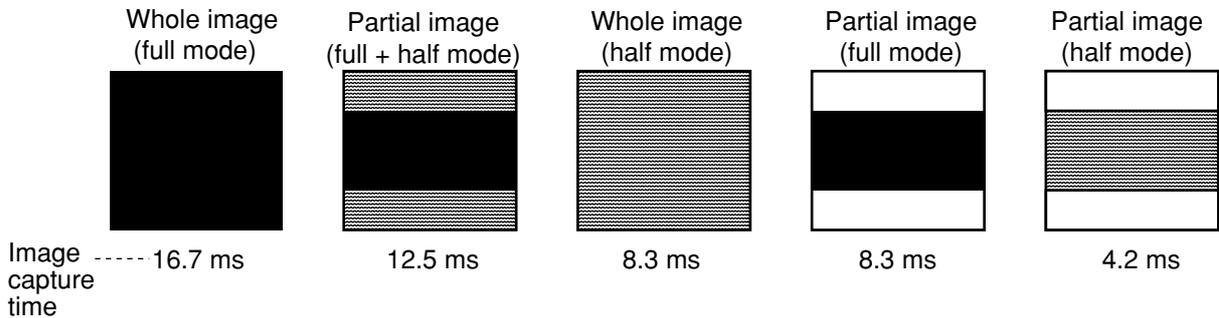**-** When "EIA" is selected, you must select a camera synchronization mode (External or Internal).
For details about camera synchronization, see page 6-8.

■ **Comparative examples of image capture times**

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

Whole image
(full mode)

Partial image
(full mode)

- For details about whole and partial images
  ⇨ See page 7-7.

Image
capture time ----33.3 ms

16.7 ms

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

| Whole image (full mode) | Partial image (full + half mode) | Whole image (half mode) | Partial image (full mode) | Partial image (half mode) |

Image
capture
time ----16.7 ms   12.5 ms   8.3 ms   8.3 ms   4.2 ms

■ **Processing details of the image capture mode**

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

Chapter 8: Specifications

8-1 Controller (IV-S31M/S32M/S33M)

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

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

*2. Variable, with partial-image capturing.

Item		Specifications		
		IV-S31M	**IV-S32M**	**IV-S33M**
Number of measurement programs		Maximum 6 per object type (measurement 0 - camera 1, measurement 0 - camera 2, measurements 1 to 4) Note: Measurement 0 is only used for positional deviation measurement.		
Simpli-fied menu	Positioning	XY coordinate, degree of match (1-point search, 2-point search) [1 window]		
	Existence inspection	Area [Maximum 8 windows]		
Window shape		Rectangle, circle, oval (when using area measurement by binary conversion, object counting by binary conversion, object identification by binary measurement)		
Distance and angle measurement		Measure distance (between two points, X coordinate, Y coordinate), measure angle (3 points, 2 points against horizontal line, 2 points against vertical line), auxiliary point (center, circle center, gravity center, line over 2 points, crossing point of two straight lines)		
Arithmetic operation		Four basic operations (+, -, X, /), root, absolute value, TAN, ATAN, maximum, minimum, average , total.		
NG image memory function		---	Maximum 128 images (8 whole screens)	
Calendar timer		---	Year, month, day, hour, minute	
Other functions		Display measuring time, light level monitor function, crosshair cursor display, change display language between Japanese and English, Run screen lock function, setting menu display "yes/no", change image display (through/freeze), change image brightness (bright/dark)		
Micro PC section	Input relays	Parallel input: 8 points (X0 to X7)		
	Output relays	Parallel output: 8 points (Y0 to Y7) General-purpose serial interface, computer link: 16 points (Y0 to Y15)		
	Auxiliary relays	128 points (C0 to C127), special area 18 points (C110 to C127)		
	Timers	8 points (TM0 to TM7), timer setting range: 0.01 to 9.99 seconds (countdown timer)		
	Counters	8 points (CN0 to CN7), counter setting range: 000 to 999 (counts down)		
External interface	Parallel interface	Input: 8 points, 12/24 VDC, approx. 7 mA (24VDC) Output: 9 points, 12/24 VDC, max. 100 mA, FET output		
	General-purpose serial interface	RS232C/RS422 (2.4 to 115.2 kbps)		
	Computer link	Built-in compatibility with certain SHARP, OMON, and Mitsubishi models		
	USB	USB device node, 12 Mbps		
Image output		1 channel, EIA 525 lines, 2:1 interlace		
Number of cameras		Maximum of 2		
Make settings		Using the IV-S30RK1 remote keypad and/or the IV-S30SP parameter setting support software		
Measu-rement start input	Internal trigger	CCD trigger (using the CCD camera)		
	External trigger	Trigger input (parallel I/F), general-purpose serial I/F, keypad trigger (for manual measuring)		
Terminal block	Interrupt processing input	1 point: External trigger (X0)		
	Inputs	7 points: Object type change (X1 to X4), external input (X5 to X7)	7 points: Object type change (X1 to X5), external input (X6 and X7)	7 points: Object type change (X1 to X6), external input (X7)
	Common for input	1 point: + or - common		
	Output	9 points: 1 READY , 8 user settable logical outputs (Y0 to Y7)		
	Common for output	1 point: + or - common		
	Power supply	2 points: +24 VDC, 0 V		
Power supply voltage / power consumption		24 VDC (±10%), 7 W		24 VDC (±10%), 8 W

Item	Specifications		
	IV-S31M	**IV-S32M**	**IV-S33M**
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 - Amplitude 0.15 mm (10 to 57 Hz), 9.8 m/s^2 (57 to 150 Hz) Number of sweeps: 10 (1 octave/min.), 3 directions (X, Y, Z)		
Shock resistance	JIS C 0912 or equivalent : 147 m/s^2 (three times each in X, Y, and Z directions)		
Noise immunity	1000 Vp-p 1µs width impulse (by noise simulator) when applied to the primary side (100 VAC) of an external DC power supply		
Outside dimensions	130 (W) × 100 (D) × 42 (H) mm (except protruding portions)		
Weight	510 g		
Accessories	- 2 main housing angle bracket - 1 monitor cable - 1 conversion connector - 1 D-sub connector (9-pin, D-sub, male, M2.6 lock screw: for communication connector of the controller) - 4 securing screws (M3 x 6: for fixing the angle bracket) - 1 instruction manual		

8

8-2 Camera specifications

[1] Camera (IV-S30C1/C2/C3/C4)

Item		Specifications			
		Standard, IV-S30C1	Micro, IV-S30C2	Hight speed, IV-S30C3	Micro and hight speed, IV-S30C4
Optical system	Lens mount method	C mount	custom φ17 mm mount	C mount	custom φ17 mm mount
Picture taking element	Method	Interline transmission method, monochrome CCD			
	Reading system	Full pixel type, partial image scanning is available			
	Reading	33.3 ms *		16.7 ms [full mode], 8.3m [half mode]*	
	Size	1/3 inch			
	No. of effective pixels	512 (horizontal) × 480 (vertical)			
	Pixel shape	Square			
Shutter	Shutter speed (s)	Settable between 1/30 and 1/10,000 for each object type			
	Method	Random shutter			
Conncter		Round, 12-pin male connector			
Connection to controller		- Using custom camera cables (IV-S30KC3: 3 m, IV-S30KC5: 5 m, IV-S30KC7: 7 m)		- Using custom camera cables (IV-S30KC3: 3 m, IV-S30KC5: 5 m)	
Operation ambient temperature		0 to 45ºC			
Operation ambient humidity		35 to 85% RH (non-condensing)			
Operation atmosphere		No corrosive gases or dust			
Outside dimensio-ns (mm)	Camera body	30 (W) × 32 (H) × 40 (D)	30 (W) × 32 (H) × 50 (D)	30 (W) × 32 (H) × 40 (D)	30 (W) × 32 (H) × 44.7 (D)
	Head	---	φ17×35.6 mm	---	φ17×35.6 mm
	Head cable	---	1m	---	1m
Weight		50 g (not including the lens)	125 g(The head weighs approximately 12 g)	50 g (not including the lens)	140 g(The head weighs approximately 13 g)
Accessories		- 1 camera angle bracket - 2 securing screws	- 1 camera angle bracket - 1 camera head bracket - 3 securing screws - 1 Instruction Manual	- 1 camera angle bracket - 2 securing screws - 1 Instruction Manual	- 1 camera angle bracket - 1 camera head bracket - 3 securing screws - 1 Instruction Manual

* Variable with partial-image capturing

[2] Camera converter (IV-S30EA1)

Item		Function
Camera to be connected	TV system	EIA equivalent camera
	Image input	1 Vp-p (75 ohm load)
	Number of scan lines	525
	Scanning method	2:1 interlace
	Synchronization system	Internal/external Note: External synchronization may not be available with some EIA cameras (The converter is compatible with Sony's S-DNPISHA and the special shutter made by Tokyo Electronic Industries)
	Scanning frequency	Horizontal: 15. 734 KHz, Vertical: 59.94 Hz
	Pulse width	HD: 6.4 ±0.3 μs, VD: 150 to 800 μs
	Power supply	12V ± 10%(300mA / one set or less)
Number of cameras that can be connected		2
Camera connectors		Round, 12-pin female connectors
Main housing connector		D-sub, 25-pin female connectors
Power supply voltage		24 V, 0.5 A (12 W)
Ambient operating temperature		0 to 45° C
Operating humidity		35 to 85% RH (non condensing)
Outside dimensions		70 (W) x 100 (H) x 25 (D) mm
Connection to the controller		Using the supplied main housing cable (250 mm)
Weight		Camera converter: approximately 255 g, main interface cable: approximately 150 g
Accessories		1 main interface cable [Cable length: 250 mm, Connector: D-sub 25 pin male, Hirose round, 12-pin male] 2 main housing mounting brackets 4 securing screws 1 instruction manual

8

[3] Camera lens (IV-S20L16)

Item	Specifications
Focal distance	16 mm
Maximum f-stop	1.6
Aperture range	1.6 to 16, Close
Focal range	50 mm to ∞
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)

[4] Camera cable: IV-S30KC3/S30KC5/S30KC7
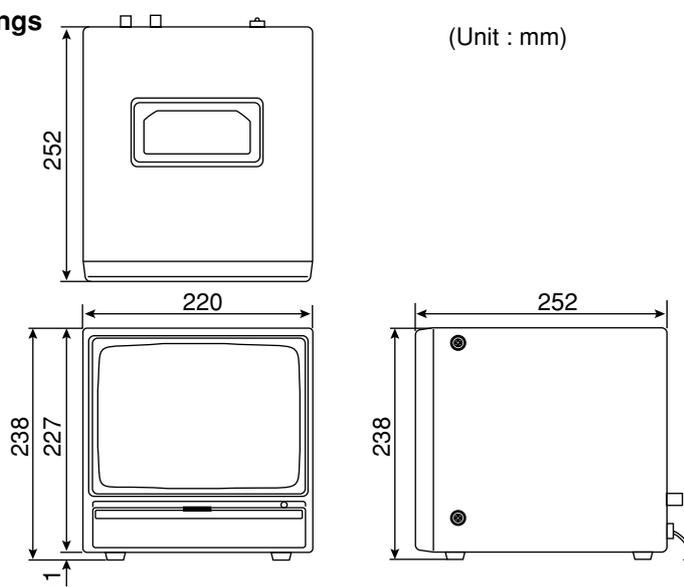
Item	Specifications
Overall length	3m (IV-S30KC3), 5m (IV-S30KC5), 7m (IV-S30KC7)
Cable sheath	Polyvinyl chrolide
Video connectors	Main housing: Round, 12-pin male connector
	Camera: Round, 12-pin male connector
Minimum bending radius	75 mm

8

8-3 Support tools

[1] Monochrome monitor IV-09MT

| Item		Speicfications
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 60ºC
Operation ambient temperature		0 to 45ºC
Operation ambient humidity		35 to 85 %RH (non-considering)
Atmosphere		No corrosive gases
Vibration resistance		JIS C 0911 or equivalent - Amplitude 0.15mm, (10 to 57Hz), 9.8m/s^2 (57 to 150Hz), No. of sweeps : 10 (1 octave/min.) 3 directions (X, Y, Z)
Shock resistance		JIS C 0912 or equivalent, 147m/s^2 (3 times each in X,Y, and Z directions)
Weight		Approx. 6 kg
Dimensions (mm)		220 (W) $\times$ 238 (H) $\times$ 257 (D) (not including prorusion)
Dielectric resistance		1000 VAC, 1 minute (between AC plug and shassis)
Insulation resistance		DC 500VDC, 10M ohms or more (between AC plug and chassis)
Accessories		One instruction manual

■ **External dimension drawings**

(Unit : mm)

[2] LED lighting equipment IV-60LD specifications

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

8

■ External dimension drawings

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

(Unit : mm)

* (2 places)
The dimensions will vary according to the installation direction of the camera.
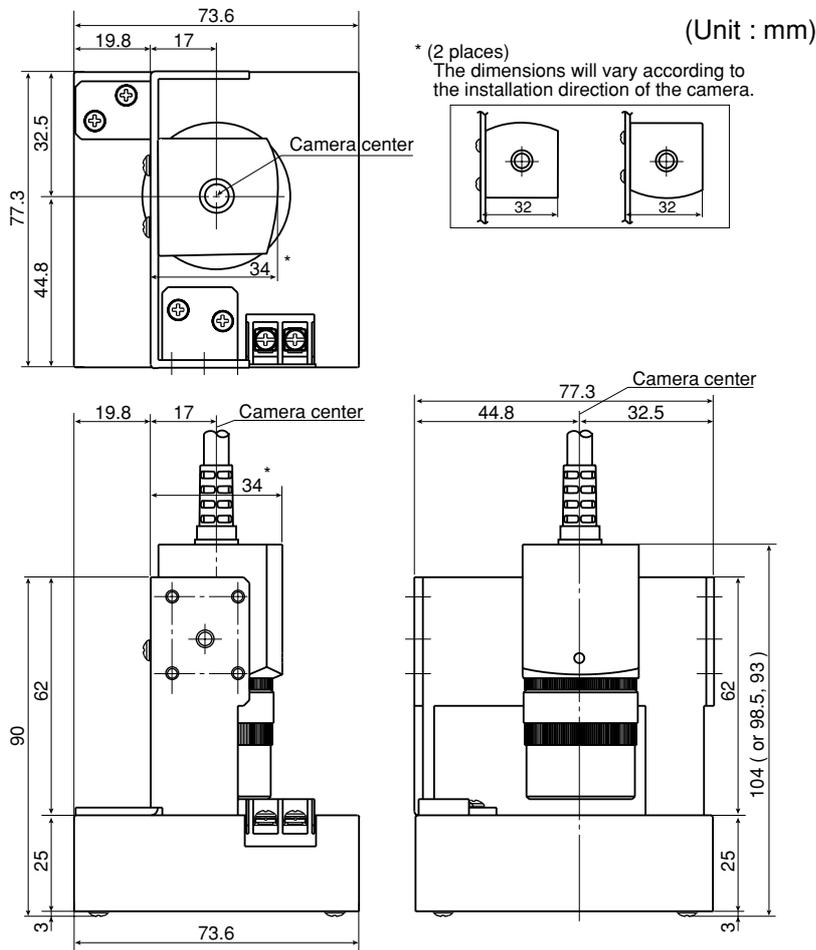
Chapter 9: Operation Examples

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

Item			Page
9-1 Simplified menu	[1]	Positioning measurement	9-2 to 9-5
	[2]	Existence inspection	9-6 to 9-9
9-2 Standard menu	[1]	Area measurement by binary conversion	9-10 to 9-14
	[2]	Positional deviation mesurement	9-15 to 9-21

■ **Preparation for operation**

Before turning ON the power, connect the IV-S30 controller, the camera, monitor, remote key pad and power supply (24 VDC). Connect the camera to the camera 1 connector (CAMERA 1) on the IV-S30 controller.
See Chapter 5 "Installation Conditions and Method" for connecting procedures.

Camera 1

Monitor

Remote key pad

Controller

Power supply (24 VDC)

9
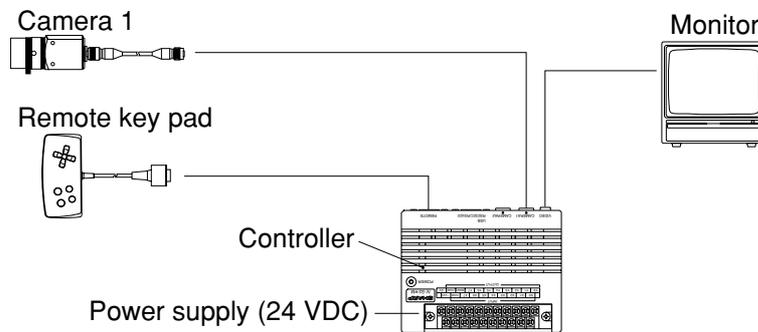
Notes

- Sections 9-1 and 9-2 give the instructions for making each measurement, starting from the initial conditions of the machine. To follow the instructions, first initialize all the machine's conditions and then start the procedures. For details about performing a complete initialization, see the respective pages, described below.

  - Simplified menus ⇨ Page 7-29
  - Standard menus ⇨ "Total initialization" in the IV-S30 user's manual (Function and Operation)
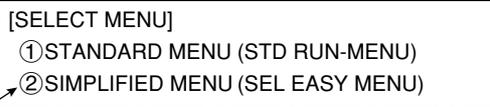
9-1 Simplified menu
[1] Positioning measurement
The following sections cover an example of how to measure the positioning of the object shown below.
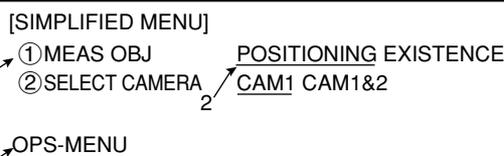
Object to be measured

(1) Power ON
When power is first turned ON after the machine is deliverd, the [SELECT MENU] screen will appear.
- When the MAIN OPS MENU used by the simplified menus (positioning) is displayed, the operations covered in steps (2) and (3) are not needed.
- If the MAIN OPS MENU used by the standard menus is displayed, please change to the simplified menus screen. ⇨ See page 6-5.

(2) Select menu

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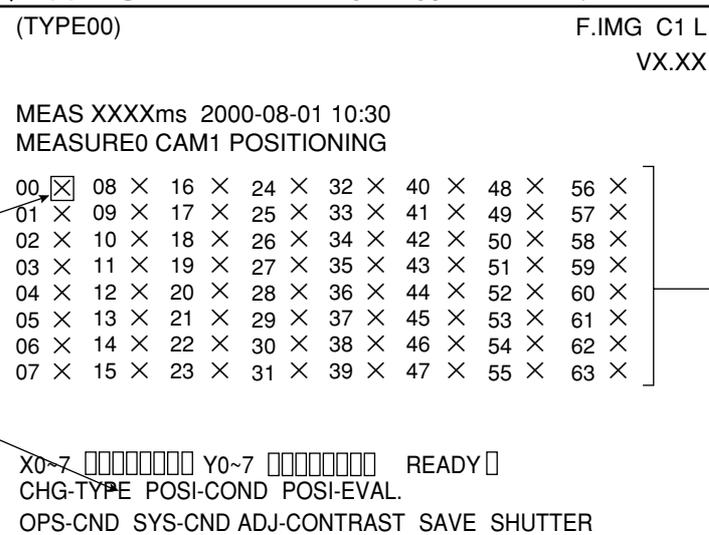 ①STANDARD MENU (STD RUN-MENU)
 ②SIMPLIFIED MENU (SEL EASY MENU)

1

 1.Move the cursor to the "②SIMLIFIED MENU" item with the up and down keys, and press the SET key.
  ⇨ The [SIMLIFIED MENU] menu screen will appear.

(3) Placing the object to be measured (positioning)

[SIMPLIFIED MENU]
 ①MEAS OBJ   POSITIONING EXISTENCE
 ②SELECT CAMERA   CAM1 CAM1&2

OPS-MENU

1   2

3

 1. Move the cursor to the "①MEAS OBJ" item using the up and down keys, and press the SET key.
 2. Move the cursor to "POSITIONING" using the left and right keys, and press the SET key.
 3. Move the cursor to the "OPS-MENU" item using the up and down keys, and press the SET key.
  ⇨ The MAIN OPS MENU for setting up positioning measurements will be displayed.

(4) Registration of an object type number (IV-S33M is registered in 00 in this example)

(TYPE00)   F.IMG C1 L
                                   VX.XX

MEAS XXXXms 2000-08-01 10:30
MEASURE0 CAM1 POSITIONING

00 ⊠   08 ✕   16 ✕   24 ✕   32 ✕   40 ✕   48 ✕   56 ✕
01 ✕   09 ✕   17 ✕   25 ✕   33 ✕   41 ✕   49 ✕   57 ✕
02 ✕   10 ✕   18 ✕   26 ✕   34 ✕   42 ✕   50 ✕   58 ✕
03 ✕   11 ✕   19 ✕   27 ✕   35 ✕   43 ✕   51 ✕   59 ✕
04 ✕   12 ✕   20 ✕   28 ✕   36 ✕   44 ✕   52 ✕   60 ✕
05 ✕   13 ✕   21 ✕   29 ✕   37 ✕   45 ✕   53 ✕   61 ✕
06 ✕   14 ✕   22 ✕   30 ✕   38 ✕   46 ✕   54 ✕   62 ✕
07 ✕   15 ✕   23 ✕   31 ✕   39 ✕   47 ✕   55 ✕   63 ✕

1

When the IV-S33M is used
⌈ When the IV-S31M is used 00 to 15 ⌉
⌊ When the IV-S32M is used 00 to 31 ⌋

2

X0~7 □□□□□□□□ Y0~7 □□□□□□□□   READY □
CHG-TYPE POSI-COND POSI-EVAL.
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER

 1. Move the cursor to the X next to object type number 00 using the up and down keys. Then press the SET key.
  ⇨ The X will change to a circle meaning that object type 00 has been registered.
 2. Move the cursor to the "POSI-COND" item using the left and right keys, and press the SET key.
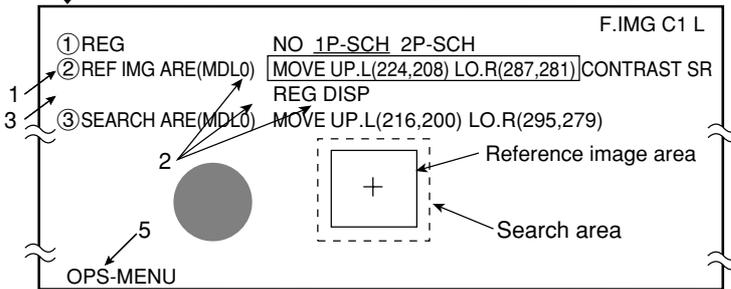 ⇨ The measurement condition setting screen will be displayed.

To the next page

9

Continued from the previous page
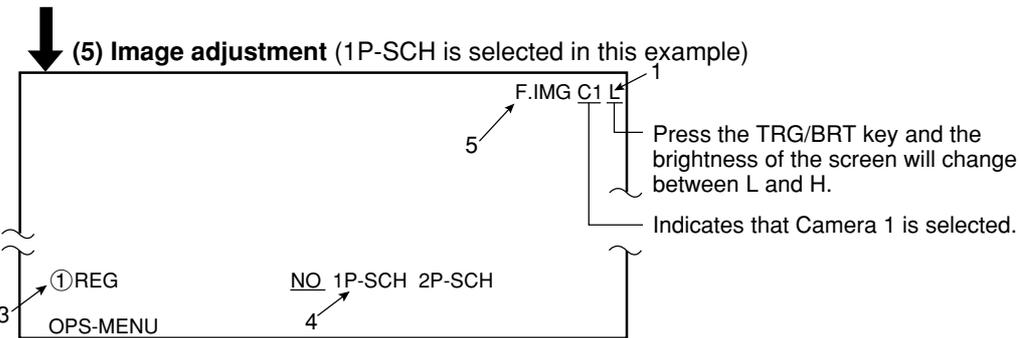
(5) Image adjustment (1P-SCH is selected in this example)

F.IMG C1 L — 1

5

Press the TRG/BRT key and the brightness of the screen will change between L and H.

Indicates that Camera 1 is selected.

① REG   NO 1P-SCH 2P-SCH

3   OPS-MENU   4

1. Press the SEL key.
   ⇨ The image taken by camera 1 will be displayed.
   - When the image is so bright that the menu display is difficult to see, press the TRG/BRT key to reduce the brightness of the image. The indicator in the upper right corner of the screen will change from "H" to "L."
2. To display the image of the object measured clearly, adjust the focus and iris opening of the camera lens (page 4-1).
3. Move the cursor to the "① REG" line, and press the SET key.
4. Move the cursor to the "1P-SCH" item with the left and right keys, and press the SET key.
   ⇨ The reference image area and search area will be displayed in the center of the screen.
5. Press the SEL key to change the screen to the freeze mode.
   ⇨ The indicator in the upper right corner of the screen will change from T to F.
   - To register reference images, you must make sure to display the freeze screen.
6. Press the ESC key to display all of the measurement condition items.

(6) Setting the measurement conditions

F.IMG C1 L

① REG   NO 1P-SCH 2P-SCH
② REF IMG ARE(MDL0) | MOVE UP.L(224,208) LO.R(287,281) | CONTRAST SR
1   REG DISP
3   ③ SEARCH ARE(MDL0) MOVE UP.L(216,200) LO.R(295,279)
         2
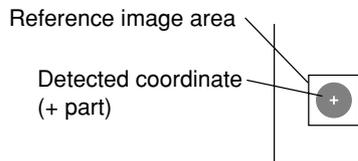
Reference image area

+

Search area

5

OPS-MENU

- If the menu overlaps the object to be measured, so that further image condition setting is difficult, press the ESC key. Only item ① will be displayed at a time.

9

1. Move the cursor to the "② REF. IMG ARE (MDL 0)" item with the up and down keys, and press the SET key.
2. Surround the object to be measured with the reference image area (solid line).
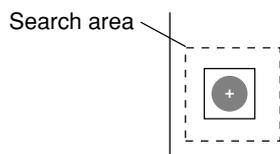   - Move the cursor to the "MOVE," "UP.L," or "LO. R," label and press the SET key.

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

After the position has been finalized, press the SET key.

Reference image area

Detected coordinate (+ part)

+

- After the reference image area position has been set, move the cursor to the "REG." item using the left and right keys, and press the SET key.
  ⇨ The stored image will be displayed in the lower right corner of the screen. After storing the image, press the ESC key.

3. Press the ESC key and move the cursor to the "③ SEARCH ARE (MDL 0)" item. Then, press the SET key.
4. Create a search area (dotted line).
   - The search area described above is the range for detecting the image registered in step 2, using the gray scale search function (see the Glossary).
   - The procedure for creating the search area is the same as described for the reference image area in step 2.

Search area

+

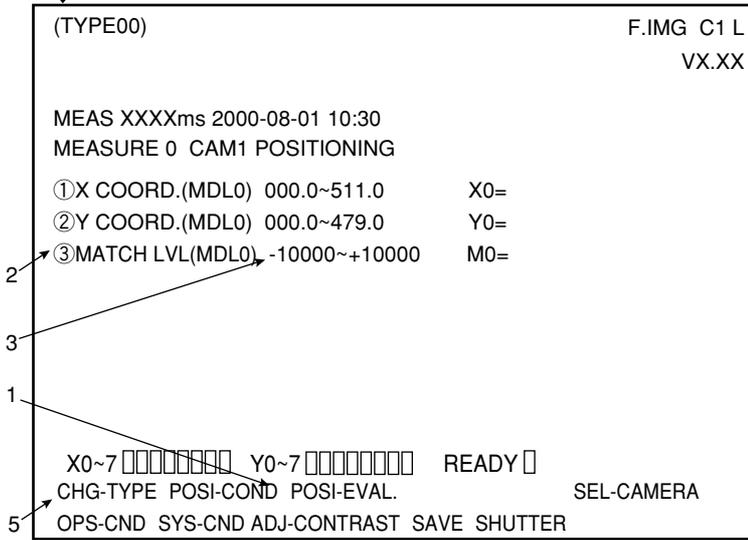- After specifying the search area position, press the ESC key.

5. Move the cursor to the "OPS-MENU" item using the up and down keys, and press the SET key.
   ⇨ The screen will return to the MAIN OPS MENU.

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Continued from the previous page

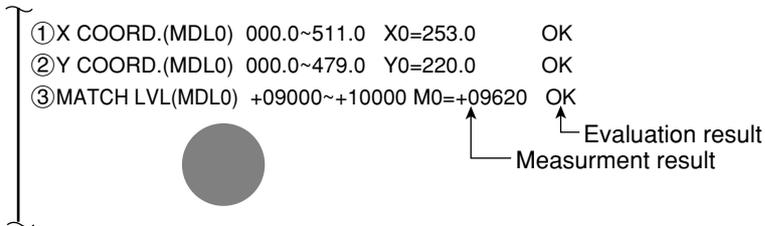**(7) Setting the position evaluation conditions**
  1. Move the cursor to the "POSI-EVAL." item on the MAIN OPS MENU using the left and right keys, and press the SET key.
     ⇨ The items ① to ③ will be displayed.

```
(TYPE00)                                          F.IMG  C1 L
                                                  VX.XX


MEAS XXXXms 2000-08-01 10:30
MEASURE 0  CAM1 POSITIONING

①X COORD.(MDL0)  000.0~511.0          X0=
②Y COORD.(MDL0)  000.0~479.0          Y0=
③MATCH LVL(MDL0)  -10000~+10000       M0=




    X0~7 □□□□□□□□  Y0~7 □□□□□□□□    READY □
CHG-TYPE  POSI-COND  POSI-EVAL.              SEL-CAMERA
OPS-CND  SYS-CND ADJ-CONTRAST  SAVE  SHUTTER
```

  2. Move the cursor to "③MATCH LVL (MDL0)" with the up and down keys, and press the SET key.
  3. Move the cursor to the minimum value position with the left and right keys, and press the SET key.
     - Select the digit to change with the left and right keys, and then set the value to +09000 with the up and down keys.
       (Criteria for a successful match: 90.00% to 100.00%)

       ③MATCH LVL(MDL0) -10000~+10000

     - After defining the minimum value, press the SET key, and then the ESC key.
  4. Press the TRG/BRT key.
     ⇨ The measurement (evaluation) results for items ① to ③ and the image will be displayed.

       ①X COORD.(MDL0) 000.0~511.0 X0=253.0   OK
       ②Y COORD.(MDL0) 000.0~479.0 Y0=220.0   OK
       ③MATCH LVL(MDL0) +09000~+10000 M0=+09620 OK
                                                  └─Evaluation result
                                          └─Measurment result

  5. Press "ESC," and move the cursor to the "CHG-TYPE" item using the left and right keys, to confirm that "Object type number 00" has been selected.
  6. Move the cursor away from the "CHG-TYPE" item using the left and right keys.
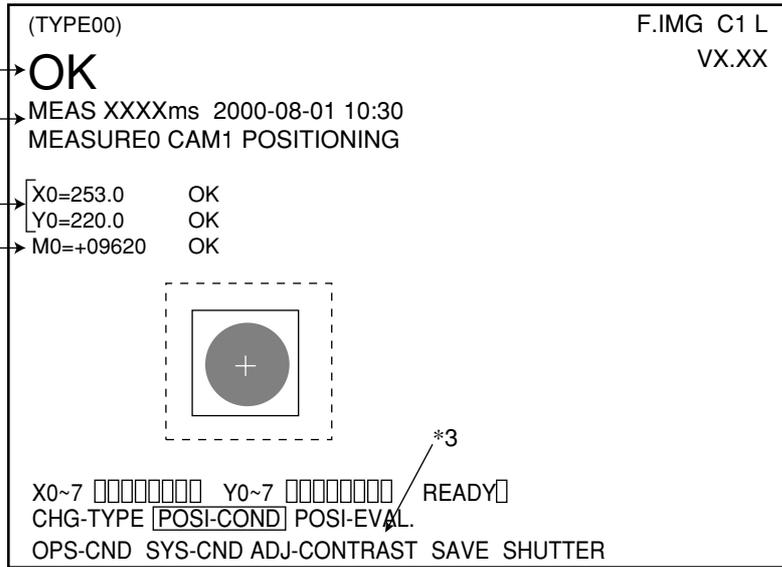
To the next page

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Continued from the previous page

Press the TRG/BRT key, and the result of measuring (evaluating) and image (search) area will be displayed.

(8) Mesuring the position

[Display of the measured result]
Final evaluation result (*1)

Measuring time

Detection coordinates of the reference image

Degree of match of the reference image (*2)

```
(TYPE00)                              F.IMG  C1 L

OK                                        VX.XX
MEAS XXXXms  2000-08-01 10:30
MEASURE0 CAM1 POSITIONING

X0=253.0      OK
Y0=220.0      OK
M0=+09620     OK




                                         *3

X0~7 □□□□□□□□  Y0~7 □□□□□□□□ / READY□
CHG-TYPE POSI-COND  POSI-EVAL.
OPS-CND  SYS-CND  ADJ-CONTRAST  SAVE  SHUTTER
```

*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 +09620" means that the degree of match (percentage of pixels that match) between pixels in the stored image and the measured image is 96.20%.
[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 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-S30 controller is turned OFF. ⇨ See page 7-26.

9

[2] Existence inspection

The following sections describe an example of the existence inspection, using the object shown below as the target.
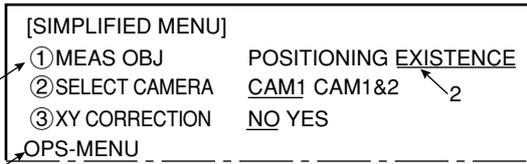
Object to be measured

(1) Power ON

When power is first turned ON after the machine is deliverd, the [SELECT MENU] screen will appear.
- When the MAIN OPS MENU used by the simplified menus (existence inspection) is displayed, the operations covered in steps (2) and (3) are not needed.
- If the MAIN OPS MENU used by the standard menus is displayed, please change to the simplified menus screen. ⇨ See page 6-5.

(2) Select menu

```
[SELECT MENU]
①STANDARD MENU (STD RUN-MENU)
②SIMPLIFIED MENU (SEL EASY MENU)
```
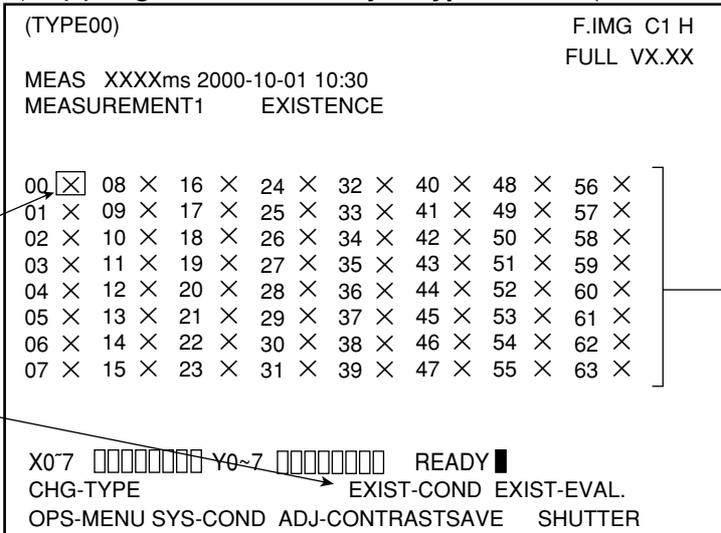1
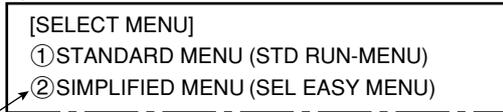
1.Move the cursor to the [②SIMLIFIED MENU] item with the up and down keys, and press the SET key.
⇨ The [SIMLIFIED MENU] menu screen will appear.

(3) Placing the object to be measured (existence inspection)

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

1. Move the cursor to the "①MEAS OBJ" item using the up and down keys, and press the SET key.
2. Move the cursor to "EXISTENCE" using the left and right keys, and press the SET key.
3. Move the cursor to the "OPS-MENU" item using the up and down keys, and press the SET key.
⇨ The MAIN OPS MENU for existence inspection will be displayed.

(4) Registration of an object type number (IV-S33M is registered in 00 in this example)

```
(TYPE00)                            F.IMG  C1 H
                                    FULL  VX.XX
MEAS   XXXXms 2000-10-01 10:30
MEASUREMENT1      EXISTENCE


00 ⊠  08 ✕  16 ✕  24 ✕  32 ✕  40 ✕  48 ✕  56 ✕
01 ✕  09 ✕  17 ✕  25 ✕  33 ✕  41 ✕  49 ✕  57 ✕
02 ✕  10 ✕  18 ✕  26 ✕  34 ✕  42 ✕  50 ✕  58 ✕
03 ✕  11 ✕  19 ✕  27 ✕  35 ✕  43 ✕  51 ✕  59 ✕
04 ✕  12 ✕  20 ✕  28 ✕  36 ✕  44 ✕  52 ✕  60 ✕
05 ✕  13 ✕  21 ✕  29 ✕  37 ✕  45 ✕  53 ✕  61 ✕
06 ✕  14 ✕  22 ✕  30 ✕  38 ✕  46 ✕  54 ✕  62 ✕
07 ✕  15 ✕  23 ✕  31 ✕  39 ✕  47 ✕  55 ✕  63 ✕



X0~7 □□□□□□□□ Y0~7 □□□□□□□□  READY ■
CHG-TYPE                EXIST-COND EXIST-EVAL.
OPS-MENU SYS-COND ADJ-CONTRASTSAVE  SHUTTER
```
1
2

When the IV-S33M is used
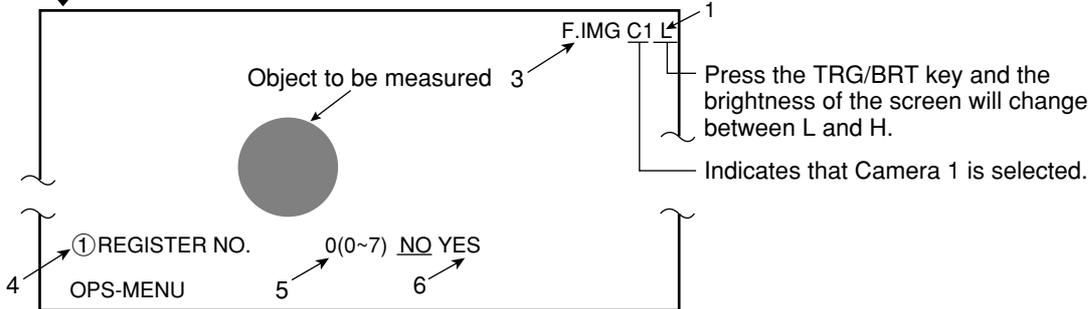⎡When the IV-S31M is used 00 to 15⎤
⎣When the IV-S32M is used 00 to 31⎦

1. Move the cursor to the X on the object type number 00 using the up and down keys. Then press the SET key.
⇨The X will change to a circle meaning that the object type has been registered.
2. Move the cursor to the "EXIST-COND" item using the left and right keys, and press the SET key.
⇨ The measurement condition setting screen will be displayed.

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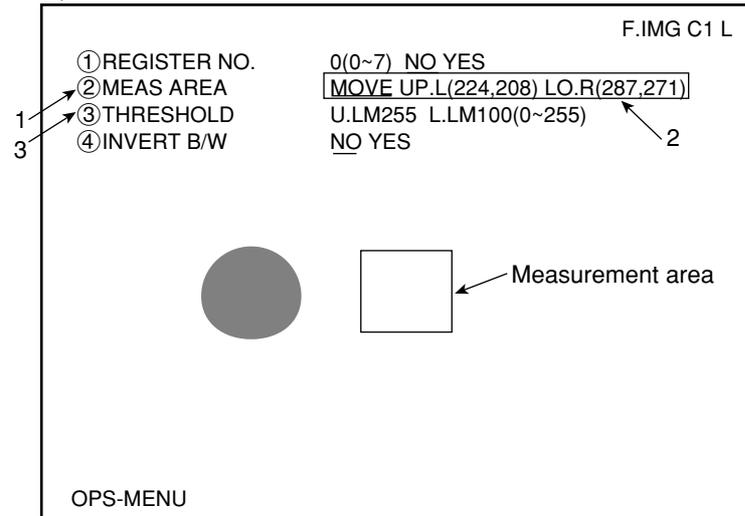
Continued from the previous page

(5) Image adjustment

1. Press the SEL key.
   ⇨ The image taken by camera 1 will be displayed.
   - When the image is so bright that the menu display is difficult to see, press the TRG/BRT key to reduce the brightness of the image. The indicator in the upper right corner of the screen will change from "H" to "L."

F.IMG C1 L — 1

Object to be measured 3

Press the TRG/BRT key and the brightness of the screen will change between L and H.

Indicates that Camera 1 is selected.

①REGISTER NO.   0(0~7) <u>NO</u> YES

4   OPS-MENU   5   6

2. To display the image of the object measured clearly, adjust the focus and iris opening of the camera lens (page 4-1).
3. Press the SEL key to change the screen to the freeze mode.
   ⇨ The indicator in the upper right corner of the screen will change from T.IMG to F.IMG.
   - To set a threshold for a binary area, make sure the IV-S30 is displaying the freeze screen. (For details about the through and freeze modes, see page 7-4.)
4. Move the cursor to the "①REGISTER NO." item using the up and down keys, and press the SET key.
5. Specify "0" for the registration number using the up and down keys.
6. Move the cursor to "YES" using the left and right keys.
   ⇨ The measurement area will be displayed in the center of the screen.
7. Press the ESC key to display all of the measurement condition items.

(6) Setting the binary area condition (measurement area)

F.IMG C1 L

①REGISTER NO.   0(0~7) NO YES
②MEAS AREA   MOVE UP.L(224,208) LO.R(287,271)
1   ③THRESHOLD   U.LM255 L.LM100(0~255)
3   ④INVERT B/W   <u>NO</u> YES   2
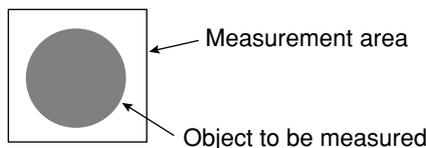
Measurement area

OPS-MENU

- If the menu overlaps the object to be measured, so that further image condition setting is difficult, press the ESC key. Only item ① will be displayed at a time.

9

1. Move the cursor to the "②MEAS AREA" item, and press the SET key.
2. Surround the object to be measured with the measurement area (solid line).
   - Move the cursor to the "MOVE," "UP.L," or "LO. R," label and press the SET key.

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

After the position has been finalized, press the SET key.

Measurement area

Object to be measured

- After specifying the position of each measurement area, press the SET key.

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Continued from the previous page

(7) Setting the binary area conditions (threshold)

```
1 ┌ ③THRESHOLD        U.LM255  L.LM100(0~255)
  └ ④INVERT B/W        NO YES
4 ~                         5
  ┌ OPS-MENU                                    ~
6
```

1. Move the cursor to the "③THRESHOLD" item using the up and down keys, and press the SET key.
2. Move the cursor to the "L.LM" item with the left and right keys, and then press the SET key.
3. Move the cursor to each digit using the left and right keys, and increase or decrease the values using the up and down keys.

   L.LM100(0~255)
   └ This cursor will move to the left and right.

   - To set the threshold parameters, see the section in the Glossary which describes them.
   - After determining the lower limit, press the SET key, and then the ESC key.
4. Move the cursor to the "④INVERT B/W" item using the up and down keys, and press the SET key.
5. Move the cursor to "YES" using the left and right keys, and press the SET key.
   - Since only the number of white pixels can be measured, select "YES" if the object is black.
6. Move the cursor to the "OPS-MENU" item using the up and down keys, and press the SET key.
   ⇨ The screen will return to the MAIN OPS MENU.

Measurement area
Object to be measured

Inversion: NO   Inversion: YES

(8) Setting the evaluation conditions
1. Move the cursor to the "EXIST-EVAL." item using the left and right keys, and press the SET key.
   ⇨ The items ① to ⑧ will be displayed.

9

```
(TYPE00)                          F.IMG  C1  L
                                        VX.XX
MEAS XXXXms 2000-08-01 10:30
MEASUREMENT1 EXISTENCE        3

①REG00 000000~245760  A00=
②REG01 000000~245760  A01=
③REG02 000000~245760  A02=
④REG03 000000~245760  A03=
⑤REG04 000000~245760  A04=
⑥REG05 000000~245760  A05=
⑦REG06 000000~245760  A06=
⑧REG07 000000~245760  A07=

X0~7 □□□□□□□□ Y0~7 □□□□□□□□  READY □      1
CHG-TYPE            EXIST-COND EXIST-EVAL. SEL-CAMERA
OPS-CND SYS-CND ADJ-CONTRAST SAVE SHUTTER
```

2. Move the cursor to "①REG00" and press the SET key.
3. Move the cursor to the upper limit position with the left and right keys, and press the SET key.
   - Select the digit to change with the left and right keys, and then set the value to 002000 with the up and down keys.

   ①REG00   000000~002000

   - After determining the upper limitm value, press the SET key, and then the ESC key.
4. Press the TRG/BRT key.
   ⇨ The measurement (evaluation) results for item ① and the image will be displayed.

                          ┌ Measurement result
                          ┌ Evaluation result
   ①REG00   000000~002000 A00=001619   OK
   ②REG01000000~245760 A01=
   ③REG02000000~245760 A02=

5. Press "ESC," and move the cursor to the "CHG-TYPE" item using the left and right keys, to confirm that "Object type number 00" has been selected.
6. Move the cursor away from the "CHG-TYPE" item using the left and right keys.

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Continued from the previous page

Press the TRG/BRT key, and the result of measuring (evaluating) and image (search) area will be displayed.
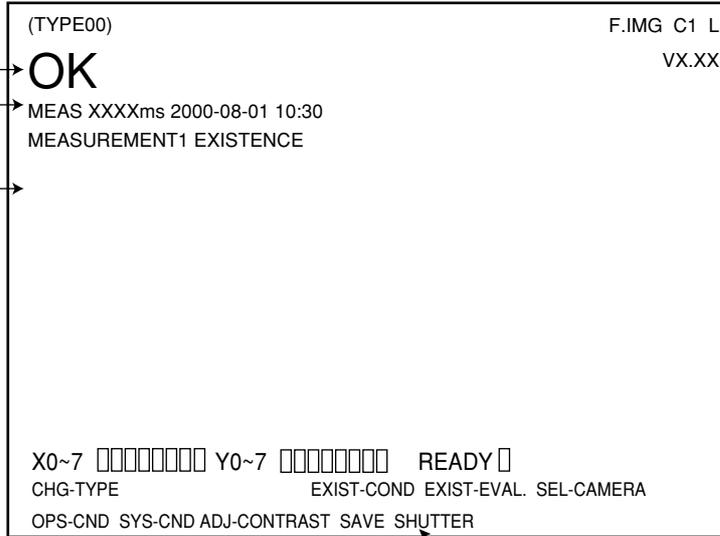
(9) Existence inspection

[Display of the measured result]

Final evaluation result (*1)

Measuring time

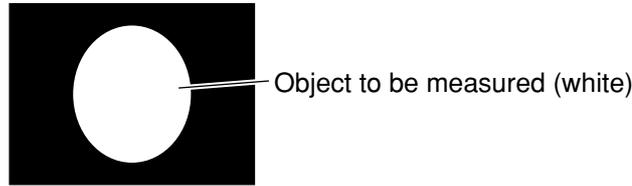Area of registration number 00 (number of pixels) and evaluation result

```
(TYPE00)                                           F.IMG  C1  L

  OK                                                    VX.XX

MEAS XXXXms 2000-08-01 10:30
MEASUREMENT1 EXISTENCE




X0~7  □□□□□□□□ Y0~7  □□□□□□□□   READY □
CHG-TYPE                      EXIST-COND  EXIST-EVAL.  SEL-CAMERA

OPS-CND  SYS-CND  ADJ-CONTRAST  SAVE  SHUTTER
```
                                                              *2

*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 as acceptable. If there is a single unacceptable item, "NG" will be displayed. The only item evaluated in the existence inspection is the area. The result will be OK if it falls within the evaluation conditions that are specified in step (8) (upper and lower limits).

*2 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-S30 controller is turned OFF. ⇨ See page 7-26.

9

9-2 Standard menu

[1] Area measurement by binary conversion

The following sections describe the operation for measuring the area of the object shown below. The area is measured by counting the number of pixels after the image has been subjected to binary processing.

— Object to be measured (white)

(1) Power ON

When power is first turned ON after the machine is deliverd, the [SELECT MENU] screen will appear.
- When the MAIN OPS MENU used by the simplified menus (positioning) is displayed, the operations covered in step (2) is not needed.
- If the MAIN OPS MENU used by the standard menus is displayed, please change to the simplified menus screen. ⇨ See page 6-5.

(2) Select menu

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

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

(3) Operation on the MAIN OPS MENU (all the conditions are initialized)

```
(TYPE00)                                T.IMG  C1  L
                                               VX.X

MEAS  0000ms  XXXX-XX-XX XX:XX
MEASURE  0 CAM1 NO




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

1. Move the cursor to the "MEA-CND" item using the left and right keys, and press the SET key.
⇨ The "TYPE MEAS COND" menu will be displayed.

(4) Registration of an object type number (the object is registered in 00 with the IV-S33M)

```
[TYPE MEAS COND]
①OBJECT  TYPE  NO.    00(0~63) NO  YES
                              *        2
```

```
OPS-MENU SAVE LOCK TITLE FINAL-CALC FINAL-OUTPUT I/O SYSTEM
[OBJECT REG.LIST]
```

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕	✕

* Object type number
IV-S33M: 00 to 63
IV-S32M: 00 to 31
IV-S31M: 00 to 15

◄ Circles will be displayed below object type number that is already registered.

1. Move the cursor to the "①OBJECT TYPE NO." item using the up and down keys, and press the SET key.
2. Move the cursor to "YES" using the left and right keys, and press the SET key.
⇨ Items ② to ⑧ will be displayed.

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Continued from the previous page

(5) Setting the measurement number ("MEASUREMENT 1" is selected for the IV-S33M)

```
[TYPE MEAS COND]
①OBJECT TYPE NO.      00(0~63) NO  YES
②SELECT CAMRA         CAM1&2   CAM1&NG-IMG
③IMG PRE-PROCESS      (TO NEXT SUB-MENU)
④MEASURE 0 CAM1       NO          (MEAS-COND) NO
⑤MEASURE 0 CAM2       NO          (MEAS-COND) NO
⑥MEASUREMENT 1        NO          (MEAS-COND)
⑦MEASUREMENT 2        NO          (MEAS-COND)
⑧MEASUREMENT 3        NO          (MEAS-COND)
⑨MEASUREMENT 4        NO          (MEAS-COND)

OPS-MENU SAVE LOCK TITLE FINAL-CALC FINAL-OUTPUT I/O SYSTEM
[MEASUREMENT 1]
①MEAS SELECTION       NO POSI-DEVIATION CHK-DEG-MATCH
                      INSPECT-LEAD     INSPECT-BGA/CSP
                      MEAS-BIN-AREA CNT-BIN-OBJ LABEL-BIN-OBJ
                      POINT-MEAS  MULTI-POSI  MULTI-MATCHES
②SELECT CAMERA        CAM1  CAM2
③CHNG GRAY LEBEL      NO YES(00.0TIMES γ+ γ- CHNG-L INCRS-M)
④SPACE FILTER         NO               NUM-OF-TIMES 0(0~5)

OPS-MENU RETURN LOCK
```

1. Move the cursor to the "⑤MEASUREMENT 1" item using the up and down keys, and press the SET key.
2. Move the cursor to "NO" using the left and right keys, and press the SET key.
3. Move the cursor to the "①MEAS SELECTION" item in the lower part of the window using the up and down keys. Then press the SET key.

(6) Setting the measurement program

```
[TYPE MEAS COND]



[MEASUREMENT 1]
①MEAS SELECTION       NO POSI-DEVIATION CHK-DEG-MATCH
                      INSPECT-LEAD     INSPECT-BGA/CSP
                      MEAS-BIN-AREA CNT-BIN-OBJ LABEL-BIN-OBJ
                      POINT-MEAS  MULTI-POSI  MULTI-MATCHES
②SELECT CAMERA        CAM1  CAM2
③CHNG GRAY LEBEL      NO YES(00.0TIMES γ+ γ- CHNG-L INCRS-M)
④SPACE FILTER         NO               NUM-OF-TIMES 0(0~5)

OPS-MENU RETURN LOCK
```

1. Move the cursor to the "MEAS-BIN-AREA" item using the left and right keys, and press the SET key.
2. Press the ESC key.

(7) Setting the registration number (00 is selected in this example)

```
[TYPE MEAS COND]


 ⑥MEASUREMENT 1    MEAS-BIN-AREA      C1 (MEAS-COND)
                                         1

[MEAS COND]              3
⑦WINDOW           NUM-OF-MASKS(1 2 4)  BINARY-IMG-MASK
⑧REGISTER NO.     00(0~15) NO  YES
  REGISTER NO.    00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
                  ○ × × × × × × × × × × × × × × ×
⑨BINARY AREA COND × × × × × × × × × × × × × × × ×
  NUMERIC CALC
OPS-MENU RETURN LOCK EVALUATION NUM-CALC OUT-COND

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

1. Move the cursor to "MEAS-COND" using the left and right keys, and press the SET key.
2. Move the cursor to the "②REGISTER NO." item in the lower part of the window using the up and down keys. Then press the SET key.
3. Move the cursor to "YES" using the left and right keys, and press the SET key.
4. Move the cursor to the "③BINARY AREA COND" item using the up and down keys, and press the SET key.
5. Move the cursor to the circle below the registration number 00, and press the SET key.

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Continued from the previous page

(8) Image adjustment

T.IMG C1 L

Press the TRG/BRT key and the brightness of the screen will change between L and H.

Indicates that Camera 1 is selected.

Measurement area

①REGISTER NO.   0(0~15)

1. Press the SEL key.
   ➡ The image taken by camera 1 will be displayed.
     - When the image is so bright that the menu display is difficult to see, press the TRG/BRT key to reduce the brightness of the image. The indicator in the upper right corner of the screen will change from "H" to "L."
2. To display the image of the object measured clearly, adjust the focus and iris opening of the camera lens (page 4-1).
3. Press the SEL key to change the screen to the freeze mode.
   ➡ The indicator in the upper right corner of the screen will change from T.IMG to F.IMG.
     - To set a threshold for a binary area, make sure the machine is displaying the freeze screen.
     (For details about the through and freeze modes, see page 7-4.)
4. Press the ESC key to display all of the binary area conditions.

(9) Setting the binary area condition (measurement area)

```
①REGISTER NO.        00(0~15)
②MEAS SHAPE          RECTANGLE  CIRCLE  ELLIPSE
③MEAS AREA           MOVE  UP.L(224,208)  LO.R(287,271)
④MASK SHAPE          NO RECTANGLE CIRCLE ELLIPSE

⑤AUTO REGIST         EXEC(L LIMIT ONRY U&L LIMITS)
⑥THRESHOLD           U.LM255  L.LM100(0~255)
⑦INVERT B/W          NO YES
⑧BINARY PROCESS      FIXED THRESHOLD-ADJ(VAR-DIFF  VAR-RATE)
⑨BINARY NOISE FILT   NO EXPD.→CONTR.   CONTR.→EXPD
⑩NUM.OF FILT PASS    EXPD.0 CONTR.0(0~5)
OPS-MENU  RETURN  LOCK  EVALUATION
```

- If the menu overlaps the object to be measured, so that further image condition setting is difficult, press the ESC key. Only one item will be displayed at a time.
- The image shown in the measurement area has already been through binary conversion.

1. Move the cursor to the "③MEAS AREA" item, and press the SET key.
2. Surround the object to be measured with the measurement area (RECTANGLE: solid line).
 - Move the cursor to the "MOVE," "UP.L," or "LO. R," label and press the SET key.
   After the position has been finalized, press the SET key.

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

Measurement area

Object to be measured (white)
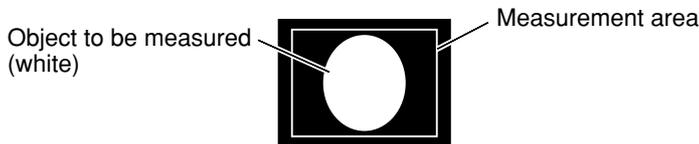
- After determining each position in the measurement area, press the SET key.

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Continued from the previous page

(10) Setting the binary area conditions (threshold)

⑥THRESHOLD   U.LM255 L.LM100(0~255)
                           2

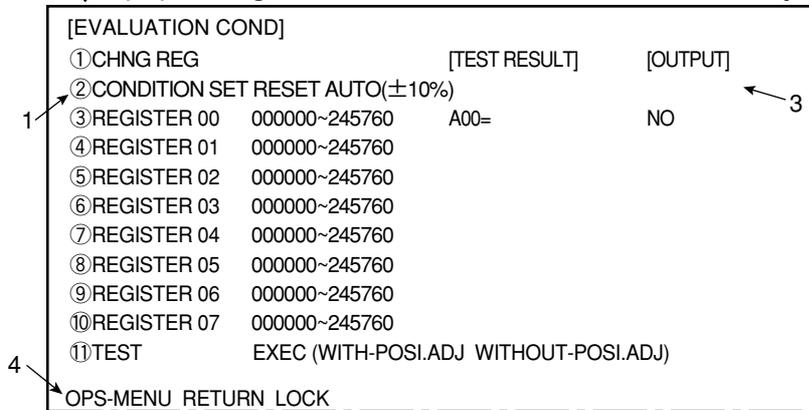OPS-MENU RETURN LOCK EVALUATION
                       4
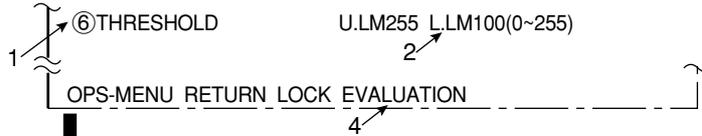
1. Move the cursor to the "⑥THRESHOLD" item using the up and down keys, and press the SET key.
2. Move the cursor to the "L.LM" item and then press the SET key.
3. Move the cursor to each digit using the left and right keys, and increase or decrease the values using the up and down keys.

        L.LM100(0~255)

                This cursor will move to the left and right.

   - To set the threshold parameters, see the section in the Glossary which describes them.
   - After determining the lower limit, press the SET key, and then the ESC key.
4. Move the cursor to the bottom line using the up and down keys, and select the "EVALUATION" item using the left and right keys. Then press the SET key.
   ⇨ The [EVALUATION COND] menu will be displayed.

(11) Setting the evaluation conditions and result output

[EVALUATION COND]
①CHNG REG   [TEST RESULT]   [OUTPUT]
②CONDITION SET RESET AUTO(±10%)   3
③REGISTER 00   000000~245760   A00=   NO
④REGISTER 01   000000~245760
⑤REGISTER 02   000000~245760
⑥REGISTER 03   000000~245760
⑦REGISTER 04   000000~245760
⑧REGISTER 05   000000~245760
⑨REGISTER 06   000000~245760
⑩REGISTER 07   000000~245760
⑪TEST   EXEC (WITH-POSI.ADJ WITHOUT-POSI.ADJ)

OPS-MENU RETURN LOCK

1. Move the cursor to "②REGISTER 00" and press the SET key.
2. Move the cursor to the upper limit position with the left and right keys, and press the SET key.
   - Select the digit to change with the left and right keys, and then set the value to 002000 with the up and down keys.

        ②REGISTER 00   000000~002000

   - After specifying the upper limit value, press the SET key, and then the ESC key.
3. Move the cursor to "OUTPUT" using the left and right keys.
   - Select "Y0" using the up and down keys, and press the SET keys.

        [OUTPUT]
          Y0

4. Move the cursor to the "OPS-MENU" item using the up and down keys.
   ⇨ The screen will return to the MAIN OPS MENU.

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Continued from the previous page

Press the TRG/BRT key, and the size of the area measured will be displayed as the number of pixels contained within the area.

(12) Area measurement

[Display of the measured result]

Final evaluation result (*1) ──────

Measuring time ──────

Area of registration number 00 ────── (number of pixels) and evaluation result

```
(TYPE00)                                         F.IMG  C1  L
                                                         VX.X
→OK
→MEAS  XXXXms XXXX-XX-XX XX:XX
 MEASUREMENT 1  MEAS-BIN-AREA
→A00=001884     OK
 A01=
 A02=
 A03=
 A04=
 A05=
 A06=
 A07=
                              *2

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

*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. The only item used for the evaluation in the area measurement by binary conversion is the area. The result will be OK if it falls within the evaluation conditions that are specified in step (11) (upper and lower limits).

*2 When the evaluation result is OK, Y0 will be turned ON because we set it that way in step (11), and a filled box ■ will be displayed. (If the result is NG, an empty box □ will be displayed.)

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-S30 controller is turned OFF.
- You can save data at any time using the "SAVE" item on the [TYPE MEAS COND], [TYPE RUN COND], or [SYSTEM COND] menu.

[TYPE MEAS COND] menu

```
[TYPE MEAS COND]
①OBJECT TYPE NO.      00(0~63) NO  YES
②SELECT CAMERA        CAM1&2   CAM1&NG-IMG

                           1
OPS-MENU SAVE LOCK TITLE FINAL-CALC FINAL-OUTPUT I/O SYSTEM
```

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-S30 will start saving the data and the progress will be displayed on the bottom of the screen.

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

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

[2] Positional deviation measurement

The following sections cover an example of how to measure the positional deviation of the positioning mark shown below.

Positioning mark

(1) Power ON

When power is first turned ON after the machine is deliverd, the [SELECT MENU] screen will appear.
- When the MAIN OPS MENU used by the simplified menus (positioning) is displayed, the operations covered in step (2) is not needed.
- If the MAIN OPS MENU used by the standard menus is displayed, please change to the simplified menus screen. ⇨ See page 6-5.

(2) Select menu

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

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

(3) Operation on the MAIN OPS MENU (all the conditions are initialized)

```
(TYPE00)                                    T.IMG  C1  L
                                                  VX.X

MEAS  0000ms  XXXX-XX-XX XX:XX
MEASURE 0 CAM1 NO



X0~7 □□□□□□□□ Y0~7 □□□□□□□□    READY□
CHG-MEA  CHG-REG  CHG-RST  CHG-C1  CHG-C2  CHG-EVAL  CUSTOM-MNU
OPS-CND  MEA-CND  SYS-CND  CHG-TYPE  NG-IMG-DSP  NEXT-NG  MANL-MEAS
```
1

1. Move the cursor to the "MEA-CND" item using the left and right keys, and press the SET key.
  ⇨ The [TYPE MEAS COND] menu will be displayed.

(4) Registration of an object type number (the object is registered in 00 with the IV-S33M)

```
[TYPE MEAS COND]
 ①OBJECT  TYPE  NO.    00(0~63) NO   YES

                                *       2


OPS-MENU SAVE LOCK TITLE FINAL-CALC FINAL-OUTPUT I/O SYSTEM
[OBJECT REG.LIST]
```
1

```
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
 ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×

32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
 ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×
48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
 ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×
```

* Object type number
  IV-S33M: 00 to 63
  IV-S32M: 00 to 31
  IV-S31M: 00 to 15

← Circles will be displayed below object type numbers that are already registered.

1. Move the cursor to the "①OBJECT TYPE NO." item using the up and down keys, and press the SET key.
2. Move the cursor to "YES" using the left and right keys, and press the SET key.
  ⇨ Items ② to ⑧ will be displayed.

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Continued from the previous page

(5) Setting the measurement number ("MEASUREMENT 1" is selected with the IV-S33M)

```
[TYPE MEAS COND]
①OBJECT TYPE          NO.00(0~63) NO  YES
②SELECT CAMERA        CAM1&2    CAM1&NG-IMG
③IMG PRE-PROCESS      (TO NEXT SUB-MENU)
④MEASURE 0 CAM1       NO          (MEAS-COND)  NO
⑤MEASURE 0 CAM2       NO          (MEAS-COND)  NO
⑥MEASUREMENT 1        NO          (MEAS-COND)
⑦MEASUREMENT 2        NO          (MEAS-COND)
⑧MEASUREMENT 3        NO          (MEAS-COND)
⑨MEASUREMENT 4        NO          (MEAS-COND)


OPS-MENU SAVE LOCK TITLE FINAL-CALC FINAL-OUTPUT I/O SYSTEM
[MEASUREMENT 1]
①MEAS SELECTION       NO  POSI-DEVIATION  CHK-DEG-MATCH
                      INSPECT-LEAD      INS  PECT-BGA/CSP
                      MEAS-BIN-AREA  CNT-BIN-OBJ  LABEL-BIN-OBJ
                      POINT-MEAS  MULTI-POSI  MULTI-MATCHES
②SELECT CAMERA        CAM1  CAM2
③CHNG GRAY LEBEL      NO  YES(00.0TIMES  γ+  γ-  CHNG-L INCRS-M)
④SPACE FILTER         NO                NUM-OF-TIMES 0(0~5)


OPS-MENU  RETURN  LOCK
```

1. Move the cursor to the "⑤MEASUREMENT 1" item using the up and down keys, and press the SET key.
2. Move the cursor to "NO" using the left and right keys, and press the SET key.
3. Move the cursor to the "①MEAS SE-LECTION" item on the lower window using the up and down keys. Then press the SET key.

(6) Setting the registration number and the mode (REGISTER NO. 0 and 1P-SCH are selected in this example)

```
[TYPE MEAS COND]


⑥MEASUREMENT 1    MEAS-BIN-AREA      C1 (MEAS-COND)



[MEAS COND]
①DTECT PRECISION  STANDARD   HIGH
②REGISTER NO.  0(0~7)  NO  1P-SCH  2P-SCH
               1P-EDGE  2P-EDGE  1P-SCH+1P-EDGE
③DTECT ANGL    NO  YES(±15°  ±30°  ±45° 360° )
   REGISTER NO. | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 |
④MDL 0          | S | × | × | × | × | × | × | × |   |   |   |   |   |   |   |   |
⑤MDL 1          | × | × | × | × | × | × | × | × |   |   |   |   |   |   |   |   |
   NUMERIC CALC | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × | × |


OPS-MENU  RETURN  LOCK  EVALUATION  DST&ANGL  NUM-CALC  OUT-COND
```

1. Move the cursor to "MEAS-COND" using the left and right keys, and press the SET key.
2. Move the cursor to the "②REGISTER NO." item on the lower window using the up and down keys. Then press the SET key.
3. Move the cursor to "1P-SCH" using the left and right keys, and press the SET key.
4. Move the cursor to the "④MDL 0" item using the up and down keys, and press the SET key.
5. Move the cursor to the "S" below the registration number 00, and press the SET key.

(7) Image adjustment

```
                                      T.IMG  C1  L



         ┌ ─ ─ ─ ─ ─ ┐
         |  ┌─────┐  |  ← Reference area
         |  |  +  |  |
         |  └─────┘  |
         └ ─ ─ ─ ─ ─ ┘  ← Search area


①REGISTER NO.    0(0~7)
```

Press the TRG/BRT key and the brightness of the screen will change between L and H.

Indicates that Camera 1 is selected.

1. Press the SEL key.
   ⇨ The image taken by camera 1 will be displayed.
      - When the image is so bright that the menu display is difficult to see, press the TRG/BRT key to reduce the brightness of the image. The indicator in the upper right corner of the screen will change from "H" to "L."
2. To display the image of the object measured clearly, adjust the focus and iris opening of the camera lens (page 4-1).
3. Press the SEL key to change the screen to the freeze mode.
   ⇨ The indicator in the upper right corner of the screen will change from T.IMG to F.IMG.
      - To set a threshold for a binary area, make sure the machine is displaying the freeze screen.
      (For details about the through and freeze modes, see page 7-4.)
4. Press the ESC key to display all of the gray scale search conditions.

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Continued from the previous page

(6) Setting the gray scale search conditions

```
①REGISTER NO.        0(0~7)
②MEAS SHAPE(MDL0)    RECTANGLE  X-LINE  Y-LINE
③REF IMG(MDL0)       NEW  EXIST000(000~000)
④REF IMG ARE(MDL0)   MOVE  UP.L(216,200)  LO.R(295,279)  CONTRAST SR
                     REG  DISP
⑤SEARCH ARE(MDL0)    MOVE  UP.L(216,200)  LO.R(295,279)
⑥DTECT CRD(MDL0)     CENTER  FREE(255,239)
⑦CONTR.PIXL(MDL0)    1  2  3

OPS-MENU  RETURN  LOCK  EVALUATION
```

- If the menu overlaps the object to be measured, so that further image condition setting is difficult, press the ESC key. Only one item will be displayed at a time.

1. Move the cursor to the "④REF. IMG ARE (MDL 0)" item, and press the SET key.
2. Surround the object to be measured with the reference image area (solid line).
   - Move the cursor to the "MOVE," "UP.L" or "LO. R," label and press the SET key.

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

After the position has been finalized, press the SET key.

Reference image area

Positioning mark

- After the reference image area position has been set, move the cursor to the "REG." item using the left and right keys, and press the SET key.
- The stored image will be displayed in the lower right corner of the screen. After storing the image, press the ESC key.
3. Press the ESC key and move the cursor to the "⑤SEARCH ARE (MDL 0)" item. Then, press the SET key.
4. Create a search area (dotted line).
   - The search area described above is the range for detecting the image registered in step 2, using the gray scale search function (see the Glossary).
   - The procedure for creating the search area is the same as described for the reference image area in step 2.
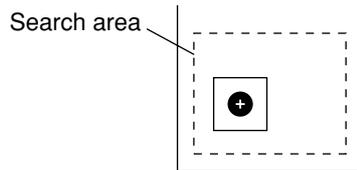
Search area

- After determining the search area position, press the ESC key.
5. Move the cursor to the bottom line using the up and down keys, and select the "EVALUATION" item using the left and right keys. Then press the SET key.
   ⇨ The [EVALUATION COND] menu will be displayed.

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(9) Setting the position evaluation conditions

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

OPS-MENU  RETURN  LOCK
```

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

```
⑦MATCH LVL(MDL0)         +09000~+10000
```

   - After specifying the lower limit value, press the SET key, and then the ESC key.
4. Move the cursor to the bottom line using the up and down keys, and select the "RETURN" item using the left and right keys. Then press the SET key.
   ⇨ The screen will return to the gray scale search menu.
5. Move the cursor to the bottom line using the up and down keys, and select the "RETURN" item using the left and right keys. Then press the SET key.
   ⇨The screen will return to the [TYPE MEAS COND] menu.

```
[TYPE MEAS COND]
①OBJECT TYPE NO.      00(0~63) NO  YES
②SELECT CAMERA        CAM1&2   CAM1&NG-IMG
③IMG PRE-PROCESS      (TO NEXT SUB-MENU)

OPS-MENU SAVE LOCK TITLE FINAL-CALC FINAL-OUTPUT I/O SYSTEM
                                        7
```

6. Press the ESC key three times.
7. Move the cursor to the "FINAL-OUTPUT" item using the up/down and left/right keys. Then press the SET key.
   ⇨ The [FINAL OUTPUT COND] menu will be displayed.

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(10) Setting the final evaluation output condition
1. Move the cursor to "①PAGE.NO." (register number) and press the SET key. Move the cursor to YES and press the SET key.
   ⇨ The items ② to ⑤ will be displayed.

```
[FINAL OUTPUT COND]
①PAGE  NO.          0(0~7) NO YES
②SET  POSITION      MOVE              3
③INPUT SIGNAL       AUX-RLY C112(0~127) EXT-INP X0(0~7)
                    TMR TM0(0~7)              CNTR CN0(0~7)
                    AN00(0~15)               OUT Y00(0~15)
④LOGIC  SYMBOL      ⊣├  ⊣╱├  ──     ∟ ⌐  DEL
⑤OUTPUT SIGNAL →   OUT Y00(0~15)        AUX-RLY C000(0~127)
                    TMR TM0(0~7)         SET-VL000(000~999)
                    CNTR CN0(0~7)        SET-VL000(000~999)
                    DEL

OPS-MENU RETURN LOCK
[PAGE0]       0   1   2   3   4   5   6   7   OUT
INPUT0
 LOGIC
INPUT1            ──            2
 LOGIC
INPUT2
 LOGIC
INPUT3
 LOGIC
```

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

```
[PAGE0]       0   1   2   3   4   5   6   7  OUTPUT
INPUT0    C112
 LOGIC    ⊣├  ──  ──  ──  ──  ──  ──  ──
```

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

```
[PAGE0]       0   1   2   3   4   5   6   7  OUTPUT
INPUT0    C112                                 Y00
 LOGIC    ⊣├  ──  ──  ──  ──  ──  ──  ──  ◇
```

5. Move the cursor to the "RETURN" item using the up/down and left/right keys. Then press the SET key.
   ⇨ The screen will return to the [TYPE MEAS COND] menu.

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(11) 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-S30 controller is turned OFF.

- You can save data at any time using the "SAVE" item on the [TYPE MEAS COND], [TYPE RUN COND], or [SYSTEM COND] menu.

  (In this example, data is saved while in the [TYPE MEAS COND] menu.)

```
[TYPE MEAS COND]
①OBJECT TYPE NO.      00(0~63) NO  YES
②SELECT CAMERA        CAM1&2   CAM1&NG-IMG
```

~1

OPS-MENU SAVE LOCK TITLE FINAL-CALC FINAL-OUTPUT I/O SYSTEM

3~
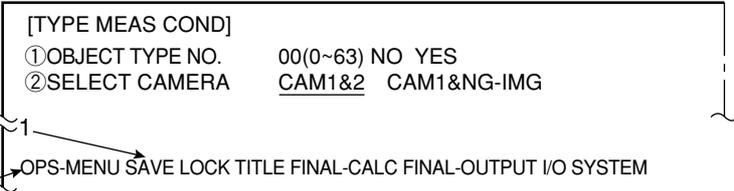
1. Move the cursor to the "SAVE" item using the left and right keys, and press the SET key.
   ⇨ The following message will be displayed on the screen.

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

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

```
                          SAVING
        REFERENCE IMG     ■■
        SYSTEM I/O        ■
        OBJECT TYPE COND  ■■■■■■■■■■□□□□□
```
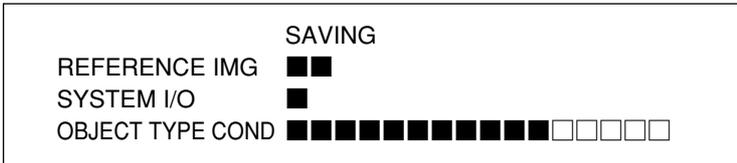
When the data has been saved in the IV-S30 flash memory, the display will change from "SAVING" to "COMPLETE SAVE."

3. Move the cursor to the "OPS-MENU" item using the left and right keys, and press the SET key.
   ⇨ The screen will return to the MAIN OPS MENU.

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Continued from the previous page

Press the TRG/BRT key, and the result of the positional deviation measurement of the registered positioning mark will be displayed.

(12) Positional deviation measurement

[Display of the measured result]

Final evaluation result (*1)

Measuring time

Registration number

Detection coordinates of the reference image

Amount of deviation from the reference image

Degree of match of the reference image (*2)

```
(TYPE00)                                    F.IMG  C1  L
                                                   VX.X
OK
MEAS  XXXXms 1999-08-01 10:30
MEASURE 0  CAM1  POSI-DEVIATION
REGISTER  NO(0~7)
X0=379.0        OK
Y0=214.0        OK
x0=+001.0       OK
y0=+000.0       OK
M0=+09735       OK
B0=




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

*3

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

- For details about saving data, see page 9-14.

9

Glossary

[A]

■ Area filter

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

■ Arrangement of the square pixels

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

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

Rectangular grid   Square grid

CCD pick-up elements   One pixel

The aspect ratio is 1: 1.
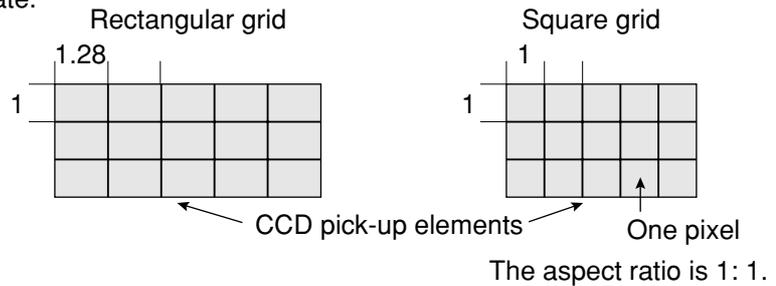
■ Artifact processing

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

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

Duration of dark area
in the line scan

Average light level (vertical)

Edge detection point
(with artifact processing: enabled)
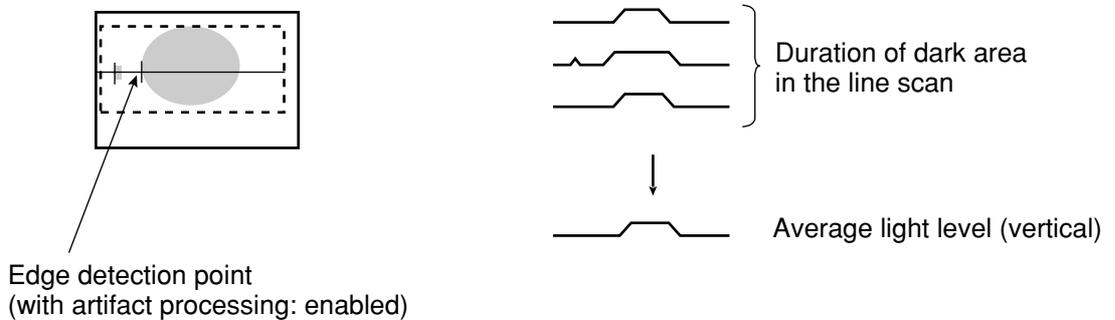
When artifact processing is disabled in the above example, the edge detection point changes.

Edge detection point (with artifact processing: disabled)
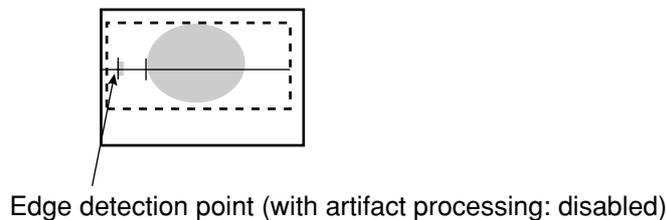
[B]

■ 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-S30 can cope with variations in lighting.

Threshold correction value

Variation in lighting

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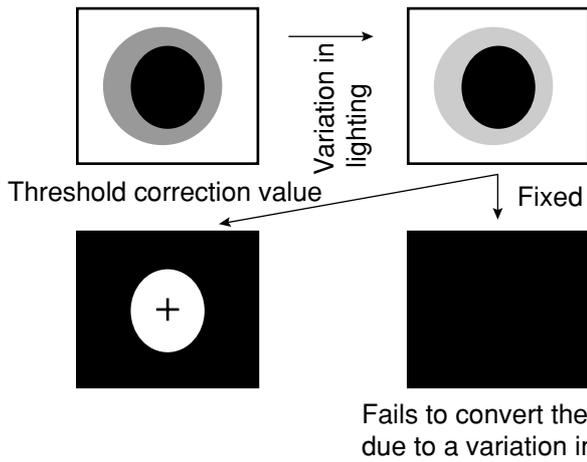
Note: In order to use the THRESHOLD (threshold adjustment function), the monitor brightness functions must be selected to measure variations in lighting. If you don't select the monitor brightness function, a BINARY CORR.: LIGHT LVL NOT SET (correcting binary value: monitor illumination not selected)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

Fails to convert the image due to a variation in lighting

■ **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.

object type 1   object type 2

⇐Feed direction   ⇐Feed direction

■ **Center of gravity**

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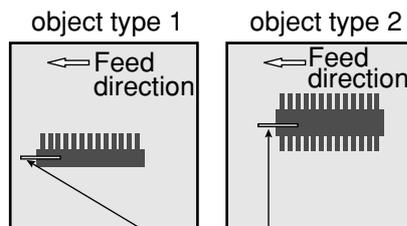
The "center of gravity" is the geographical center of the image. It is determined by treating the binary image to be measured as an object that has mass.

■ **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-S30 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-S30.

■ **Contraction**

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

[E]

■ **Edge emphasis**
⇨ See "Space filter."

■ **Edge extraction**
⇨ See "Space filter."

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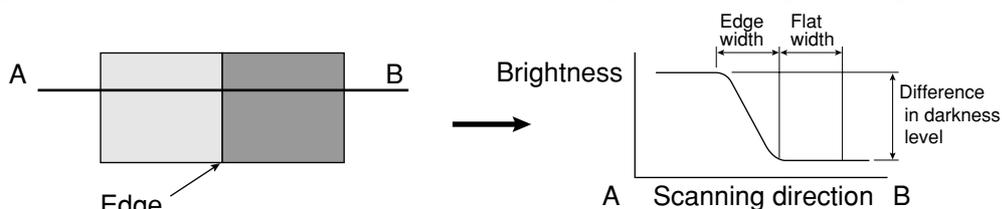
[An example of detecting a point using the edge detection function and user specified criteria]

- Horizontal transition point from light to dark (moving from left to right)
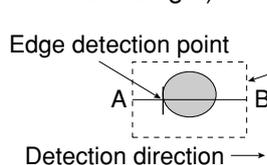
- Vertical transition point from light to dark (moving from top to bottom)
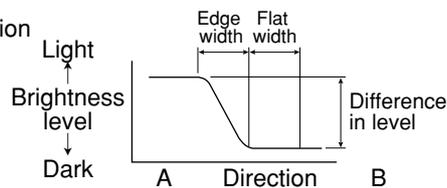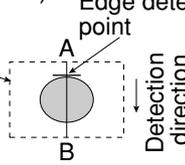
- Horizontal transition point from light to dark (moving from right to left)
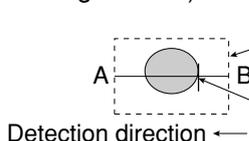
- Vertical transition point from light to dark (moving from bottom to top)
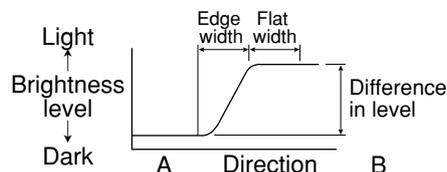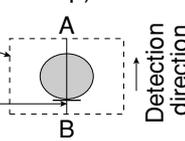
- Center (dark), horizontal (left and right)
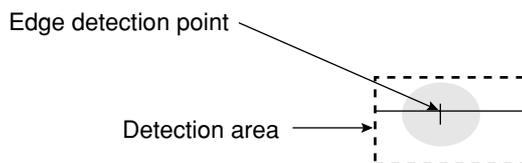
- Edge detection of the inside and outside edges of a two circles

B: Moving right horizontally from dark to light

A: Moving right horizontally from light to dark

C: Moving left horizontally from dark to light

D: Moving left horizontally from light to dark

Internal diameter (between B and C)
External diameter (between A and D)
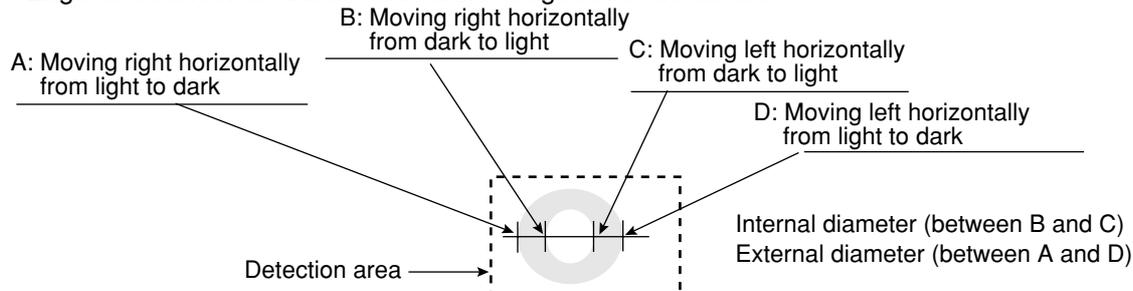
■ **Expansion**
⇨ See "Expansion and contraction to elimiate binary noise in the image."

G-3

■ **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.
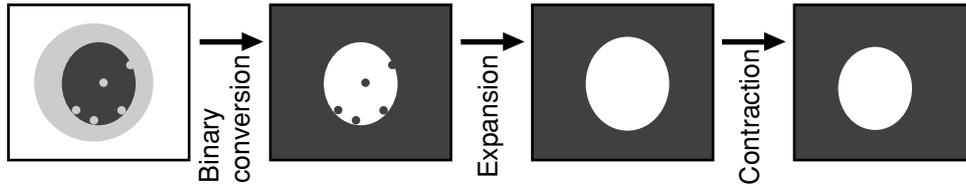
②Contraction ➡ expansion

   Delete isolated white points by contraction and then restore the original image size by expansion.
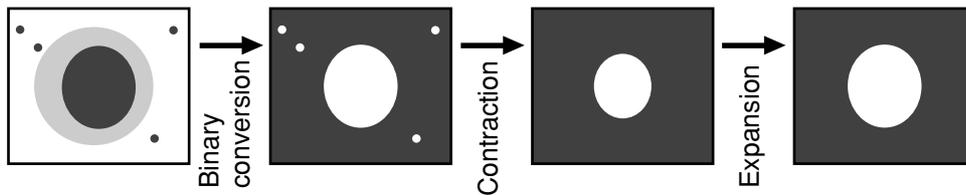
[F]

■ **Fillet width (shading width)**

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

G
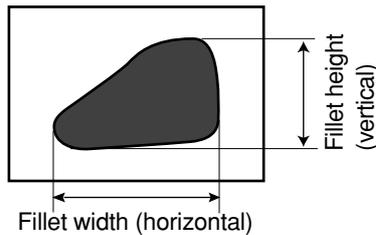
■ **Flat width**

   ⇨ See "Edge detection."

■ 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.

Conventional NTSC system | Full pixel reading system

Odd line
Even line

CCD

Odd line | Even line | Full lines

Image signal
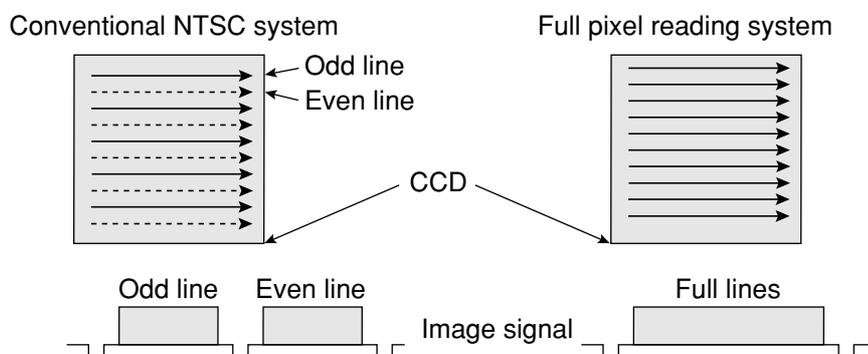
[G]

■ Gray scale check using the normalization correlation method

Even when the IV-S30 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-S30 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)   **(Application)**

Maximum matching level value – – – – – – – – – – → Shape inspection

The center coordinates where the highest – – – – – – ► Positional deviation measurement
level of matching is obtained

Reference image

Search range in the image

Detected image
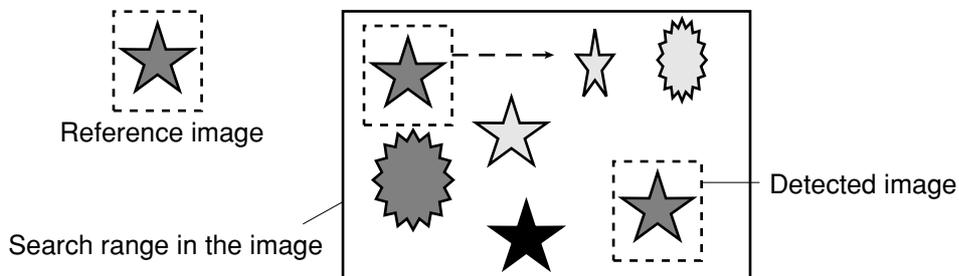
[H]

G

■ Halogen lamp

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

■ High frequency lighting

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

① Low contrast image   ② Good contrast image
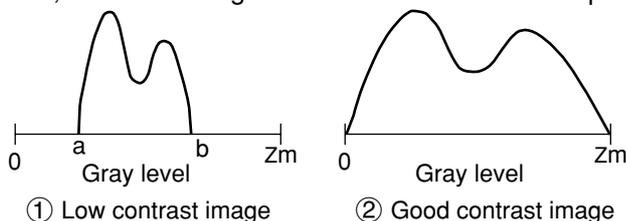
[I]

■ 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.
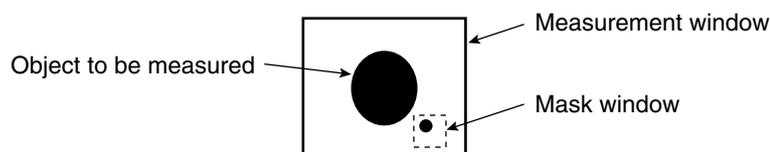
■ Mid gray level emphasis

Emphasize the mid gray level. This improves contrast while remaining the background image.
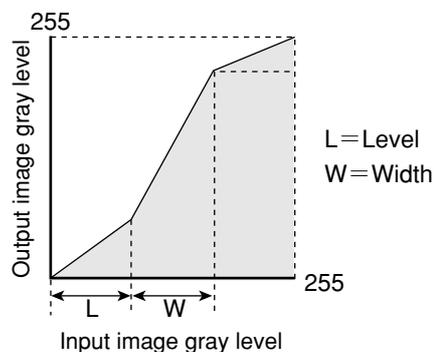
L＝Level
W＝Width

[N]

■ **Normalization correlation**

To determine whether the levels between the reference image and the input image match, the IV-S30 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 = $\{ A \div \sqrt{B \times C} \} \times 10000$

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

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

$C = N\Sigma (T \times T) - (\Sigma T) \times (\Sigma T)$: 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.
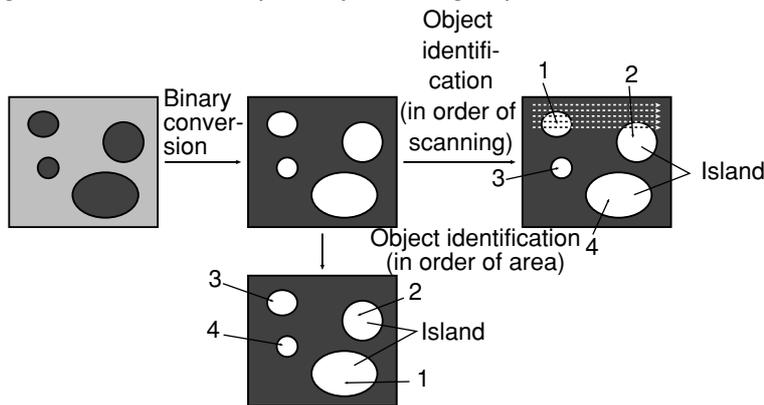
G

[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-S30 can automatically determine the width of the partial image window. You can change back and forth between reading the whole image and a partial image.
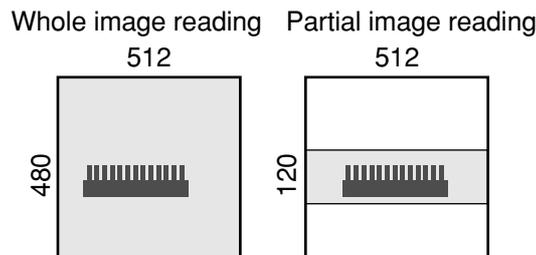
■ **Pixel**

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

■ **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-S30 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-S30 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

Search speed
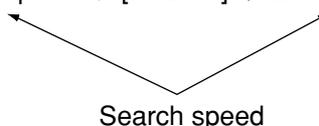
■ **Setting window boundaries (enable/disable)**
This function enables and disables the labeling (object identification) of binary images located that cross over the window frame boundary.

G

Window　Labeling (Enable window boundaries)

Binary conversion

Labeling (Disable window boundary)

Images 1 and 3 cross over the window frame edges and are measured together with the areas outside the window frame edges.

Condition: Labeling (in order they are scanned)
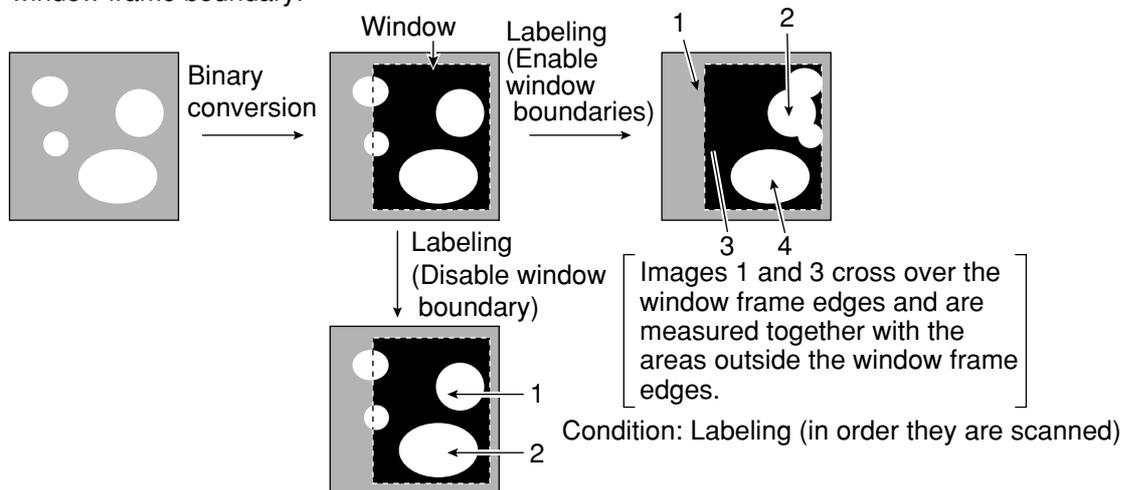
■ Shading correction

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.

New image   Uneve areas of brightness   Corrected image
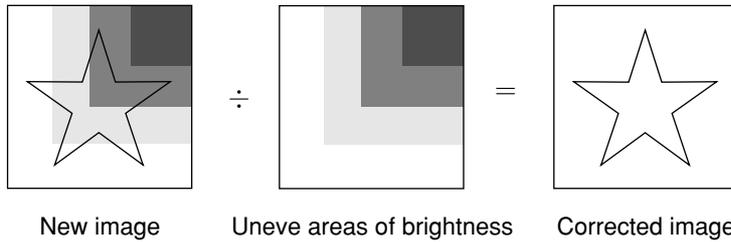
■ Smoothing

⇨ 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-S30, 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. - Since noise elements are difficult to select, they will not affect the output.	- Display smooth images with decreased noise. - Used to eliminated surface flaws and unevenness in the reflected light caused by protrusions or dents. - This type of smoothing (averaging) is faster than the median smoothing.
Smoothing (average)	- Specify the average pixel gray level from the surrounding 3 x 3 area. - Since noise elements are included in the average, the noise will affect the output.	
Edge emphasis	- Display images with sharp boundaries between brighter and darker areas. - Used to stabilize and create a binary outline around unclear objects.	
Edge extraction	- Display images after extracting and clarifying the boundaries between the brighter and darker areas.	- Used to measure objects with low contrast.
Horizontal edge	- Horizontal edge extraction: Display only the horizontal boundaries of an object.	
Vertical edge	- Vertical edge extraction: Display only the vertical boundaries of an object.	

G

■ **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-S30). "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-S30).

(High precision)
Search coordinates use a
sub pixel level of precision

Reference image

(Standard)
Search coordinates use
a pixel level of precision

Degree of match

Degree of match
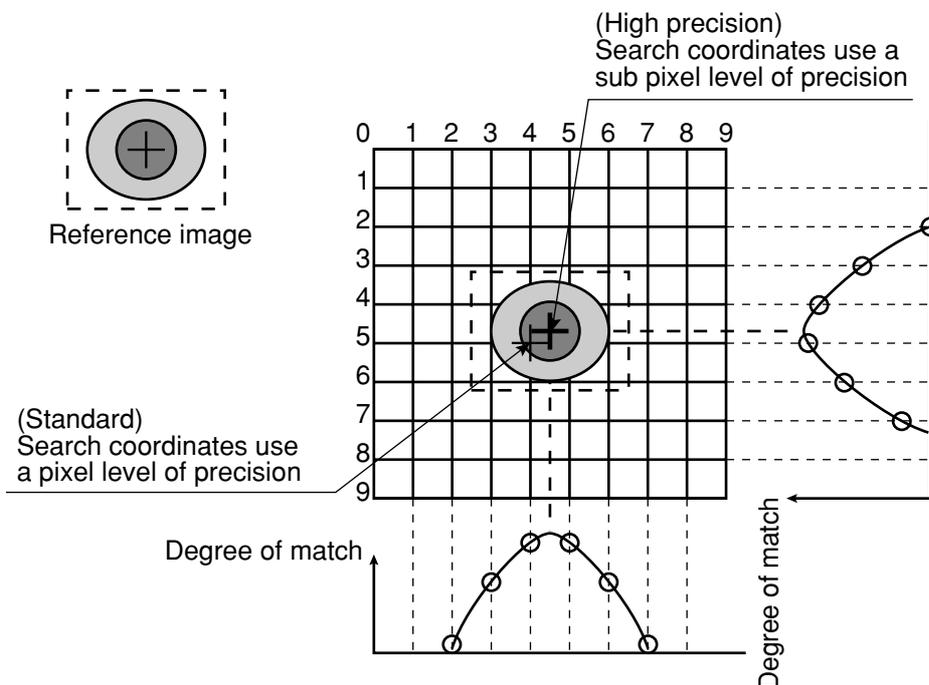
[T]

■ **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-S30 treats the "areas darker than the lower limit value" or "brighter than the upper limit value" as "black." It treats that the areas between the upper limit value and lower limit value as "white." However, if the white-black reverse function is enabled, conversion to white/black will be reversed. Normally, if you want to use only one threshold value for binary conversion, set the upper limit value to "255." Then you only need to adjust the lower limit value to a threshold value that works for our application.

Threshold value B

Binary conversion
(Upper limit = 255, lower limit = A)

Threshold value A

(Captured image)

Binary conversion
(Upper limit = 255, lower limit = A)

Binary conversion
(upper limit = A,
lower limit = B)

(Threshold value)
255
Lower
limit A   White

B   Black

0

(Threshold value)
255
Upper
limit A   Black

            White

Lower
limit B   Black

0

(Threshold value)
255
A

            White

Lower
limit B

            Black

0

G
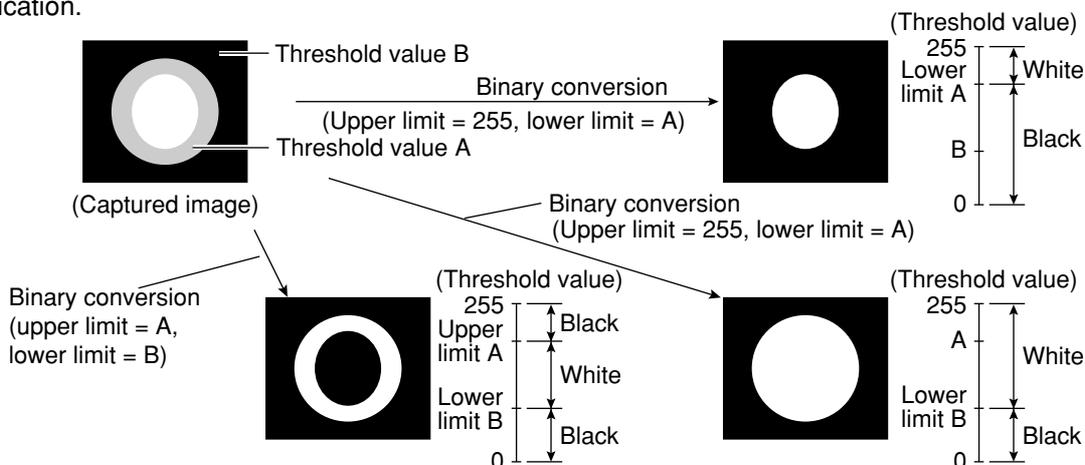
(Example for adjustment)

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.

White Black

255

The size of the white area changes depending on the threshold value setting.

As the value increases, the black part grows larger.

Stable range *

White

As the value decreases, the white part grows larger.

Lower limit threshold

0

Horizontal coordinate of the dotted line

Inspection image

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-S30 captures images using CCDs, which are the light sensitive elements in the camera. The IV-S30 may capture more than one target image to be measured for image processing, and it may capture images not required for measurement. In these cases, a window is used to pick out just the desired target for measurement. The area inside the window will contain the object to be measured and the areas outside the window will be ignored.

G

Window

Object to be measured

Objects outside the designated measurement area
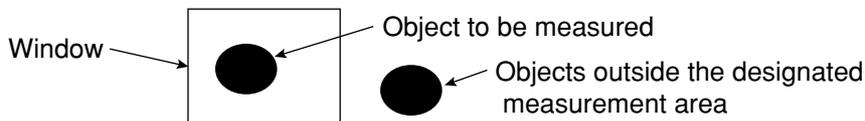
[γ]

■ γ **positive correction**

Used when the mid gray level is too low.

255

Output image gray level

255

Input image gray level
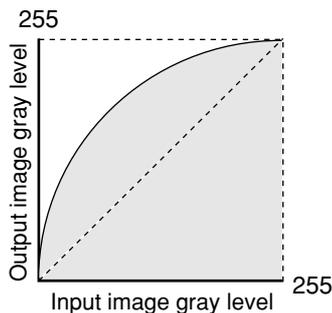
■ γ **negative correction**

Used when the mid gray level is too high.

255

Output image gray level

255

Input image gray level
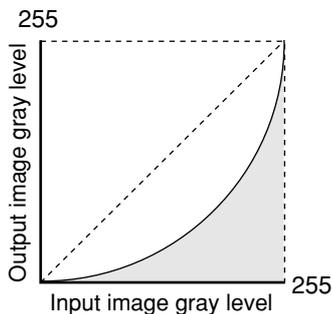
Appendix

Appendix 1: Commercially available peripheral devices

Described below for your reference are peripheral devices needed to build a system around the IV-S30. (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, Toranomon, 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

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■ Table of standard items related to the IV-S30 handled by SHARP

SHARP's article Nbr.	Moritex's article Nr.	Item name	Specifications
IV-1A0101	ML-0614	CCTV lens	C mount f = 6 mm
IV-1A0102	ML-0813	CCTV lens	C mount f = 8 mm
IV-1A0103	ML-1214	CCTV lens	C mount f = 12 mm
IV-1A0104	ML-2514	CCTV lens	C mount f = 25 mm
IV-1A0105	ML-3514	CCTV lens	C mount f = 35 mm
IV-1A0106	ML-5018	CCTV lens	C mount f = 50 mm
IV-1A0107	ML-7527	CCTV lens	C mount f = 75 mm
IV-1A0201	ML-EXR	Close up ring	A set of 7 intermediate rings
IV-1A0301	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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