SHARP

Ver. 2.0

Image Sensor Camera
IV-S300 Series

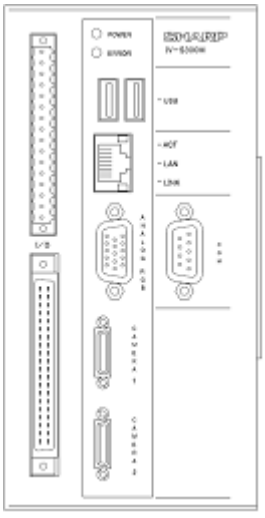
Software version: V3.1

Model

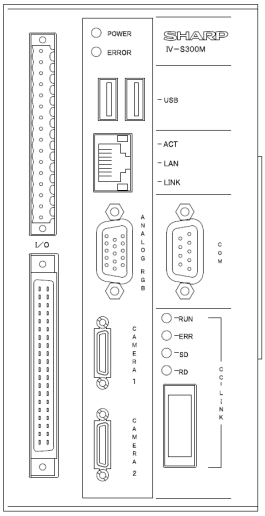
Controller **IV-S300J**
IV-S300M
IV-S310M

User's Manual

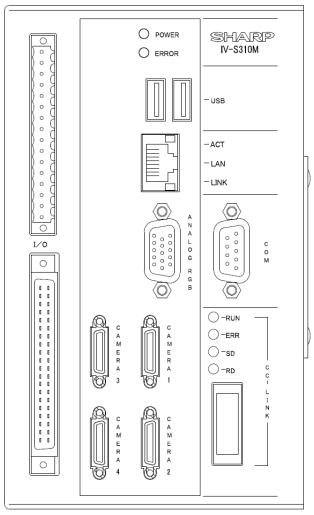
IV-S300J



IV-S300M



IV-S310M



Thank you for choosing Sharp's Control Device.

Please read this manual thoroughly before the use of the device for your safety and proper use of the device, especially Safety Precautions, and keep this manual near the device so that you can refer to it whenever required.

About this book

This book describes the IV-S300J, IV-S300M and IV-310M (Device) installed with program version V3.1.

- Ethernet is a registered trademark of XEROX Inc., in the United States.
- All other corporation names, product names, or commodity names are either trademarks or registered trademarks of their respective corporation.

Precautions

- Information in this manual is subject to change without notice and does not represent a commitment on the part of Sharp Corporation ("SHARP") and its sales distributors.
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- SHARP strongly recommends you to store important data on a separate memory device.
  Data may be lost or altered in virtually any electronic memory device under certain circumstances like by electrostatic discharge and electromagnetic field. Therefore, SHARP assumes no responsibility for data lost or otherwise rendered unusable whether as a result of improper use, repairs, defects or any other causes.

- SHARP assumes no responsibility for direct, special, incidental or consequential damages resulting from the use of this Device including the pre-installed software and any of its functions, including but not limited to loss of revenue, loss of actual or anticipated profits, loss of business, loss of reputation, loss of damage to or corruption of data, financial losses or claims from third persons, except the liability waived in accordance with the applicable law.

- When you plan to incorporate our device ("Device") into your system, you are requested to make the design of the system such that even if a problem or malfunction occurs within the Device, it will not lead to a serious accident in your system. You should incorporate back-up measures and fail-safe features in your system that will thoroughly protect your system in case a problem or error occurs in the Device.

- The Device is designed and manufactured for general applications in ordinary industries use. Therefore, it must not be used in specific applications that may affect public, such as nuclear power plants and other power generating plants. Such applications require a special warranty of quality that SHARP explicitly does NOT offer for our Device.
  However, if a user will certify that a special quality warranty for the Device is not required, and will limit the use of the Device to non critical areas of these types of applications, SHARP will agree to such use.
  If you are planning to use the Device for applications that may affect the lives of human beings and property, and you need highly reliable performance in particular, such as in the fields of aviation, medical care, transportation, combustion or fuel processing equipment, passenger cars, amusement park rides, or safety equipment, please contact our dealer so that we can agree on the specifications and use of the Device in your application.

CAUTION

Before connecting or disconnecting external equipment to the Device:

- Make sure to shut off the power to the Device before connecting or disconnecting any external equipment (except USB related equipment).
  Connecting or disconnecting the equipment while power is supplied to the Device may cause a malfunction on the Device or the external equipment.
  Be especially careful when connecting or disconnecting the camera cable.

Software License

IV-S300J, IV-S300M and IV-310M use GPL/LGPL software and you have the right to obtain, modify or distribute it.
Please contact our dealer to know the details of the right and get the source code.
Please, however, note that we cannot accept any questions about the source code.

Safety Precautions

Read this manual and other document of this product carefully before installing, operating, maintaining or checking this product, in order to use it safely and correctly.

Make sure you understand all of the operations of the device that is used with this product, safety information, and cautions before starting to use this product.

In this user's manual, safety precautions are classified as either "Warning" or "Caution," as follows:

⚠ WARNING	Incorrect handling is likely to lead to death or serious injury.
⚠ CAUTION	Incorrect handling may lead to property damage or injury.

Even when the **CAUTION** is given, serious problems may occur, depending on the circumstances. In all cases, important points are discussed. Be sure to follow the advice given.

1) Installation

⚠ CAUTION
● Use the product only in the environment specified in Precautions for Use and Section 11 of this user's manual. Electric shock, fire or malfunction may occur when used under high temperature, high humidity, dusty or corrosive atmosphere, or when vibration or shock loading occurs. ● Install the product according to Section 2 of this user's manual. Incorrect installation may cause the product to fall, breakdown, or malfunction. ● Do not put foreign material such as chipped wire into this product. Failure to follow this may result in a fire, device breakdown or malfunction. ● Do not damage, disassemble, bind up, bundle, bend forcedly, put heavy material on or pinch the power cord. Failure to follow this may result in a fire, an electric shock or damage to the product.

2) Wiring

⚠ CAUTION
● Connect this product only to the power source meeting the specification. Connection to a power source other than the specification may cause a fire. ● All wiring and connections should be done by a qualified electrician. Incorrect wiring may result in a fire, an electric shock or damage to the product.

3) Use

WARNING

- Assemble an emergency stop circuit and interlock circuit outside of this product.
  Otherwise the machines controlled by this product may malfunction or be damaged by a problem with this product.
- Turn off the power immediately in case this product smoked, smelled unusually, etc.
  Failure to follow this may result in a fire or an electric shock.
- Don't touch the terminals while power is present.
  Do not pour or insert liquid and metal parts into inside of this product.
  Failure to follow this may result in an electric shock.
- Turn off the power immediately and do not touch the product in case of thunder.
  Failure to follow this may result in a fire, electric shock or injury.

CAUTION

- Take utmost care when changing parameters for the operating condition while this product is operating.
  Faulty operation may damage the machines controlled by this product or cause an accident.
- Turn the power on according to the operating instructions of the entire control system.
  Turning the power on in wrong order may cause damage on the machines or an accident.

4) Maintenance

WARNING

- Do not discard this product that contains a lithium battery in an incinerator or fire.
  An explosion or sparks may occur.

Prohibited

- Don't disassemble, alter or modify this product.
  A fire, property damage, or malfunction of the product may occur.

CAUTION

- Turn off the power source of this product before installing/removing any components for this product.
  Failure to follow this may result in an electric shock, damage to this product or malfunction.

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Section6: Serial Communication (No Protocol) (continued)

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Section1: Outline

1-1 Controller (IV-S300J, IV-S300M or IV-310M) and other products sold separately

[1] Products packed together with the Controller

The following items are packed together with the Controller you purchased.

・IV-S300J, IV-S300M or IV-S310M x 1

[Accessories]

D-sub connector x 1, 16-pin connector x 1 (※), 40-pin connector x 1 (※),
Main body mounting brackets x 2, Bracket screws x 4 and User's manual (this manual) x 1

※: IV-S300J does not include these connectors as the accessories.

[2] Products sold separately (optional)

The following products are available as items sold separately (optional) for the Controller.

(1) Cameras

- **Cameras exclusively for the Controllers**
  - IV-S300C6 (CCD digital monochrome camera) 0.25 M pixels (512 x 480)
  - IV-S300C7 (CMOS digital monochrome camera) 0.25 M pixels (512 x 480)
  - IV-S300CA (CMOS digital monochrome camera) 0.25 M pixels (512 x 480)
  - IV-S300CD (CMOS digital monochrome camera) 1.3 M pixels (1280 x 960)
  - IV-S300C2 (CMOS digital monochrome camera) 2 M pixels (1920 x 1080)
  - IV-S300C5 (CMOS digital monochrome camera) 6.5 M pixels (2560 x 2560)
  - IV-S300C8 (CMOS digital color camera) 0.25 M pixels (512 x 480)
  - IV-S300C3 (CMOS digital color camera) 2 M pixels (1920 x 1080)
- **Cameras for Controllers including IV-200X series**
  - IV-S200C6 (CCD digital monochrome camera) 0.25 M pixels (512 x 480)
  - IV-S210C2 (CCD digital monochrome camera) 2 M pixels (1920 x 1080)
  - IV-C250C8 (CCD digital color camera) 0.25 M pixels (512 x 480)
  - IV-C250C3 (CCD digital color camera) 2 M pixels (1920 x 1080)

(2) Camera cable

Cables to connect the above camera to the Controller.

- IV-S300K3 (cable length: 3 m)
- IV-S300K5 (cable length: 5 m)
- IV-S300KA (cable length: 10 m)

Note: IV-S300KA cannot be used with cameras IV-S300C5 and IV-S300C2/C6/C7/C3/C8/CA/CD.

(3) Camera lens

① **High-resolution lens**

- IV-1B2008 (focal distance: 8 mm)
- IV-1B2012 (focal distance: 12 mm)
- IV-1B2016 (focal distance: 16 mm)
- IV-1B2025 (focal distance: 25 mm)
- IV-1B2035 (focal distance: 35 mm)
- IV-1B2050 (focal distance: 50 mm)

② **Camera lens**

- IV-S20L16 (focal distance: 16 mm)

1-2 Name and Function of each part

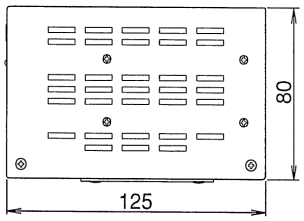
[1] Name and Function of the Controller

Figure of IV-S300M

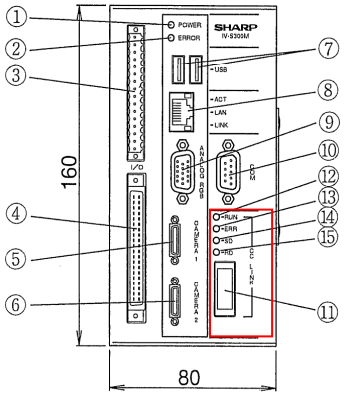
IV-S300J does not have parts ⑪ to ⑮ for CC-Link.

Unit: mm

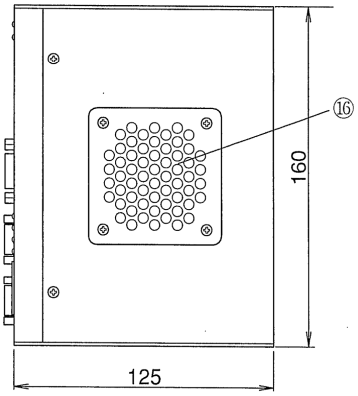
・ Top



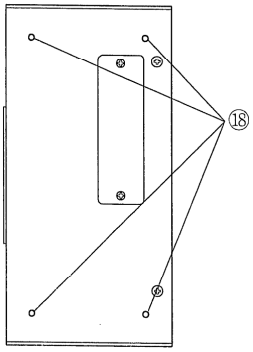
・ Front



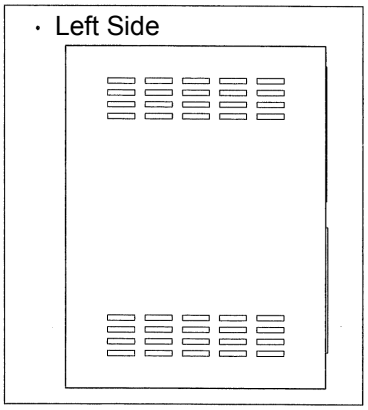
・ Right Side



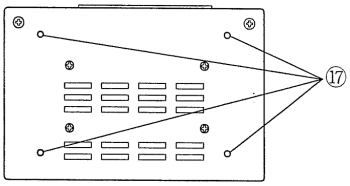
・ Back



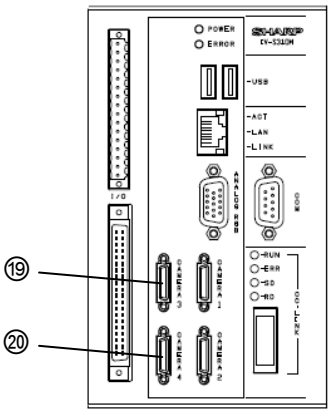
・ Left Side



・ Bottom



IV-S310M has two more camera connectors as shown on the right.



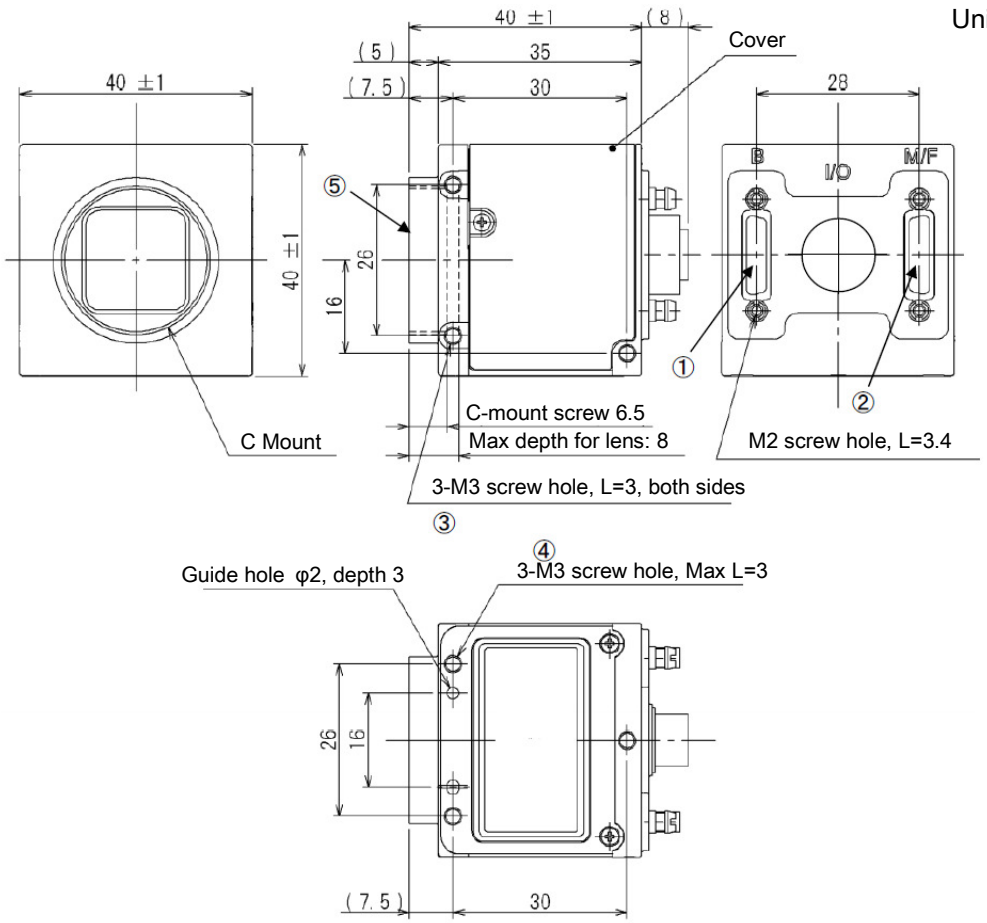
	Name	Function
⑲	Camera 3 connector (CAMERA3)	Connector for connecting camera cable (IV-S300K3/K5/KA). The camera connected to Camera 3 connector becomes Camera 3 and that connected to .Camera 4 connector becomes Camera 4
⑳	Camera 4 connector (CAMERA4)	

	Name	Function
①	Power lamp (POWER)	This lamp turns green when the power is supplied to the Controller.
②	Error lamp (ERROR)	This lamp turns red upon power on for a few seconds and when an error occurs.
③	Power and I/O connector (16 pin terminal)	This connector contains 3 power input terminals, 2 exclusive input terminals and 8 exclusive output terminals.
④	I/O connector (40 pin terminal)	This connector contains 2 exclusive output terminals, 16 general output terminals, 2 exclusive input terminals and 16 general input terminals.
⑤	Camera 1 connector (CAMERA1)	Connector for connecting camera cable (IV-S300K3/K5/KA). The camera connected to Camera connector 1 becomes Camera 1 and that connected to Camera connector 2 becomes Camera 2.
⑥	Camera 2 connector (CAMERA2)	
⑦	USB host connector (USB): 2 connectors IV-S300J: Left: USB3.0,Right: USB2.0 IV-S300M/IV-S310M: Both: USB3.0	Connect an USB flash drive to back up data such as the parameters. ・ An USB flash drive with a password function cannot be used. ・ The right click of an USB mouse is disabled. Note: Do not connect something other than an USB mouse or USB flash drive to the connector.
⑧	LAN interface connector (LAN)	Connector for an Ethernet cable. (10BASE-T/100BASE-TX/1000BASE-T compatible cable)
⑨	Analog RGB Monitor Connector (ANALOG RGB)	Connect a synch-on-green type analog RGB monitor that can display VGA signals.
⑩	Serial interface connector (COM)	Use to connect the Controller with a PC for serial communication (general-purpose serial I/F) or a PLC using the computer link.
⑪	CC-Link connector	Use to CC-link with Mitsubishi's PLC. [Recommended connectors for CC-link: Sumitomo 3M] ・ Connector: 35505-6000-B0M GF or 35A05-60S0-B0M GF ・ Power Clamp Branch connector type-Y: 35715-L010-B0M AK ・ Power Clamp Terminator: 35T05-6M00-B0M GF
⑫	Run lamp	This lamp turns green when the Controller is normal during CC-link and goes off when the Controller is disconnected from the network or in time over condition.
⑬	ERR lamp	This lamp turns red when CRC error occurs during CC-link.
⑭	SD lamp	This lamp turns green while sending data during CC-link.
⑮	RD lamp	This lamp turns green while receiving data during CC-link.
⑯	Vent hole (A fan is built in)	A fan filter (option) can be attached to the hole.
⑰	Bracket fixing holes (for bottom)	
⑱	Bracket fixing holes (for back)	

[2] Name and Function of the Cameras

1. IV-S300C5 (CMOS digital monochrome camera)

Unit: mm



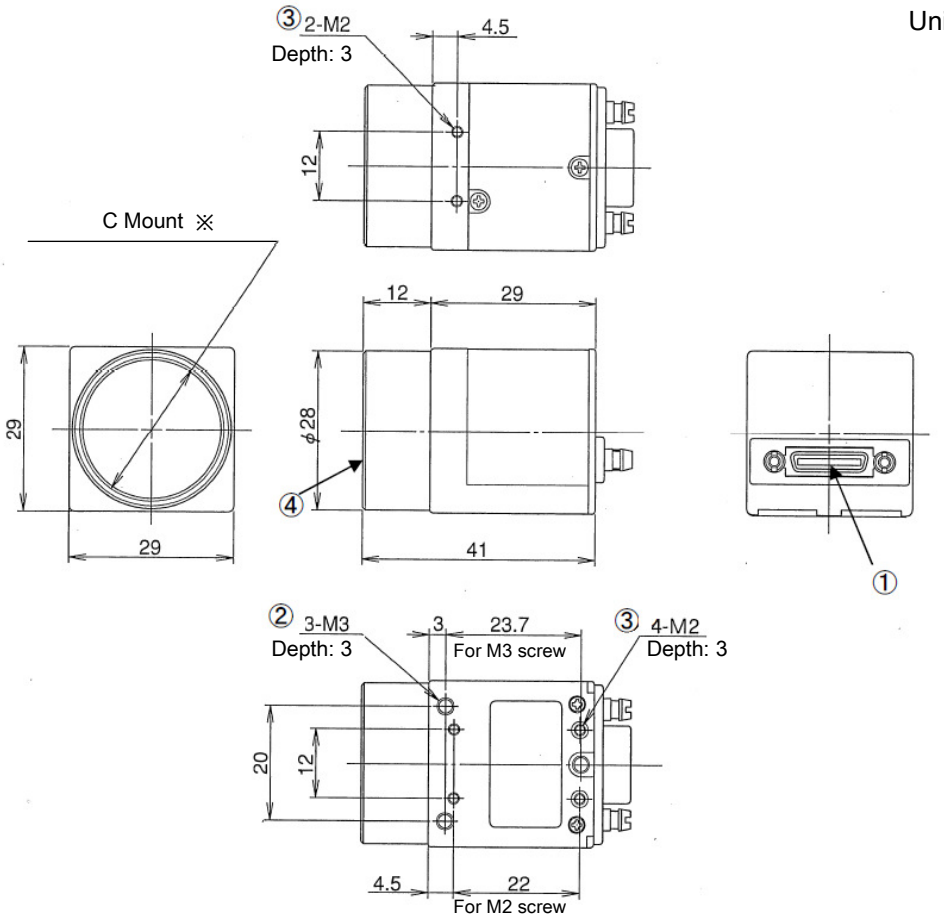
	Name	Function
①	Camera B Connector	Connect SDR connector of a camera cable (IV-S300K3/K5). Note: Be sure to use camera cables with the same length. Be sure to connect the connector of the cable labeled "Camera Side" to IV-S300C5. ▪ The camera cable connected to Camera B Connector must be connected to CAMERA 1 (for IV-S300J/IV-S300M) or CAMERA 1/3 (for IV-S310M) connector of the Controller and attach the accessory ID label [B(CAM1)] or [B(CAM3)] to the cable. ▪ The camera cable connected to Camera M/F Connector must be connected to CAMERA 2 (for IV-S300J/IV-S300M) or CAMERA 2/4 (for IV-S310M) connector and attach the accessory ID label [M/F(CAM2)] or [M/F(CAM4)] to the cable.
②	Camera M/F Connector	
③	Fixing Screw Holes (M3)	The holes for fixing the camera. (3 points at side)
④	Fixing Screw Holes (M3)	The holes for fixing the camera. (3 points at bottom)
⑤	Lens Holder	Holder for C mount lens.

Note:

1. Each camera has its specific field of view. When precision is required for the field of view, provide a mechanism that can adjust the camera mounting surface.
2. Provide a camera mounting base made of insulating material and isolate the frames of the Controller and the camera to improve noise immunity.

2. IV-S300C2/C7 (CMOS digital monochrome camera)
IV-S300C6 (CCD digital monochrome camera)
IV-S300C3/C8 (CMOS digital color camera)

Unit: mm



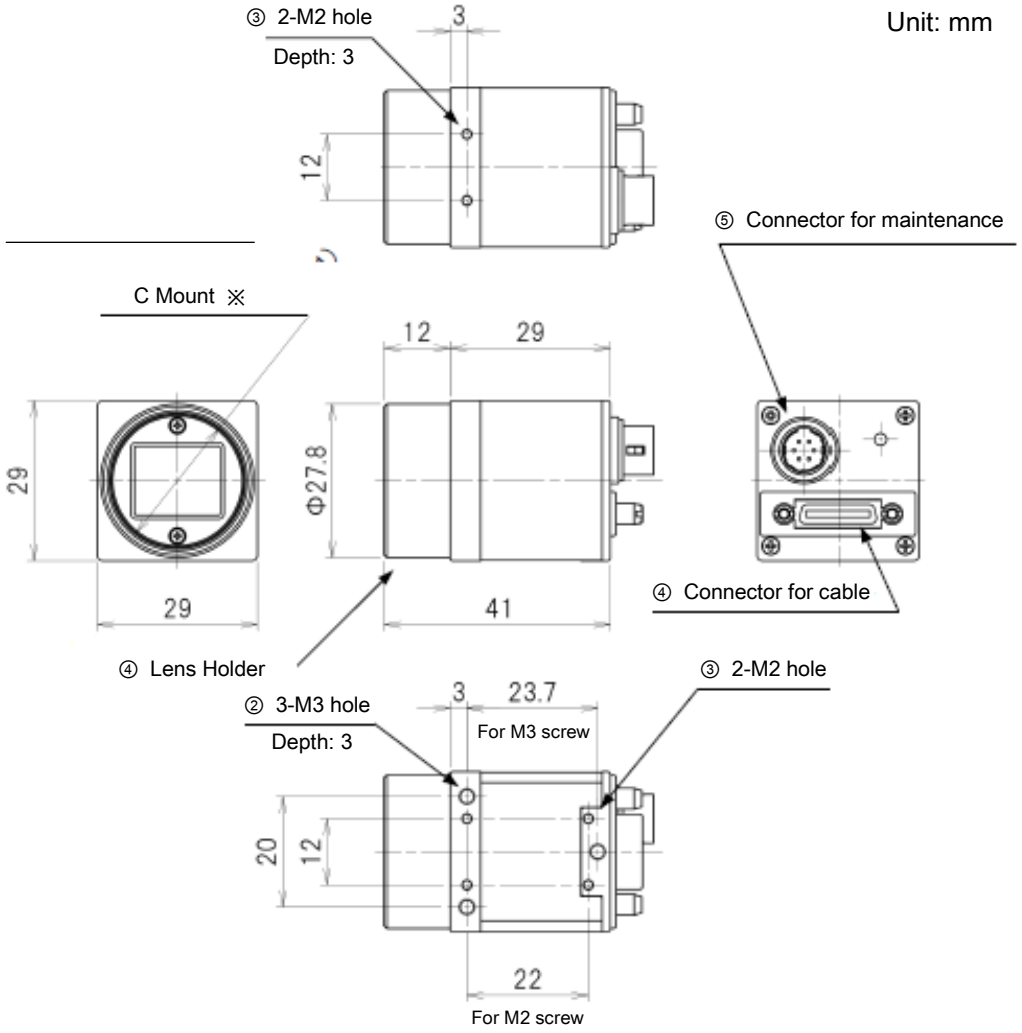
※ The C Mount screw is complying with ANSI/ASME B1.1, 1-32UN (2B).
Use a C Mount lens with which the maximum screw length from the lens mount surface is 6 mm and the maximum sticking out length is 10 mm.

	Name	Function
①	Camera Cable Connector	Connect SDR connector of a camera cable (IV-S300K3/K5).
②	Fixing Screw Holes (M3)	The holes for fixing the camera. (3 points at bottom)
③	Fixing Screw Holes (M2)	The holes for fixing the camera. (4 points at bottom and 2 points at top)
④	Lens Holder	Holder for C mount lens.

Note:

1. Each camera has its specific field of view. When precision is required for the field of view, provide a mechanism that can adjust the camera mounting surface.
2. Provide a camera mounting base made of insulating material and isolate the frames of the Controller and the camera to improve noise immunity.

3. IV-S300CA/CD (CMOS digital monochrome camera)



※ The C Mount screw is complying with ANSI/ASME B1.1, 1-32UN (2B).
Use a C Mount lens with which the maximum screw length from the lens mount surface is 6 mm and the maximum sticking out length is 10 mm.

	Name	Function
①	Camera Cable Connector	Connect SDR connector of a camera cable (IV-S300K3/K5).
②	Fixing Screw Holes (M3)	The holes for fixing the camera. (3 points at bottom)
③	Fixing Screw Holes (M2)	The holes for fixing the camera. (4 points at bottom and 2 points at top)
④	Lens Holder	Holder for C mount lens.
⑤	Connector for maintenance	Connector for maintenance by Sharp. Do not connect anything.

Note:

1. Each camera has its specific field of view. When precision is required for the field of view, provide a mechanism that can adjust the camera mounting surface.
2. Provide a camera mounting base made of insulating material and isolate the frames of the Controller and the camera to improve noise immunity.

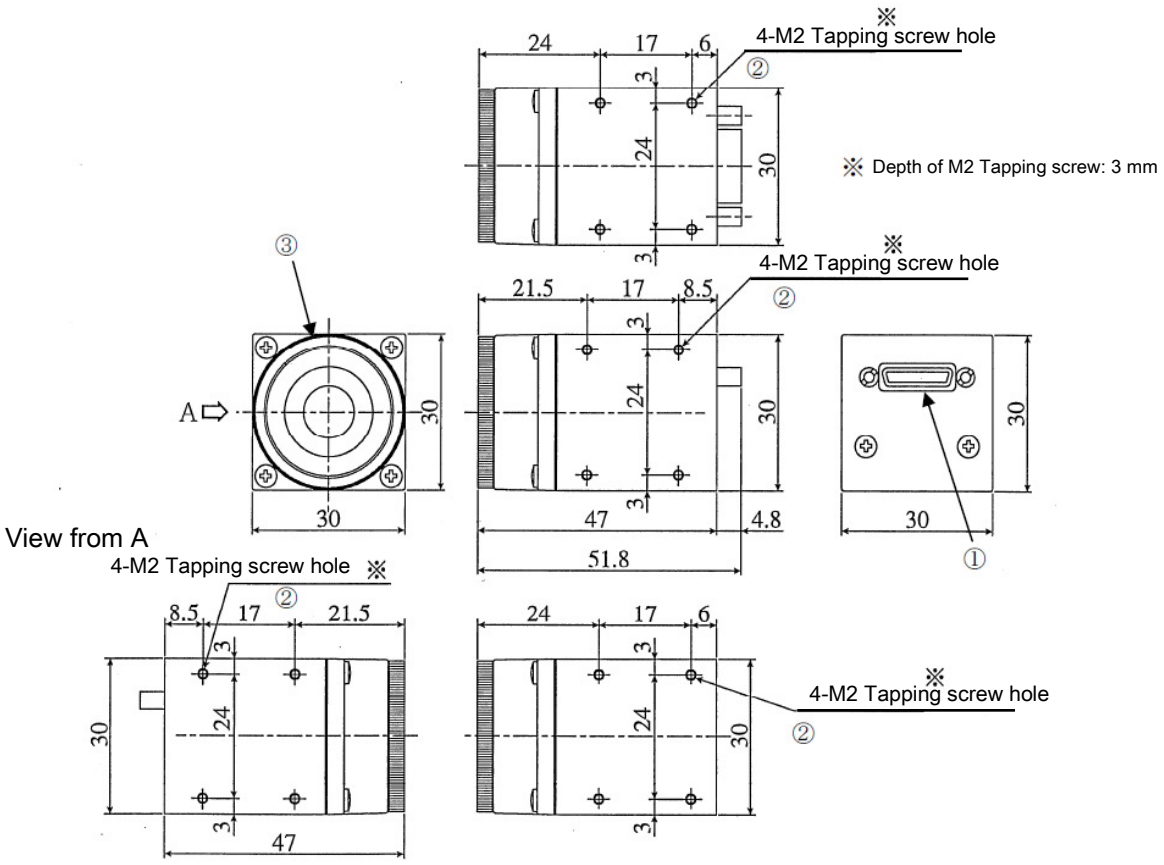
4. IV-S200C6 (CCD digital monochrome camera)

IV-S210C2 (CCD digital monochrome camera)

IV-C250C8 (CCD digital color camera)

IV-C250C3 (CCD digital color camera)

Unit: mm



	Name	Function
①	Camera Cable Connector	Connect SDR connector of a camera cable (IV-S300K3/K5/KA).
②	Fixing Screw Holes (M2)	The holes for fixing the camera. (Each 4 points at top, bottom and 2 side)
③	Lens Holder	Holder for C mount lens.

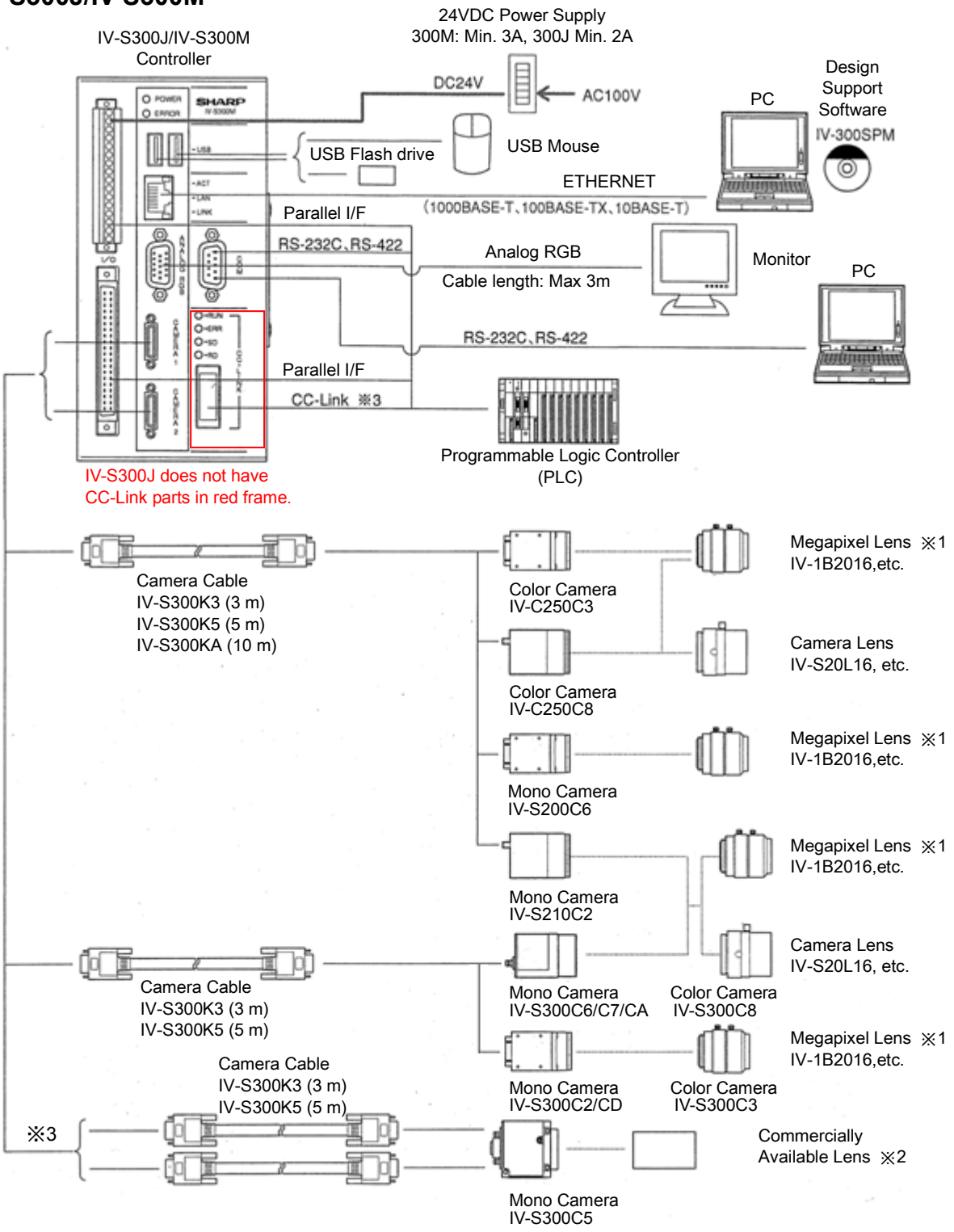
Note:

1. Each camera has its specific field of view. When precision is required for the field of view, provide a mechanism that can adjust the camera mounting surface.

Section 2: Installation and Wiring

2-1 System configuration

IV-S300J/IV-S300M

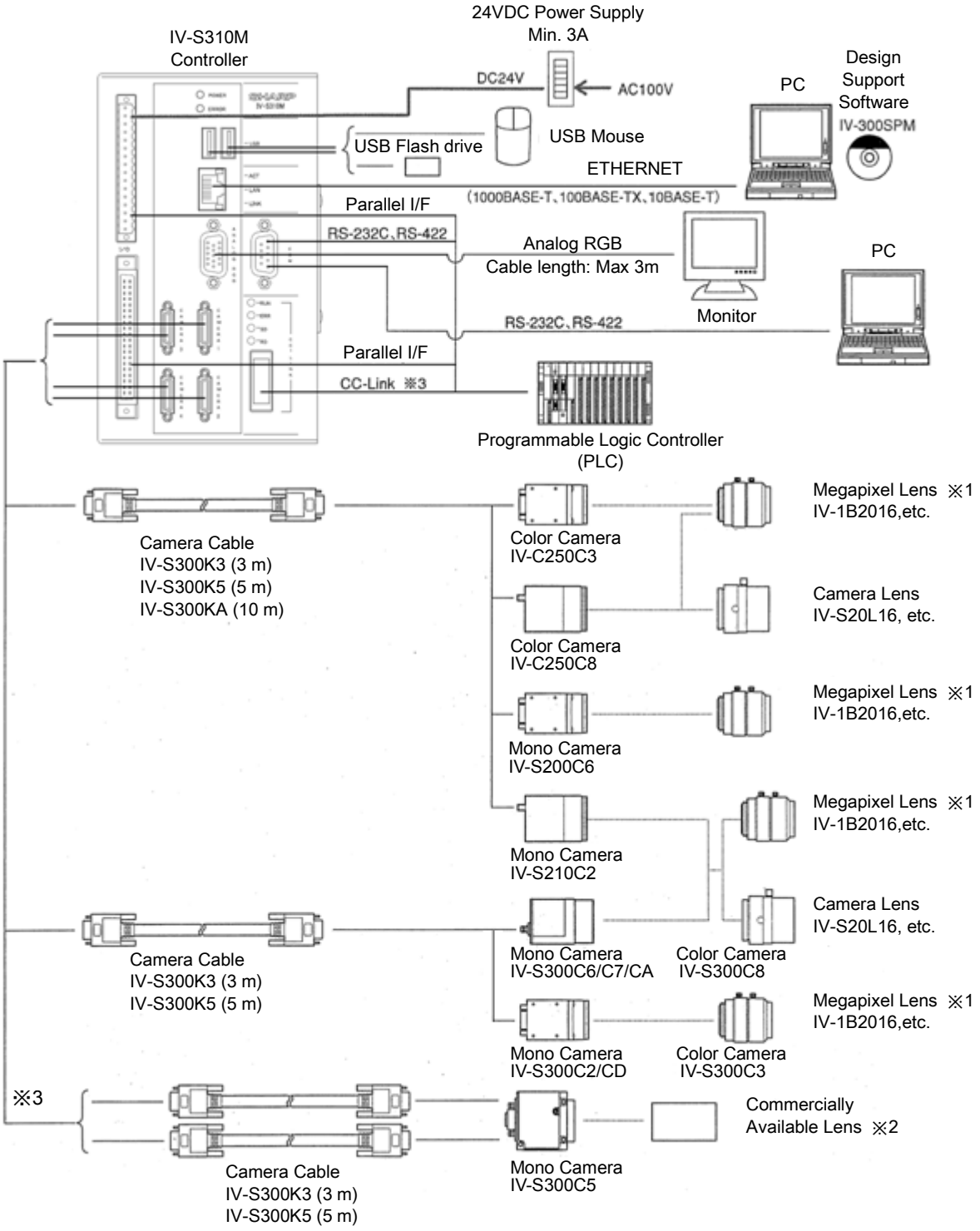


※1: Megapixel Lens Focal Length
IV-1B2008: 8 mm, IV-1B2012: 12 mm, IV-1B2016: 16 mm
IV-1B2025: 25 mm, IV-1B2035: 35 mm, IV-1B2050: 50 mm

※2: For the commercially available lens to use with IV-S300C5, please contact our dealer.

※3: The CC-Link can be connected to only Mitsubishi's PLC.

IV-S310M



※1: Megapixel Lens Focal Length
IV-1B2008: 8 mm, IV-1B2012: 12 mm, IV-1B2016: 16 mm
IV-1B2025: 25 mm, IV-1B2035: 35 mm, IV-1B2050: 50 mm
※2: For the commercially available lens to use with IV-S300C5, please contact our dealer.
※3: The CC-Link can be connected to only Mitsubishi's PLC.
※4: Camera cable of IV-S300C5 must be connected to Camera 1/2 or Camera 3/4 connectors.

2-2 Installation

2-2-1 Attachment of the Controller (IV-S300J/IV-S300M/IV-S310M)

[1] Attachment of Controller

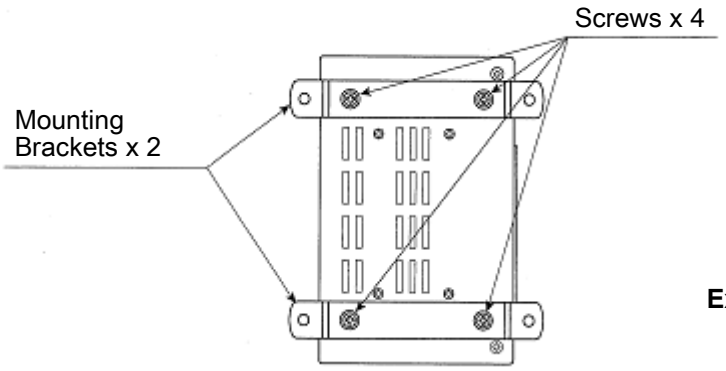
There are 2 ways for the attachment of the Controller main body: bottom or back mounting.

Use the 2 mounting brackets and the 4 screws provided as the accessory of the Controller for the attachment.

Attach the bracket to the bottom or the back of the Controller, accordingly.

Fix the bracket to the attachment surface with 4 screws through the φ4.5 mounting holes of the bracket.

[Bottom mounting]



Example of IV-S300M

[2] Space for the Controller Mounting

Spaces for securing good ventilation of the Controller, the wiring of camera cable, etc. and attachment/removal of the cables must be taken into account.

Please provide the following spaces around the Controller.

Note:

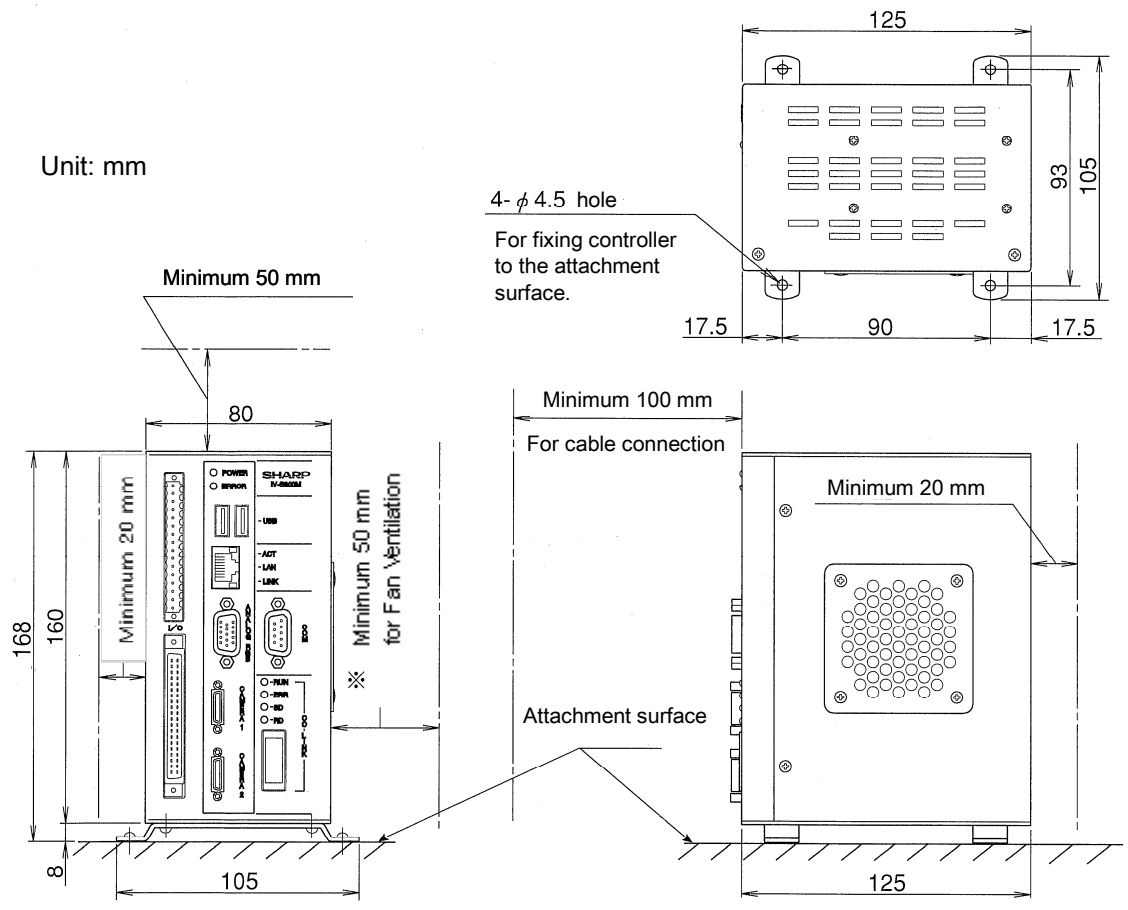
- Do not cover the hole for ventilation fan or block the ventilation path of the Controller.
- Using the Controller. above the upper limit (45˚C) of the operating environment temperature range (0 to 45˚C) may degrade its long-term reliability.
  Use the Controller under temperature as low as possible.

1. Bottom mounting

IV-S300J/IV-S300M

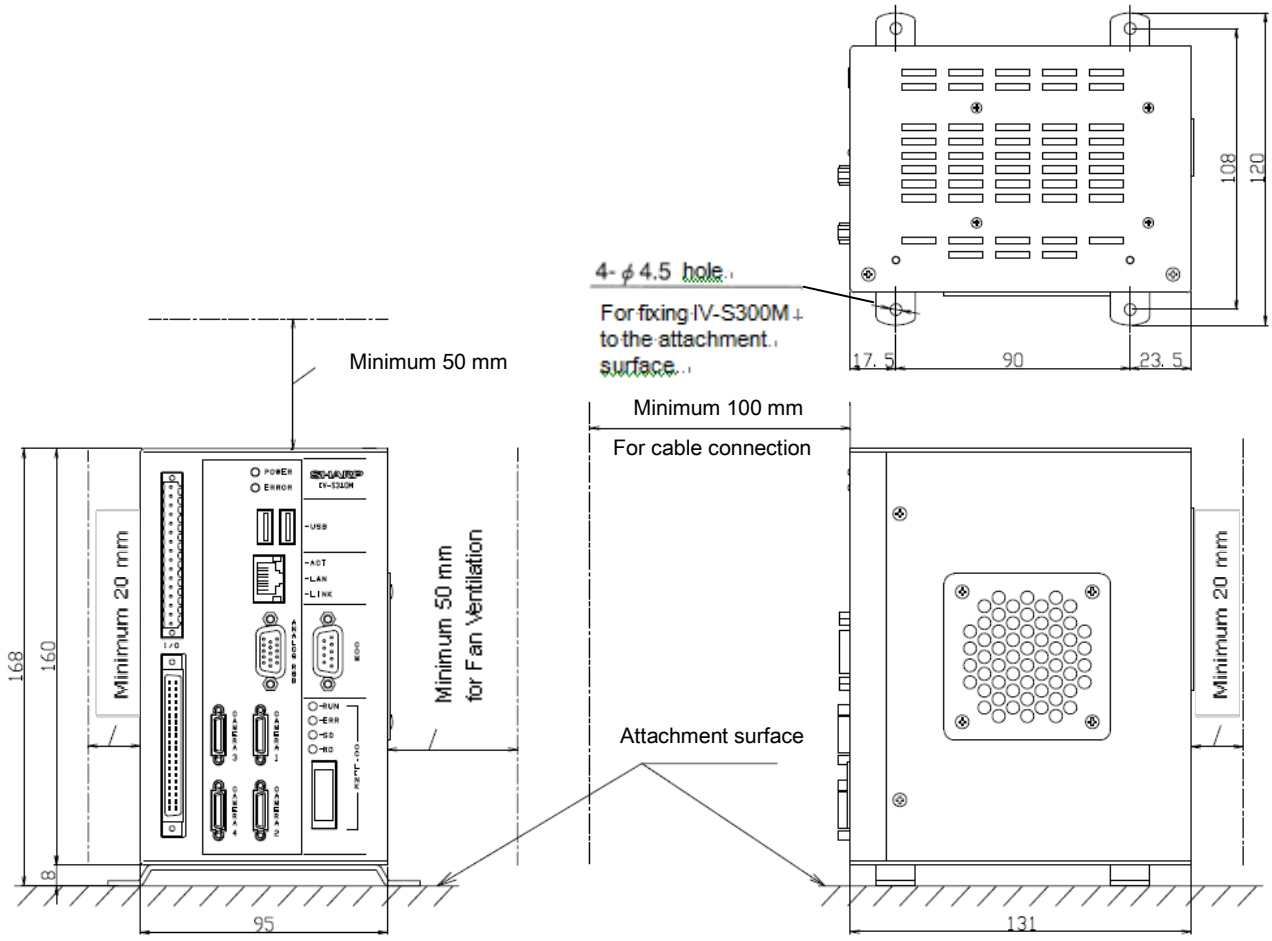
Note: The picture is that of IV-S300M.

Unit: mm



※: Please provide minimum 60 mm space when the optional fan filter is used.

IV-S310M

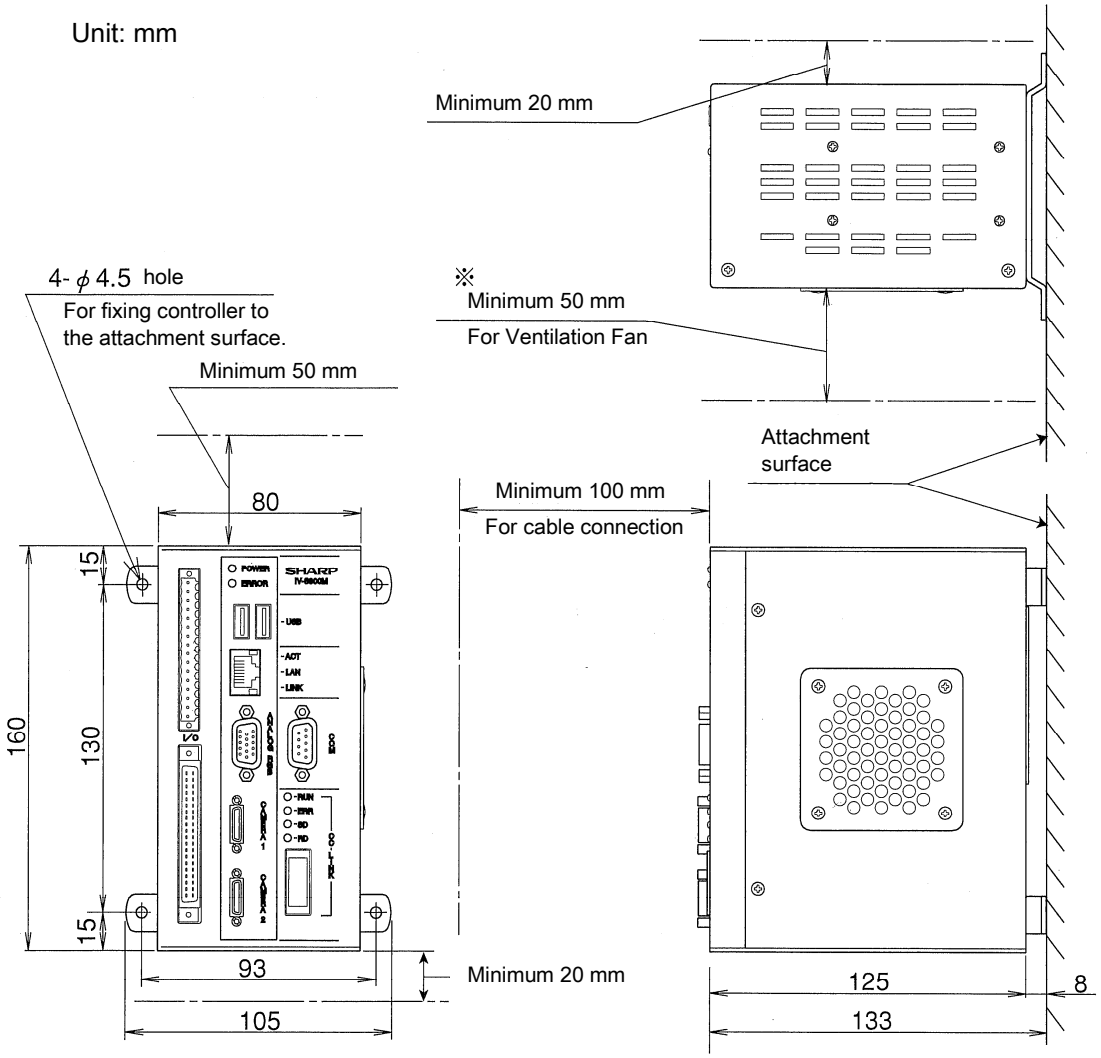


※: Please provide minimum 60 mm space when the optional fan filter is used.

2. Back mounting

IV-S300J/IV-S300M

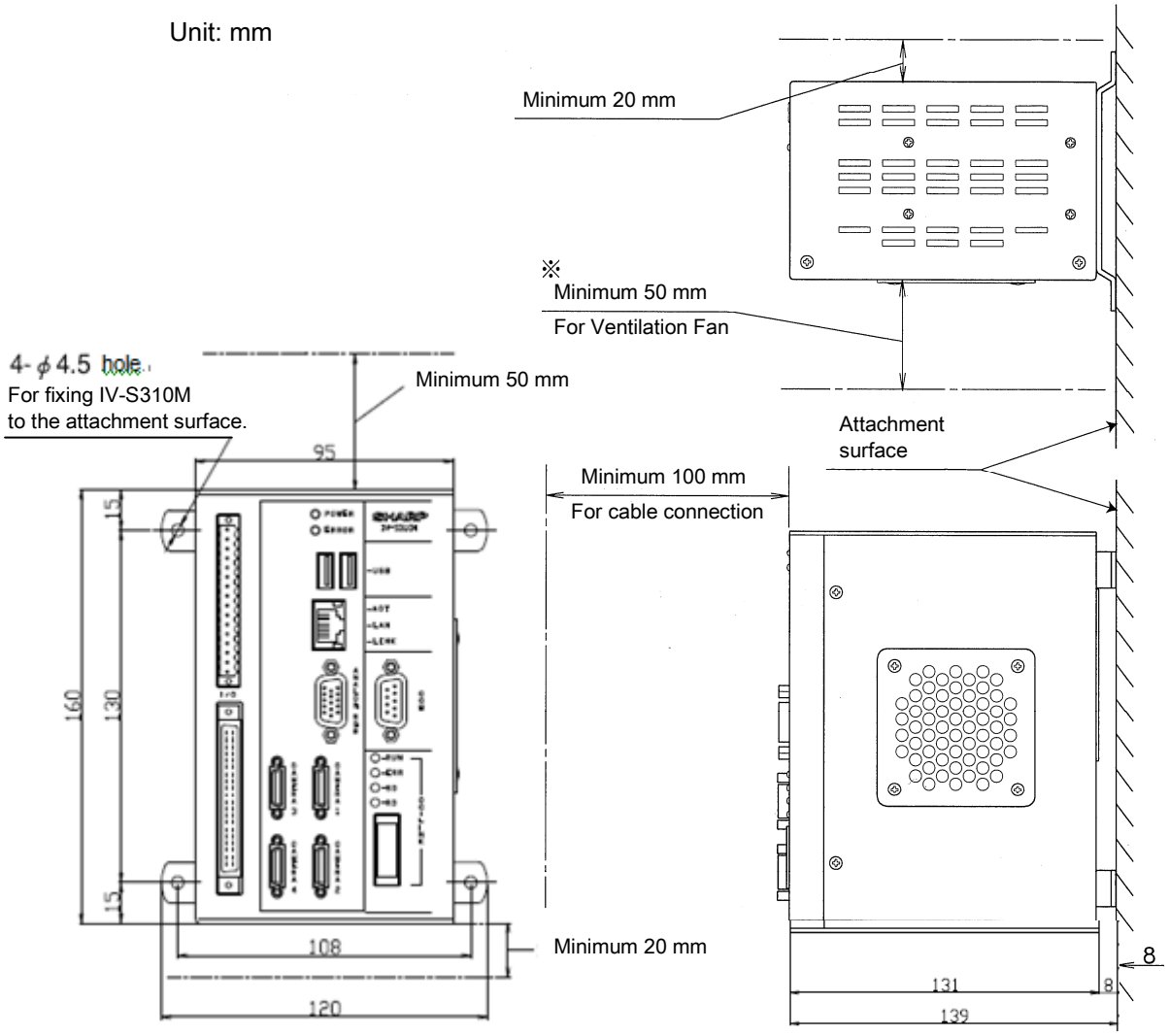
Note: The picture is that of IV-S300M.



※: Please provide minimum 60 mm space when the optional fan filter is used.

IV-S310M

Unit: mm



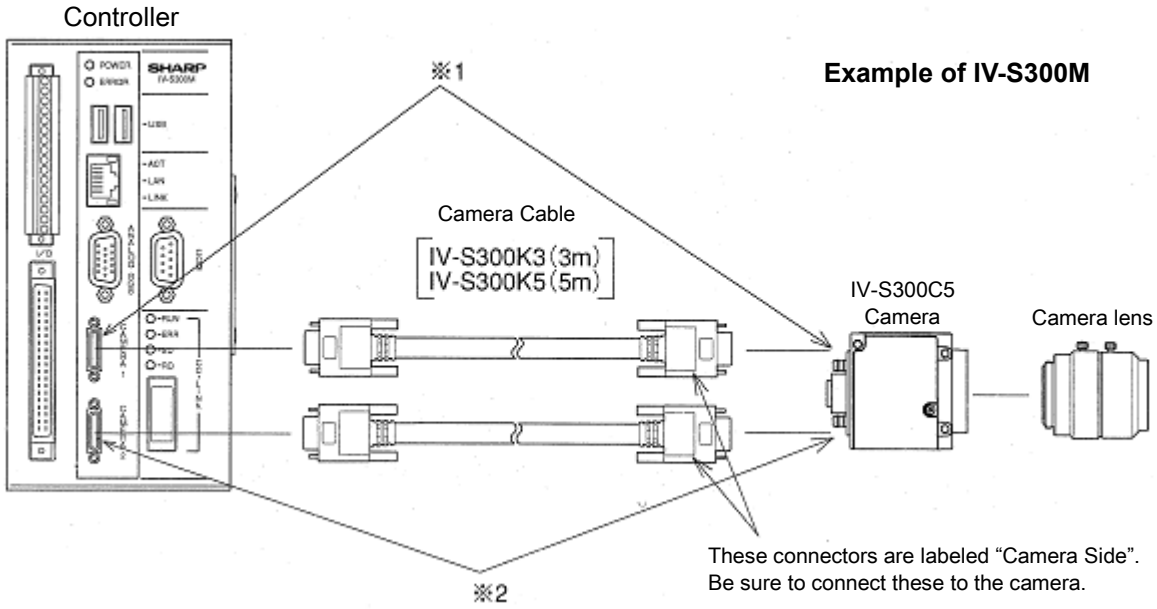
※: Please provide minimum 60 mm space when the optional fan filter is used.

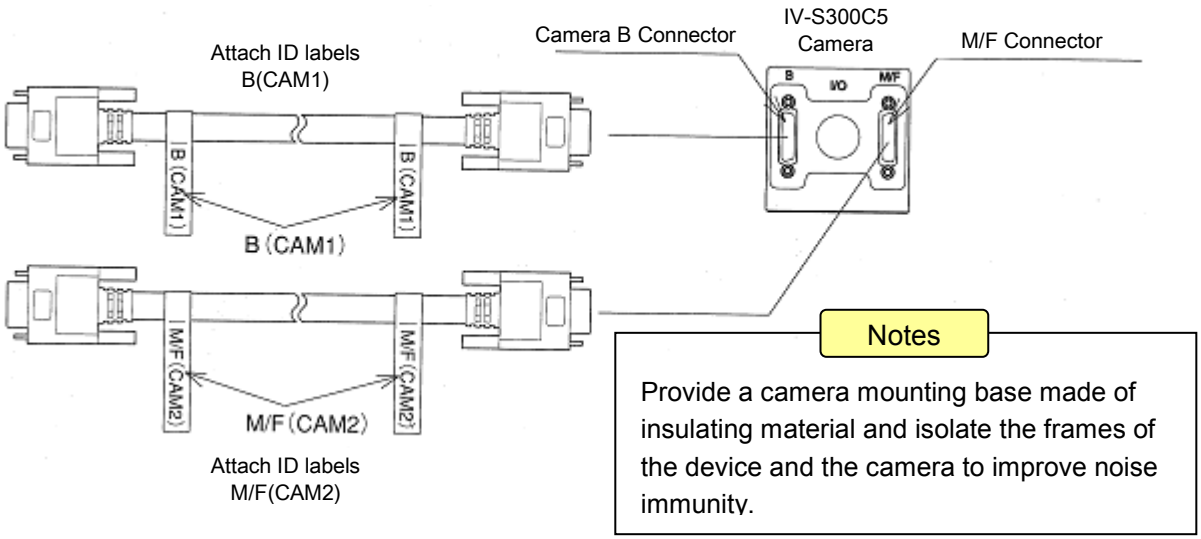
2-2-2 Installation of Camera

[1] IV-S300C5

IV-S300C5 camera is a high resolution digital monochrome camera that employs global shutter CMOS image sensors and compatible with C mount lens.
Like a CCD camera, it can capture a still image by one shot.

- Only 1 unit of IV-S300C5 can be connected to IV-S300J/ IV-S300M controller.
  Two units of IV-S300C5 can be connected to IV-S310M controller.
  When connecting 2 units, connect one to CAMERA 1 and CAMERA 2 connectors, and the other to CAMERA 3 and CAMERA 4 connectors.
- Two camera cables (IV-S300K3/K5) of the same length need to be used with IV-S300C5.
  Note 1: Be sure to connect the connector of the cable labeled “Camera Side” to IV-S300C5.
  Note 2: The camera cable connected to Camera B connector must be connected to CAMERA 1 (for IV-S300J/IV-S300M) or CAMERA 1/3 (for IV-S310M) connector of the Controller and attach the accessory ID label [B(CAM1)] or [B(CAM3)] to the cable.
  Note 3: The camera cable connected to Camera M/F connector must be connected to CAMERA 2 (for IV-S300J/IV-S300M) or CAMERA 2/4 (for IV-S310M) connector and attach the accessory ID label [M/F(CAM2)] or [M/F(CAM4)] to the cable.





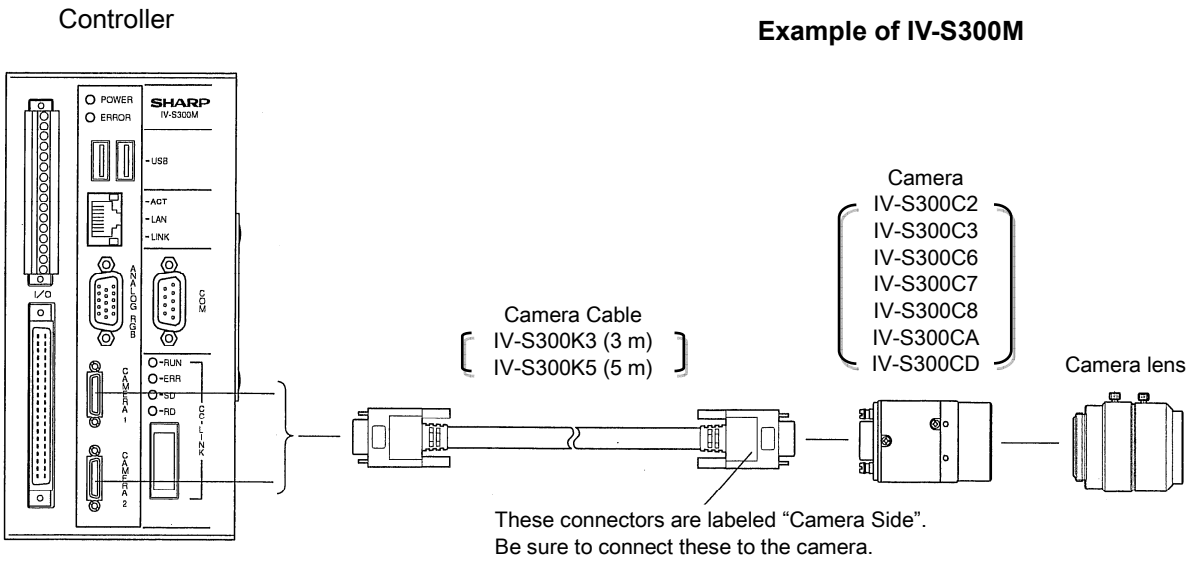
Notes

Provide a camera mounting base made of insulating material and isolate the frames of the device and the camera to improve noise immunity.

[2] IV-S300C2/C3/C6/C7/C8/CA/CD

- IV-S300C2 (CMOS digital monochrome camera) 2 M pixels (1920 x 1080)
- IV-S300C3 (CMOS digital color camera) 2 M pixels (1920 x 1080)
- IV-S300C6 (CCD digital monochrome camera) 0.25 M pixels (512 x 480)
- IV-S300C7 (CMOS digital monochrome camera) 0.25 M pixels (512 x 480)
- IV-S300C8 (CMOS digital color camera) 0.25 M pixels (512 x 480)
- IV-S300CA (CMOS digital monochrome camera) 0.25 M pixels (512 x 480)
- IV-S300CD (CMOS digital monochrome camera) 1.3 M pixels (1280 x 960)

- Maximum 2 units of these cameras can be connected to IV-S300J/IV-S300M and maximum 4 units of the cameras can be connected to IV-S310M at a time.
- These cameras can be used together with IV-S200C6 (CCD digital monochrome camera), IV-S210C2 (CCD digital monochrome camera), etc. but cannot be used with IV-S300C5 (CMOS digital monochrome camera).
- These cameras cannot use the camera cable IV-S300KA (10 m length).
  Use only with IV-S300K3 (3m) or IV-S300K5 (5 m) camera cable.



Notes

Provide a camera mounting base made of insulating material and isolate the frames of the device and the camera to improve noise immunity.

[3] IV-S200C6, IV-S210C2 and IV-C250C3/C8

IV-S200C6, IV-S210C2 and IV-C250C3/C8 cameras are CCD digital cameras and compatible with C mount lens.

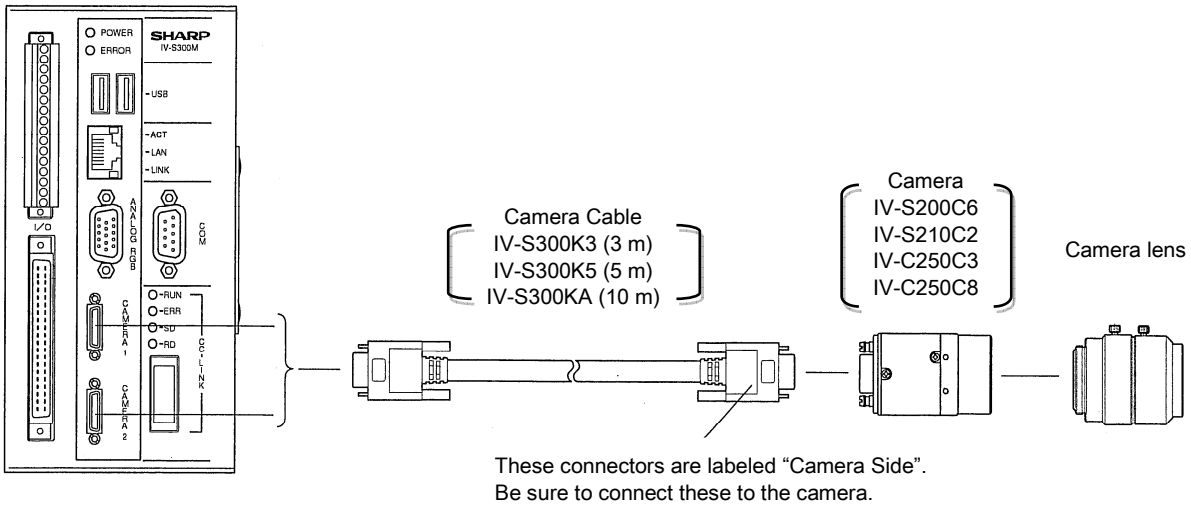
- IV-S200C6 (high-speed CCD digital monochrome camera) 0.25 M pixels (512 x 480)
- IV-S210C2 (high-resolution CCD digital monochrome camera) 2 M pixels (1920 x 1080)
- IV-C250C3 (high-speed digital color camera) 2 M pixels (1920 x 1080)
- IV-C250C8 (high-speed digital color camera) 0.25 M pixels (512 x 480)

・ Maximum two units of IV-S200C6, IV-S210C2 and IV-C250C3/C8 can be connected to IV-S300J/IV-S300M and maximum four units of the cameras can be connected to IV-S310M at a time.

・ They can also be used together with IV-S300 series cameras except IV-S300C5.

Controller

Example of IV-S300M



Notes

Provide a camera mounting base made of insulating material and isolate the frames of the device and the camera to improve noise immunity.

[4] Camera Cable Connection

Pay attention to the following points when using camera cables (IV-S300K3/K5/KA):

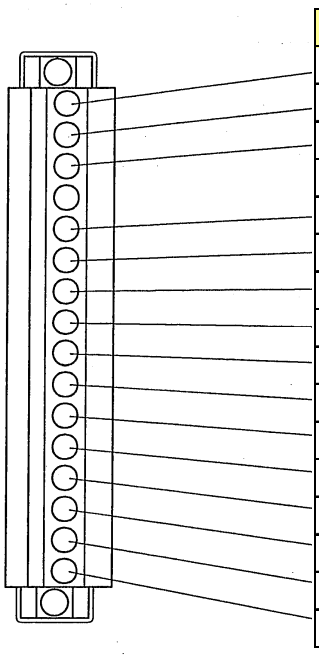
1. Be sure to connect the connector with Camera Side seal to the camera connector.
   Controller side connector does not have any marking.
2. Be sure to fix the cable when it is used in the environment of much vibration.
3. Do not pinch the cable partially.
   When fixing the cable with a fixing bracket or etc., be sure to provide a cushion between the cable and the bracket or use a bracket that does not damage the jacket of the cable.
4. Do not pull or apply excessive force to the cable and connectors forcedly during installing the cable.
5. After installing the cable, be sure to check that no forces are directly applied to the connectors at both ends of the cable and cable itself.
6. Do not pull the cable to disconnect the connectors.
   Always hold the body of the connector to connect or disconnect.
7. Do not twist the cable.

2-3 Wiring

2-3-1 Wiring of the Power and I/O connector (16-pin terminal)

The terminal names and details of the 16-pin connector of the Controller are shown below.

・ A 16 pin connector (accessory) for plugging into the Controller comes with the unit.



Terminal	Signal	
FG	Ground	Power Input
+24V	Power supply (+24V)	
+ 0V	Power supply (+0V)	
-----	-----	
TRG1	Start inspection (Camera 1)	Exclusive Input
TRG2	Start inspection (Camera 2)	
COM	Input common	
RDY1	Trigger ready (Camera 1)	Exclusive Output
STO1	Output strobe (Camera 1)	
JDG1	Total judgment (Camera 1)	
FL1	Strobe (Camera 1)	
RDY2	Trigger ready (Camera 2)	
STO2	Output strobe (Camera 2)	
JDG2	Total judgment (Camera 2)	
FL2	Strobe (Camera 2)	
COM(-)	Output signal common (-)	

- Wiring Requirement

Item	Condition
Wire Gauge	AWG28 – 14 (0.2 – 1.5 mm^2)
Wire Type	Single wire, Twisted wire
Wire End Treatment	Strip off the insulation by 6 mm
Terminal Screw	M2
Tightening Torque	0.25N・m

- Wiring Instruction

  Wire the 16 pin connector while it is not plugged into the Controller.

  1. Turn the terminal screws on the 16-pin connector counter clock wise using a slotted screwdriver and loosen them.
  2. Insert the wire stripped conductor, and then tighten the terminal screws to a torque of 0.25 N-m.
  3. After connecting all the conductors, plug the 16-pin connector into the Power and I/O (16 terminals) connector on the Controller and tighten the screws on the edge of the connector.

[Note]

・ Soldered wires may cause a contact failure.

・ Make sure to connect only one line to each terminal whenever possible.
  Placing multiple lines on one terminal may cause a contact failure.

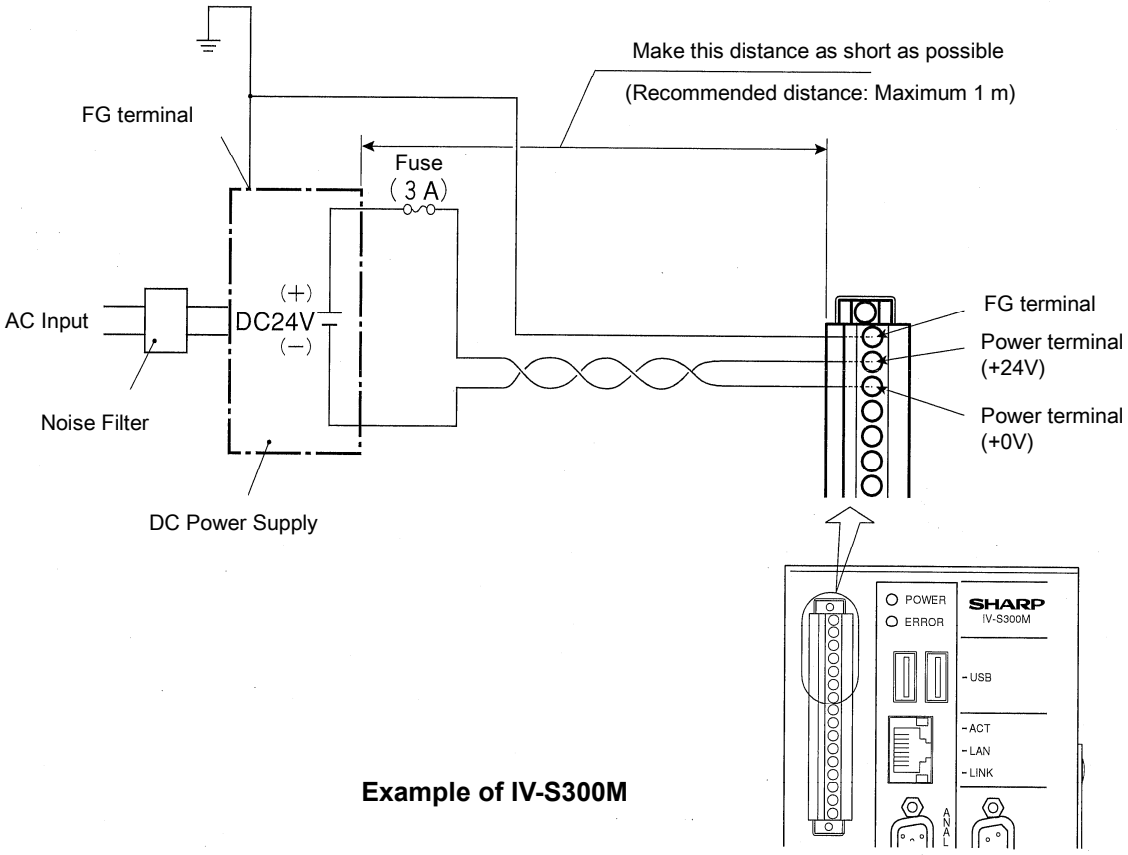
・ Do not plug or unplug the 16-pin connector while power is present.

・ Do not pull on the cable to unplug the 16-pin connector.

[1] Wiring of the Power Supply

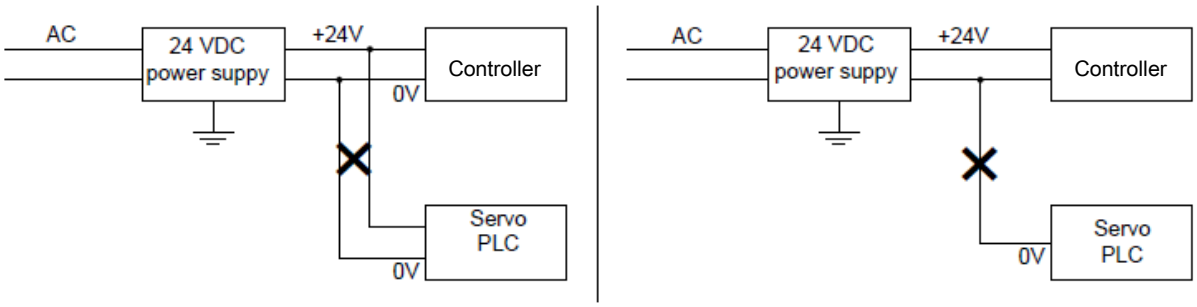
Connect a commercially available DC power supply (+24 V, +0 V).to the 16-pin power and I/O connector power terminals. Use a constant voltage power supply with the following specifications.

Model	Output current	Power voltage	Recommended
IV-S300J	2A or more	24VDC ± 10%	PBA50F-24 made by Cosel
IV-S300M/IV-S310M	3A or more	24VDC ± 10%	PBA75F-24 made by Cosel



Example of IV-S300M

- Do not use the DC power supply for any equipment other than the Controller.
  Connecting the power supply to other equipment can cause a surge current from the other equipment to enter the Controller and may cause it to malfunction.



- Be careful when connecting power to the +24V and +0V power terminals.
  Reversed polarity connections may damage the Controller.
- Make sure to turn off the power before connecting/disconnecting the camera cables to/from the Controller.

[Note]

In order to improve noise immunity, perform the following:

- Make sure to provide class D grounding on the DC power supply FG terminal.
- Keep the power line between the Controller and the DC power supply as short as possible. (Recommended distance: 1 m or less)
  Do not route the 24V power cable close to noise generating sources, such as motor power supply lines.
- Use twisted pairs to provide power.
- Wire the Power and I/O Connector (16 pin connector) while it is not plugged into the Controller. After they are wired, plug the connector to the Controller.
  Wiring the terminals while the connector is plugged into the Controller may damage it.

[2] Wiring of the I/O terminals [parallel I/F]

(1) Input/Output Port

In order to prevent malfunctions caused by electrical noise, the input and output on the 16-pin Power and I/O connector are isolated by photocouplers.
Use the input and output ports below the maximum rating as follows:

1. Input Port

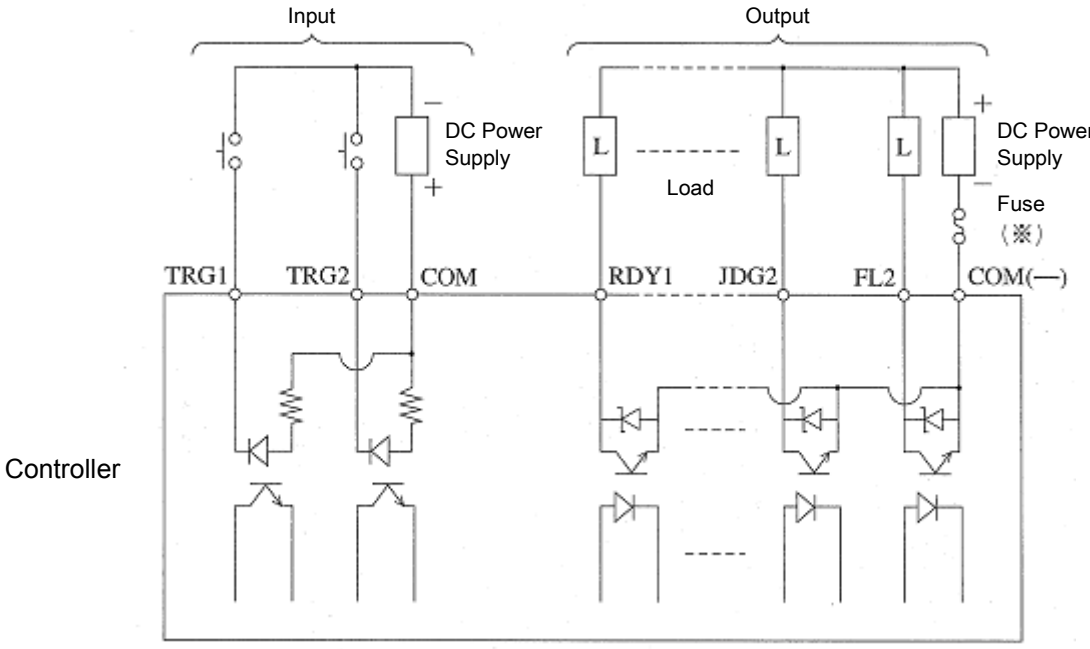
Item	Rating
	Input
Rated input voltage	12/24 VDC
Input voltage range	10.8 to 26.4 VDC
Input voltage level	ON: 10.5 V or less, OFF: 5 V or more
Input current level	ON: 3 mA or less, OFF: 1.5 mA or more
Input impedance	3.3 kΩ
Response time	20 μs or less (OFF -> ON)
	500 μs or less (ON -> OFF)

2. Output Port

Item	Rating
	Output
Rated output voltage	12/24 VDC
Load voltage range	10.8 to 26.4 VDC
Rated maximum output current	20 mA DC
Output type	Photocoupler, open collector
ON voltage drop	2.5 V or less (20 mA)
Isolation system	Photocoupler isolation
Response time	5 μs or less (OFF -> ON)
	150 μs or less (ON -> OFF)

(2) Wiring diagram

Wiring diagram for input and output on the 16-pin power and I/O connector is shown below.



※ Fuse rating must be selected depending on the loads.

2-3-2 Wiring of the I/O connector (40-pin) [parallel I/F]

The terminal names and details of the 40-pin connector that is plugged into the I/O connector (40 pins) on the Controller are shown below.

IV-S300M/310M:

- A 40 pin connector comes with the Controller.
  A commercially available FCN connector (40 pins) can also be used.

IV-S300J:

- A 40 pin connector does not come with the Controller.
  Please prepare commercially available FCN connector (40 pins).
  Examples: Connector FCN-361J040-AU and hood FCN-360C040-B.

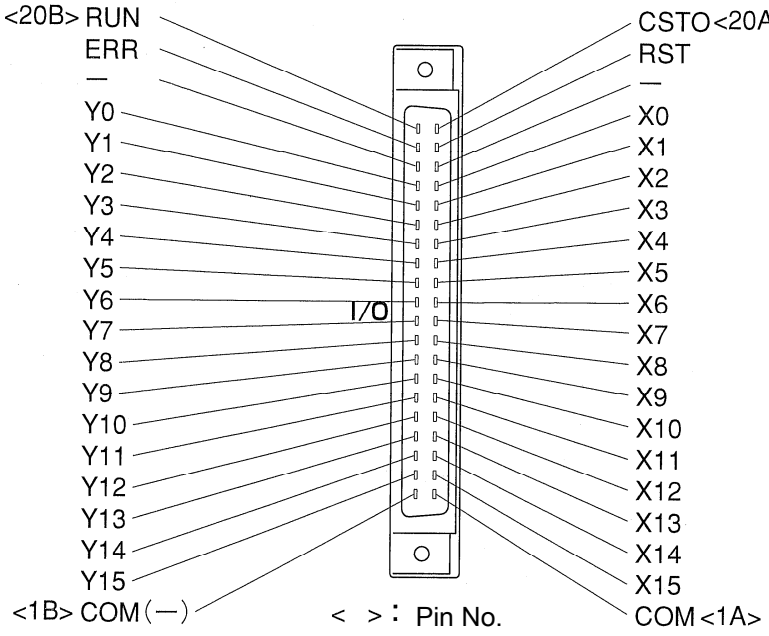
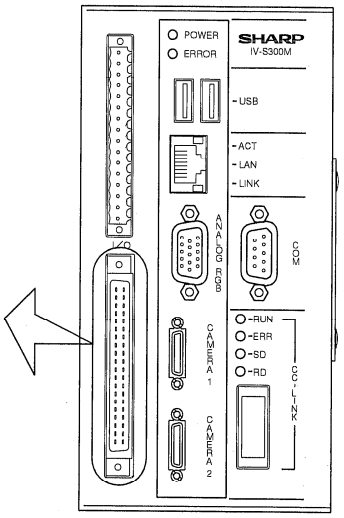


Figure of IV-S300M



Note: Note that the above is the figure when viewing the 40 pin connector of Controller, not the one of 40 pin connector to be plugged into the Controller.
Connect wires to the 40 pin connector by keeping this in mind.

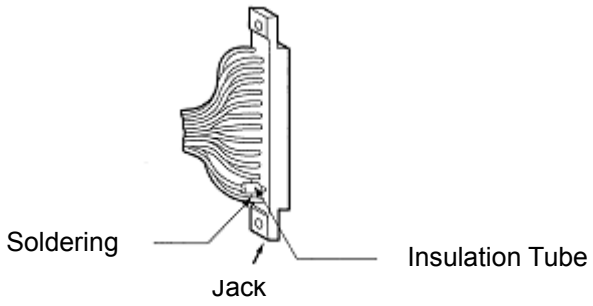
Terminal	Signal (Output)	
RUN	Running	Exclusive Output
ERR	Error	
-----	Spare	
Y0	General Purpose Output	
:		
Y15		
COM(-)	Output Common (-)	

Terminal	Signal (Input)	
CSTO	Command Input	Exclusive Input
RST	Reset	
-----	Spare	
X0	General Purpose Input	
:		
X15		
COM(-)	Input Common (-)	

[1] Assembly of the 40-pin connector

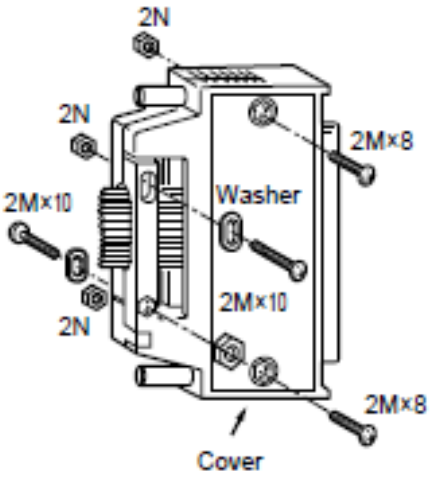
Assemble the 40-pin connector (accessory) before plugging the I/O connector (40 pin) into the Controller as follows.

1. Insert an insulation tube to each signal line.



2. Solder each signal line to the corresponding connector terminal.
   Solder after checking the connector terminal and I/O connector (24 pin) names.

3. Assemble the connector.
   The parts needed to assemble the connector (screws, washers, and nuts) are supplied together with the connector.



- Use the following recommended cable for signal lines:
  Multi-pair vinyl insulated cable
  18P x 0.18, 57VV−SB (Fujikura)

[2] Wiring of the I/O terminals [parallel I/F]

In order to prevent malfunctions caused by electrical noise, the input and output on the 40-pin I/O connector are isolated by photocouplers.

Use the input and output ports below the maximum rating as follows:

(1) Input Port

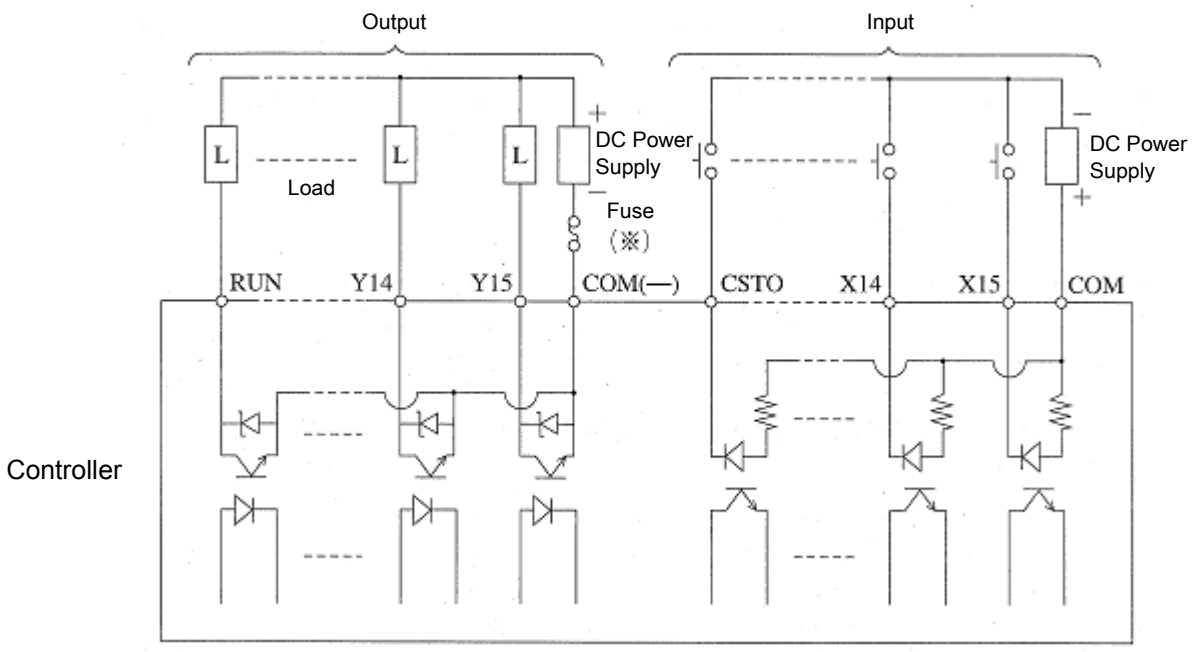
Item	Input Rating
Rated input voltage	12/24 VDC
Input voltage range	10.8 to 26.4 VDC
Input voltage level	ON: 10.5 V or less, OFF: 5 V or more
Input current level	ON: 3 mA or less, OFF: 1.5 mA or more
Input impedance	3.3 kΩ
Response time	20 μs or less (OFF -> ON)
	500 or less (ON -> OFF)

***(2)* Output port**

Item	Output Rating
Rated output voltage	12/24 VDC
Load voltage range	10.8 to 26.4 VDC
Rated maximum output current	20 mA DC
Output type	Photocoupler open collector
ON voltage drop	2.5 V or less (20 mA)
Isolation system	Photocoupler isolation
Response time	5 μs or less (OFF -> ON)
	150 μs or less (ON -> OFF)

[3] Wiring diagram

Wiring diagram for the 40-pin I/O connector is shown below.



※ Fuse rating must be selected depending on the loads.

2-3-3 Wiring for Communication with a PC (general-purpose serial I/F)

Connect a PC to the serial interface connector (RS-232C/RS-422) of the controller.

- **IV-S300M/310M:**
  The connector comes with the controller.
- **IV-S300J:**
  The connector does not come with the controller.
  Please prepare commercially available (9 pin D-sub male, lock screw M2.6) connector.

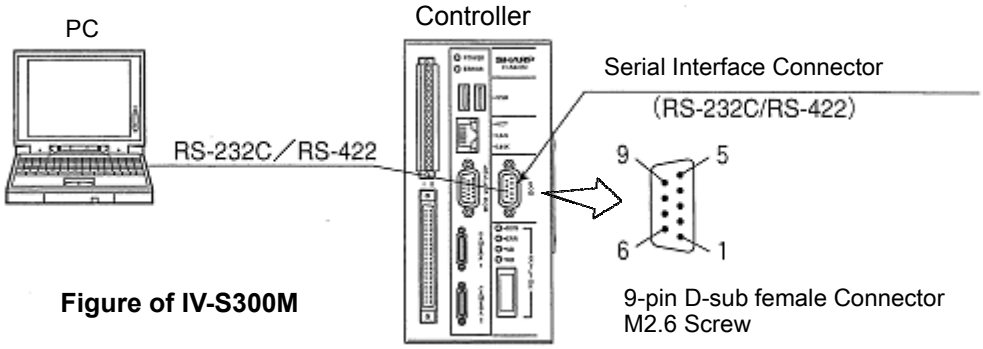
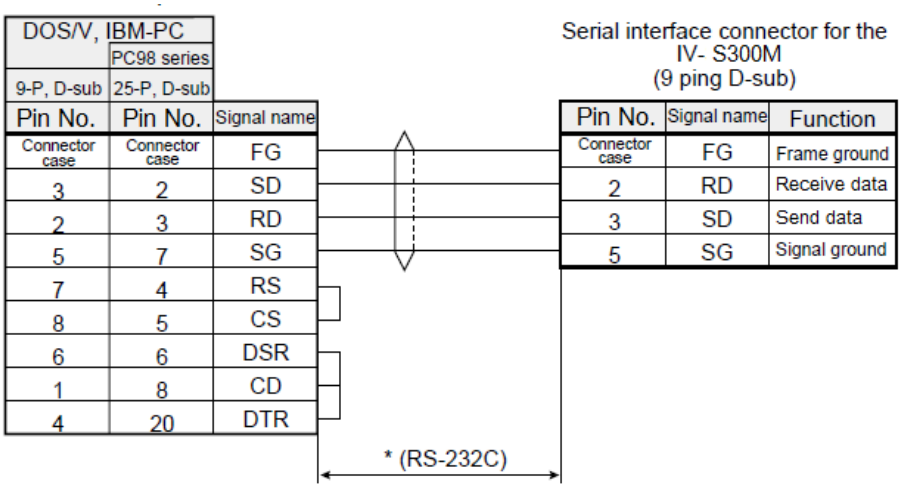


Figure of IV-S300M

● Signal names and details of the serial interface connector (RS-232C/RS-422)
・Pin numbers 1 and 6 are reserved. Do not use them

Communication protocol	Pin number	Signal name	Description	Type
RS-232C	2	RD	Receive data (PC -> Controller)	Input
	3	SD	Send data (Controller -> PC)	Output
	5	SG	Signal ground -	-
RS-422	4	TA	Send data (Controller -> PC)	Output
	7	TB		
	8	RA	Receive data (PC -> Controller)	Input
	9	RB		
Connector case		FG	Frame ground	-

[1] To communicate using RS-232C



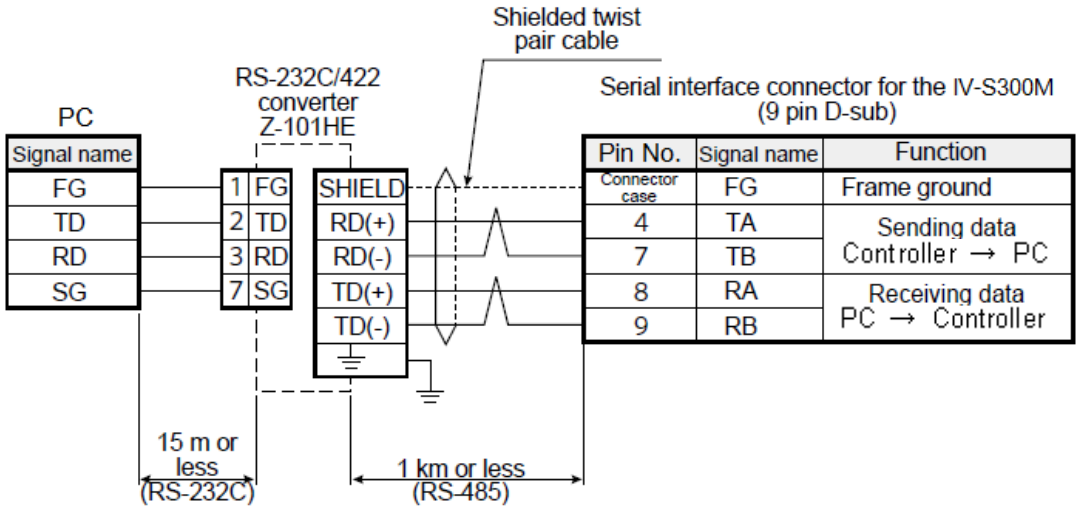
● The maximum signal cable length depends on the transmission speed.

Transmission speed (kbps)	Cable length
2.4, 4.8, 9.6,19.2	Maximum 15 m
38.4,115.2	Maximum 2 to 3 m

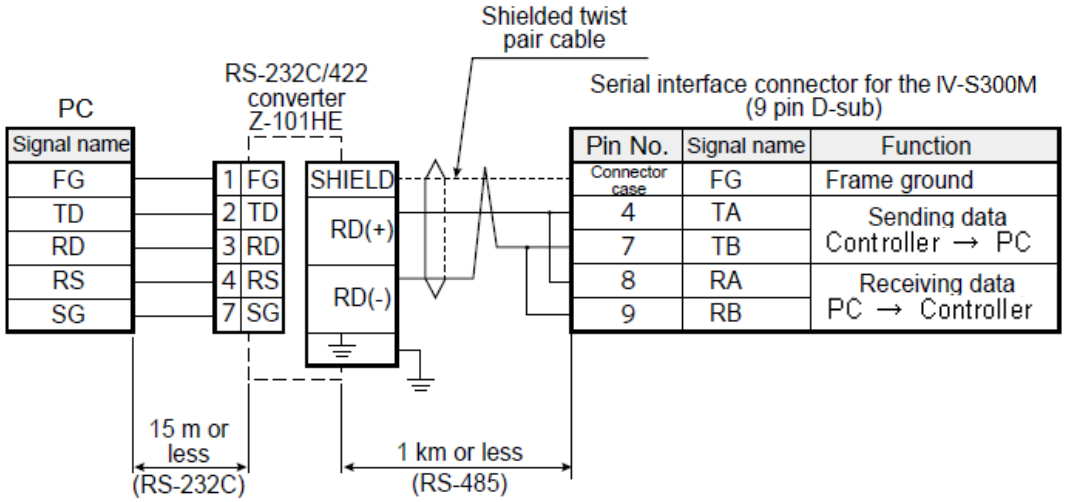
・Please test the communications before using the controller.

[2] To communicate using RS-422

■ 4 line system



■ 2 line system



Notes

- The termination resistance for the Controller is always set to "Enable."

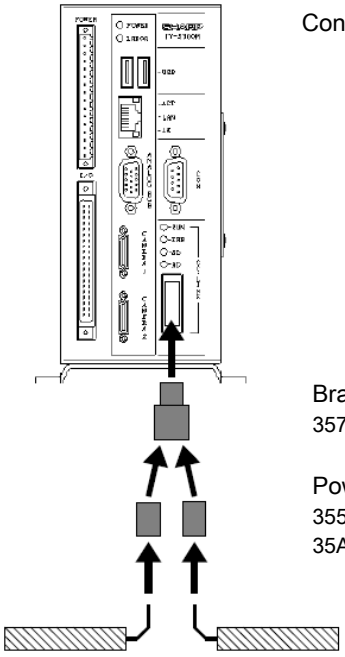
2-3-4 Wiring for CC-Link

Note: IV-S300J does not have CC-Link function.

[1] Recommended Connector and Cable

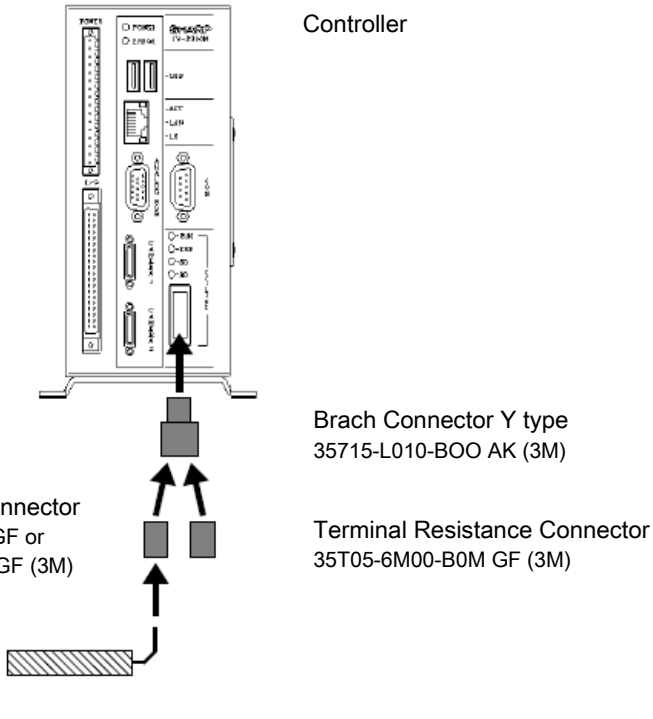
1. When the controller, IV-S300M or IV-S310M, locates in the middle of CC-Link network.

Figure of IV-S300M



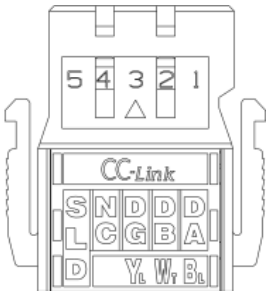
2. When the controller, IV-S300M or IV-S310M, locates at the end of CC-Link network.

Figure of IV-S300M



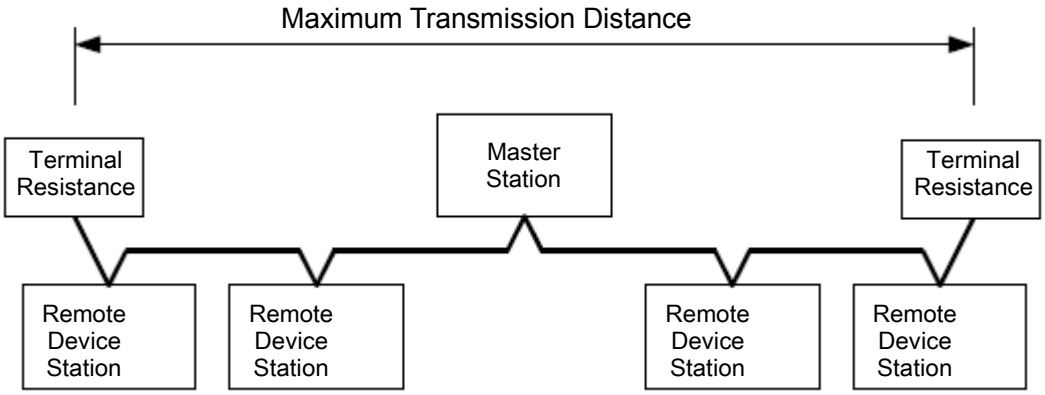
[2] Connector Pins

Pin No.	Signal Name	Color
1	DA	Blue
2	DB	White
3	DG	Yellow
4		Do not use
5	SLD	Ground (shield)



[3] Transmission Speed and Cable Length

All the devices and cables must be compatible with Ver. 1.10.



- When Round Cable for communication, 79100-110SBH, is used:

Transmission Speed	156 kbps	625kbps	2.5Mbps	5Mbps	10Mbps
Cable Length between Stations	> 20 cm	> 20 cm	> 20 cm	> 20 cm	> 20 cm
Maximum Transmission Distance	1200 m	900 m	400 m	160 m	100 m

- When Round Cable for moving parts, 79100-110SBZ-5, is used:

Transmission Speed	156 kbps	625kbps	2.5Mbps	5Mbps	10Mbps
Cable Length between Stations	> 20 cm	> 20 cm	> 20 cm	> 20 cm	> 20 cm
Maximum Transmission Distance	600 m	450 m	200 m	80 m	50 m

- When the above 2 types of the Round Cable are used in the CC-Link:
  The 2 types Round Cables exclusive for Ver. 1.10 can be used together as far as the following condition is met:

  Maximum Transmission Distance of Round Cable
  for communication 79100-110SBH ≧Length of Cable for CC-Link
  + Round Cable for moving parts (transmission distance 70%) x 1.43
  + Round Cable for moving parts (transmission distance 50%) x 2
  + Round Cable for moving parts (transmission distance 30%) x 3.34

[4] Cautions in Setting up CC-Link

● **Transmission Speed/Maximum Transmission Distance**

The maximum transmission distance depends on the cables to be used.
Use the cable within the maximum transmission distance.

● **Minimum Bending Radius**

Keep the minimum bending radius of the cable to be used.
If not kept, problems such as disconnection of connector or cable, cut wire of the cable, etc. may occur.

● **Tensile Force**

Avoid giving tensile force on the cable.
If not avoided, problems such as disconnection of connector or cable, cut wire of the cable, etc. may occur.

● **External Noise**

Route the signal wires away from power lines to avoid giving induced noises on the signals.
Recommended distance is 100 mm or more.
Do not install the Controller in the same control box where high voltage device is installed.
Provide a surge suppressor to the devices that tend to generate noises.

● **Relay Connection of CC-Link Cables**

Use of a relay terminal and a connector may result in communication error.
It is recommended to connect cables directly to the CC-Link unit or use a CC-Link repeater unit.

● **Wiring to Moving Parts**

The cable to be used for moving parts must be the one exclusively for moving parts.
Also, note the following in the wire connection:

1. Do not damage the jacket of wire.
2. Do not do wiring with the wire twisted.
3. Minimized the number of cable fixing.
4. Do not fix a cable where it moves.
5. Do wiring with the optimum length.
6. Keep the bending radius of a cable 10 times or more of the cable diameter.

● **Others**

1. Turn off any power of the devices to be connected when doing the wiring for connection.
2. When use a cable in drum or bundled condition, be careful not to use it in twisted condition.
3. Do not provide a device not for CC-Link, like an arrester, in the communication path.
   If provided, normal communication may not be done due to reflection or reduction of signals.
4. Avoid electric and mechanical interference from other cables such as power line, etc.

● **Wiring of the Connector**

Please wire the connector following the instruction that can be obtained from the following URL.

http://multimedia.3m.com/mws/media/575459O/3mtm-power-clamp-wiremount-connector-instructions.pdf

● **Terminal Resistance**

Be sure to prove the units at both ends with a terminal resistance

● **Grounding of Shield Wire**

1. Connect both ends of the shield wire of the cable exclusively for CC-Link to ”SLD” terminal of each unit.
2. Use the “FG” terminal of each unit as the terminal exclusively for grounding.
3. Grounding must be type D (100Ω or less) .
4. The “SLD” and “FG” terminals of each unit are connected

● **Grounding Method**

1. Use a wire of 1.6 mm diameter or 2 mm^2 or more for the grounding connection.
2. Do not bundle the grounding wire together with power line cables.

2-3-5 Connection of SVGA Monitor

Connect a SVGA monitor to RGB monitor connector (ANALOG RGB) of the Controller with a commercially available analog RGB cable.

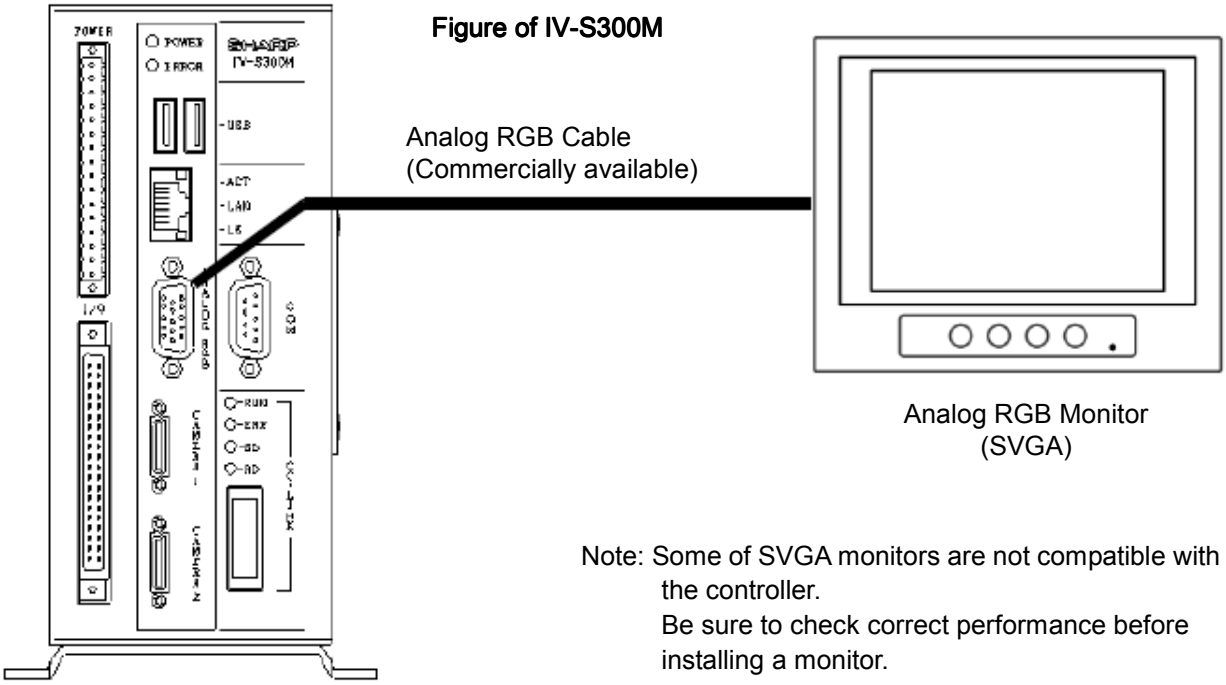


Figure of IV-S300M

Note: Some of SVGA monitors are not compatible with the controller.
Be sure to check correct performance before installing a monitor.

2-3-6 Connection of Ethernet

Connect Ethernet to Ethernet hub of the Controller with a commercially available Ethernet cable.
An Ethernet cable with shield (STP cable) is recommended to have higher noise immunity.
The Ethernet of the controller does not support AutoMDI/MDI-X.
Please use a cross cable when connecting controller with a PC, etc. without through Ethernet hub.

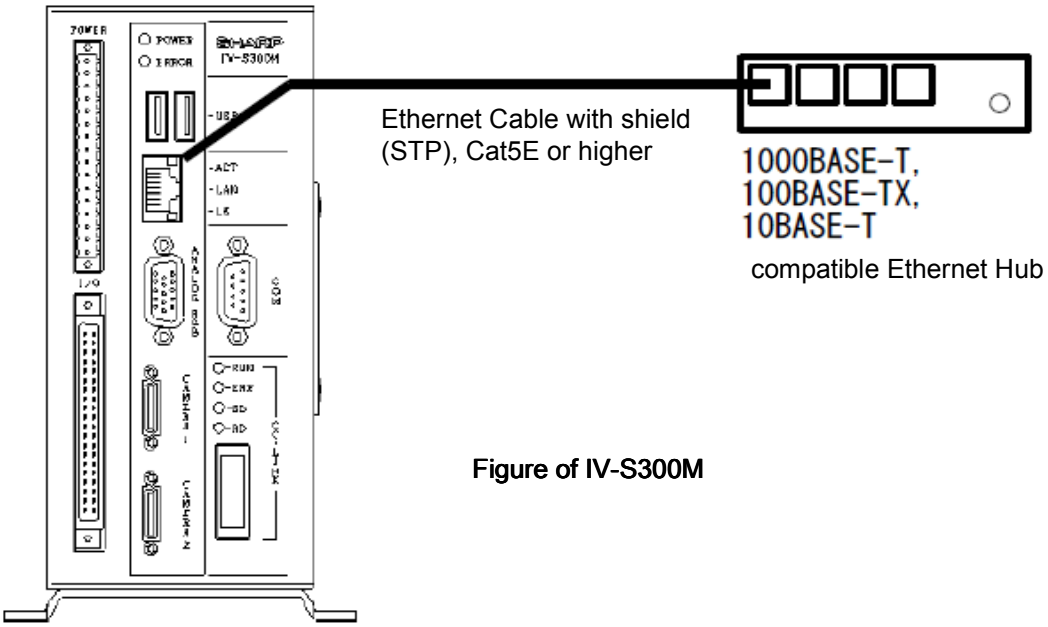


Figure of IV-S300M

2-3-7 Connection of USB Device

Two commercially available USB devices, such as mouse, trackball mouse, flash drive and SD/HDD, can be connected to the Controller. (Maximum rating of two connections: 1 A)

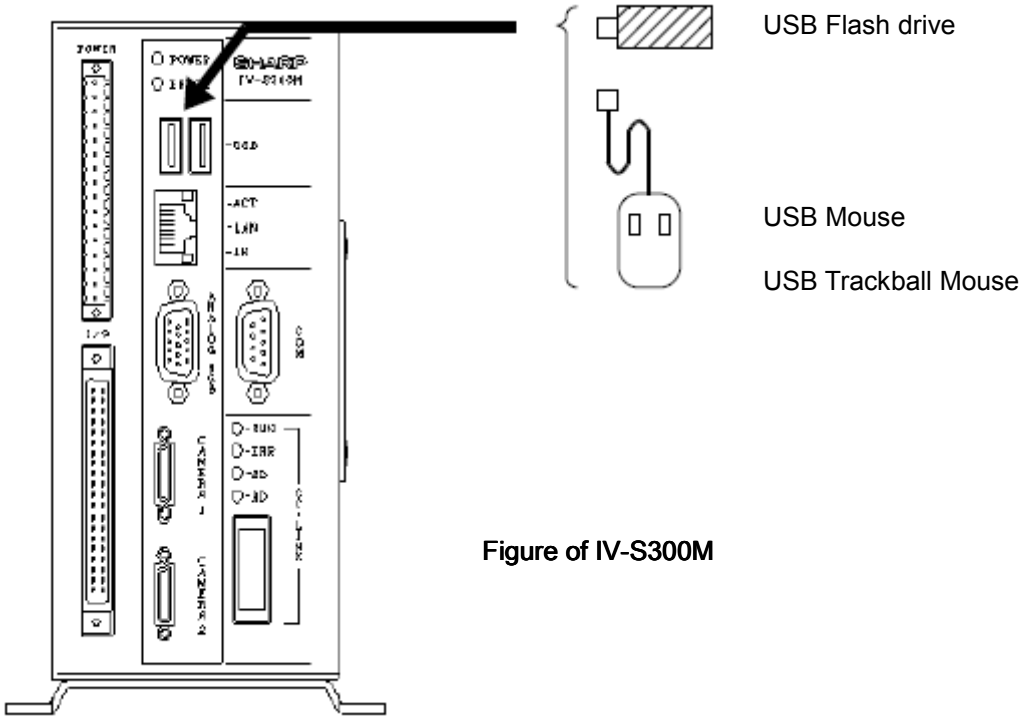


Figure of IV-S300M

Caution:

1. Do not connect other devices than the above.
2. Do not connect an USB device while the Controller is operating. Inspection may be interrupted, otherwise.
   - Connectable USB Flash drive and USB SSD/HDD
     Note: Some of USB memory devices are not compatible with the Controller.
     Be sure to check correct performance before installing an USB memory device.

Requirements for an USB flash drive and USB SSD/HDD

- Class: USB Mass Storage class
- Format: FAT or FAT32
  1. NTFS and exFAT formats are not supported.
  2. 64GB or higher USB memory devices can be used.
     However, Windows cannot format at FAT32 for a drive with 32GB or higher.
     To format 32GB or higher memory device, a format tool provided by SSD/HDD manufacturer is required.
- Do not use the security function of an USB memory device.
  1. Hardware Encrypted USB Flash Drive is not supported
  2. Hardware Encrypted USB Flash Drive can be used if the security software is not installed.
  3. Some USB Flash Drives are installed with the security software in it.
     For such ones, use it after formatting at FAT32.
- Do not use an USB Flash Drive with additional functions such as an anti-virus function.
- Do not use an exclusive tool such as for high speed at Windows side.
- Do not set such as ReadyBoost for speeding up of Windows.

2-4 Setting of Lighting Equipment and Selection of Camera Lens

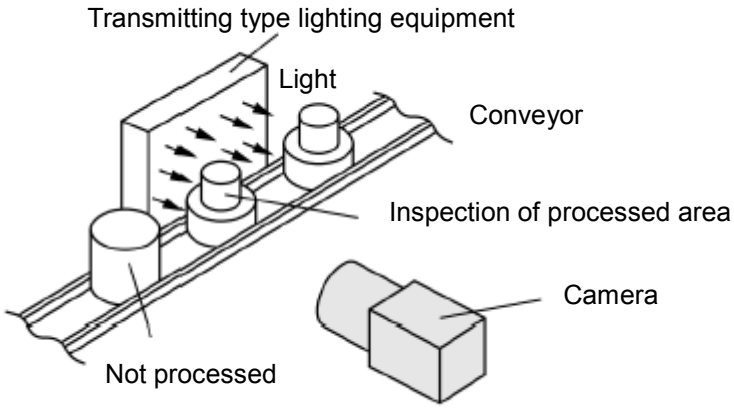
2-4-1 Setting of Lighting Equipment

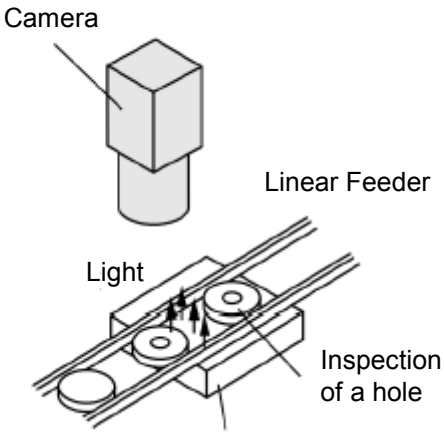
Lighting for a workpiece is very important for the image processing because it affects on the inspection results.
Make sure to select suitable lighting equipment.

- Use enough and even illumination over the inspection area.
- Use lighting equipment that does not flicker, such as high frequency fluorescent lamps or halogen lamps.
- Please contact us for the suitable lighting equipment.

[1] Transmitted Lighting

This is the method to light an inspection object evenly from its back and inspect the shadow picture.
Stable binarization inspection can be expected because the contrast is high.
Example:

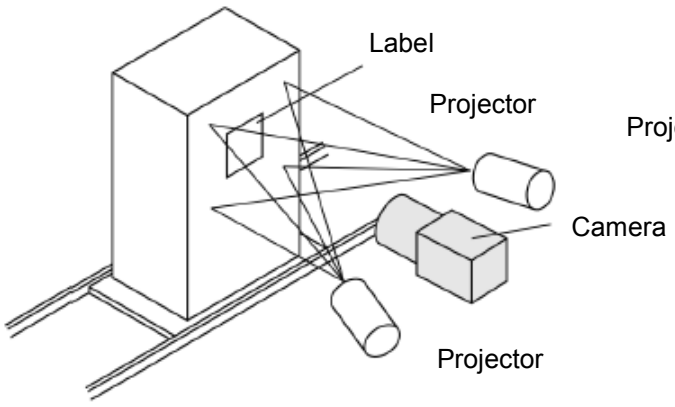




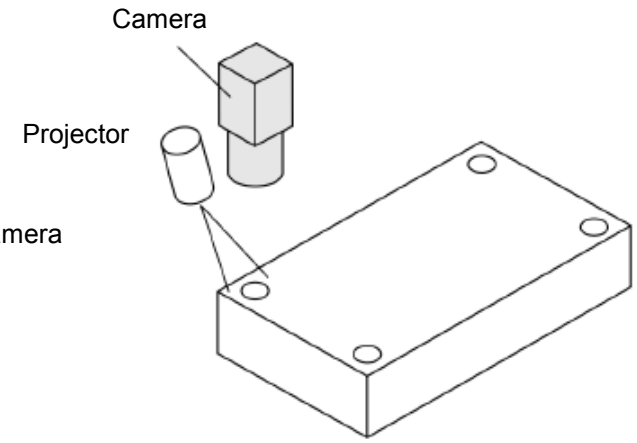
Transmitting type lighting equipment
by surface emitting LED

[2] Reflected Lighting

This is the method to light an inspection object from an angle and capture the reflected light.
An appropriate image may not be captured when the reflection is close to full-reflection as with a metal surface.
Example



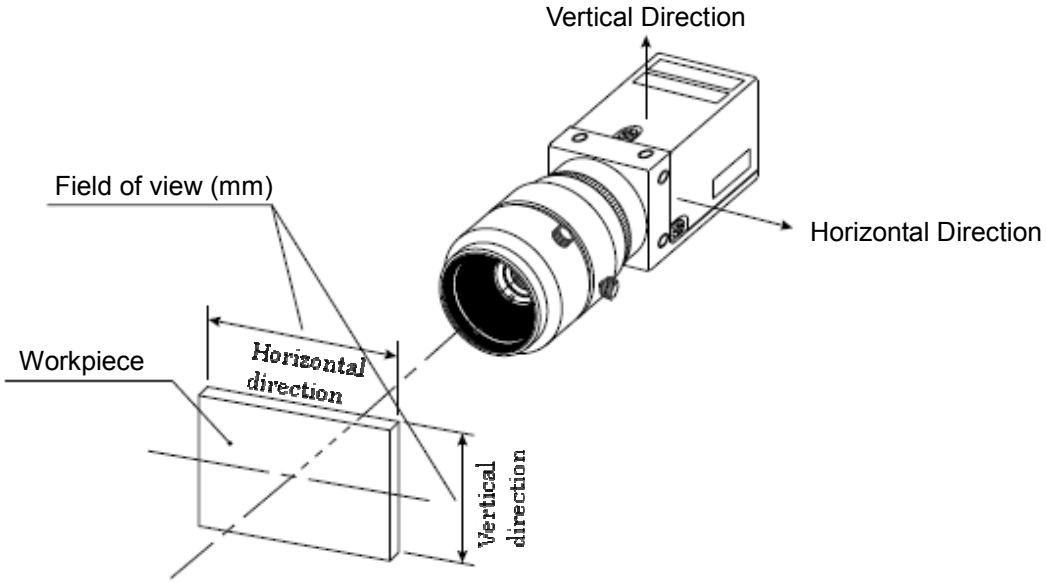
Inspection of Label Attachment

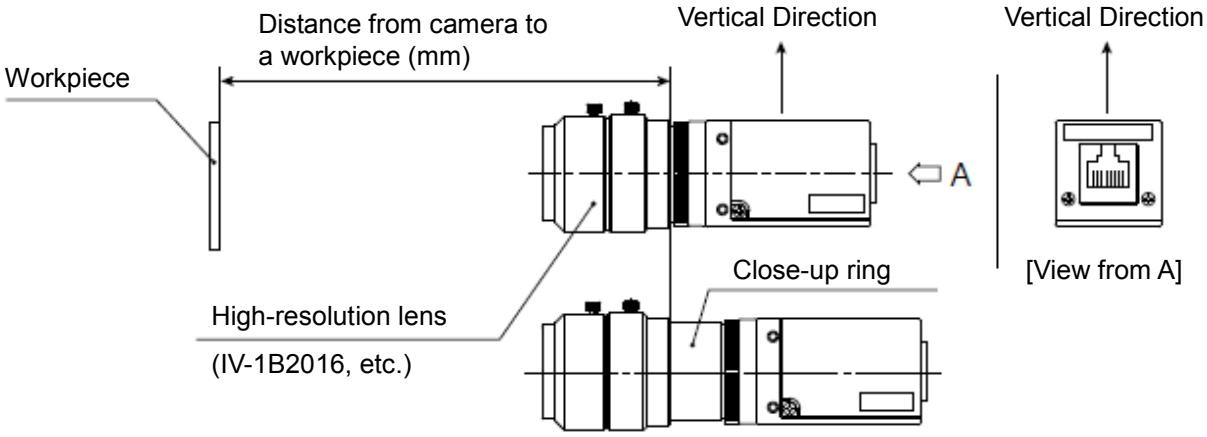


Inspection of Hole Position Coordinates

2-4-2 Selection of Camera Lens

The optimum lens for a camera can be selected according to the camera type, camera installation distance and field of view (size of a workpiece to inspect).

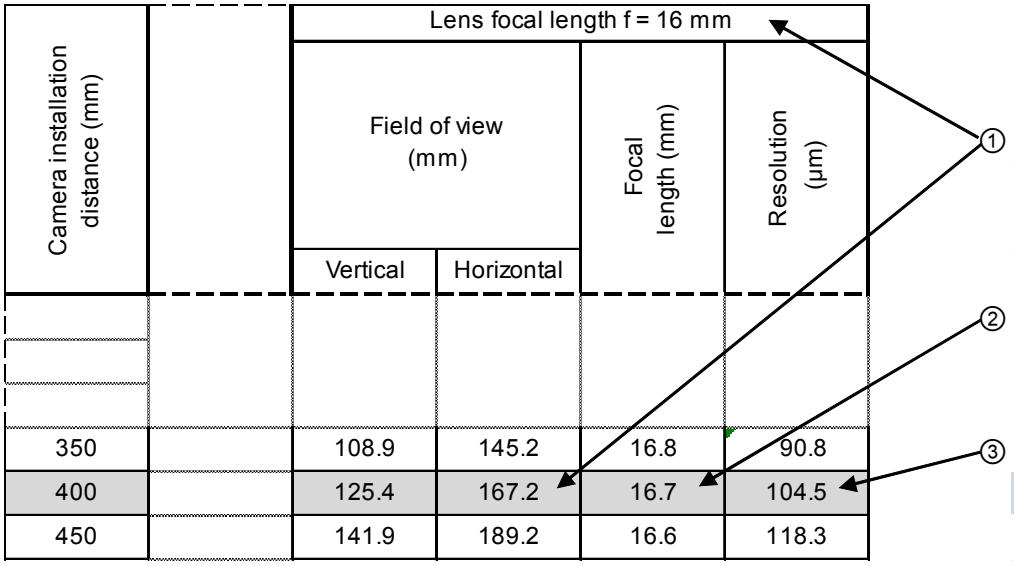




The camera installation distance, field of view (both vertical and horizontal), lens focal length f, focal length and resolution have the relationship shown in the lens selection table as shown in next page.

Example:

The procedure for selecting an optimum lens, when the object is 400 mm from the camera (Camera installation distance) and the Field of view (horizontal) is 160 mm, is shown below.
Find the value you need in the lens selection table.



Camera installation distance (mm)		Lens focal length f = 16 mm			
		Field of view (mm)		Focal length (mm)	Resolution (μm)
		Vertical	Horizontal		
350		108.9	145.2	16.8	90.8
400		125.4	167.2	16.7	104.5
450		141.9	189.2	16.6	118.3

① Selecting lens focal length f

Follow the line for a “Camera installation distance” of 400 mm in the “Horizontal Field of view” column that is closest to 160 mm, which is 167.2 mm.
A 167.2 mm “Field of view” is shown in the column of “Lens focal length f=16 mm”.
Therefore, a lens with focal length of 16 mm is considered to be optimum.

② Considering the focal length

The closest focal length depends on the lens.
When capturing an image at shorter than the closes focal length, a close-up ring must be used between the camera and the lens.
The value in the “Focal length” column in the table is the actual focal length.
The 16.7 mm is longer than the “Lens focal length f = 16 mm” by 0.7 mm.
Use a close-up ring of 0.7 mm thickness.

③ Resolution

When the displayed image fills the whole monitor screen and the horizontal field of view is 167.2 mm, the resolution will be 104.5 μm as calculated below:

Resolution = 167.2 mm / 1600 (number of pixels) = 104.5 μm

Notes

- The values in the lens selection table are for reference before installation.
  Be sure to check the actual performance with the lens during the installation because each lens has its own specific characteristics.
- When a lens with shorter focal distance (f = 12 mm or less) is used, peripheral distortion around the edge of the lens increases.
  Use a lens with longer focal distance to capture an image precisely over the screen.

2-4-3 Lens Selection Table

[1] Lens for IV-S300C5

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
120	85.6	85.6	9.8	33.4	58.8	58.8	14.6	23.0	45.3	45.3	20.5	17.7
140	115.7	115.7	9.4	45.2	80.1	80.1	13.9	31.3	61.3	61.3	19.3	23.9
160	145.8	145.8	9.2	57.0	101.4	101.4	13.5	39.6	77.3	77.3	18.6	30.2
180	175.9	175.9	9.1	68.7	122.8	122.8	13.3	48.0	93.3	93.3	18.2	36.4
190	191.0	191.0	9.1	74.6	133.4	133.4	13.2	52.1	101.3	101.3	18.0	39.6
200	206.0	206.0	9.0	80.5	144.1	144.1	13.1	56.3	109.3	109.3	17.9	42.7
210	221.1	221.1	9.0	86.4	154.8	154.8	13.0	60.5	117.3	117.3	17.7	45.8
220	236.2	236.2	9.0	92.3	165.4	165.4	12.9	64.6	125.3	125.3	17.6	48.9
230	251.2	251.2	8.9	98.1	176.1	176.1	12.9	68.8	133.3	133.3	17.5	52.1
240	266.3	266.3	8.9	104.0	186.8	186.8	12.8	73.0	141.3	141.3	17.4	55.2
260	296.4	296.4	8.9	115.8	208.1	208.1	12.7	81.3	157.3	157.3	17.3	61.4
280	326.5	326.5	8.8	127.5	229.4	229.4	12.7	89.6	173.3	173.3	17.2	67.7
300	356.6	356.6	8.8	139.3	250.8	250.8	12.6	98.0	189.3	189.3	17.1	73.9
350	431.9	431.9	8.8	168.7	304.1	304.1	12.5	118.8	229.3	229.3	16.9	89.6
400	507.2	507.2	8.7	198.1	357.4	357.4	12.4	139.6	269.3	269.3	16.8	105.2
450	582.5	582.5	8.7	227.5	410.8	410.8	12.4	160.5	309.3	309.3	16.7	120.8
500	657.8	657.8	8.7	257.0	464.1	464.1	12.3	181.3	349.3	349.3	16.6	136.4
550	733.1	733.1	8.6	286.4	517.4	517.4	12.3	202.1	389.3	389.3	16.5	152.1
600	808.4	808.4	8.6	315.8	570.8	570.8	12.3	223.0	429.3	429.3	16.5	167.7
650	883.7	883.7	8.6	345.2	624.1	624.1	12.2	243.8	469.3	469.3	16.4	183.3
700	959.0	959.0	8.6	374.6	677.4	677.4	12.2	264.6	509.3	509.3	16.4	198.9
750	1034.3	1034.3	8.6	404.0	730.8	730.8	12.2	285.5	549.3	549.3	16.4	214.6
800	1109.6	1109.6	8.6	433.4	784.1	784.1	12.2	306.3	589.3	589.3	16.3	230.2
850	1184.9	1184.9	8.6	462.8	837.4	837.4	12.2	327.1	629.3	629.3	16.3	245.8
900	1260.2	1260.2	8.6	492.3	890.8	890.8	12.2	348.0	669.3	669.3	16.3	261.4
950	1335.5	1335.5	8.6	521.7	944.1	944.1	12.2	368.8	709.3	709.3	16.3	277.1
1000	1410.7	1410.7	8.6	551.1	997.4	997.4	12.2	389.6	749.3	749.3	16.3	292.7
1050	1486.0	1486.0	8.6	580.5	1050.8	1050.8	12.1	410.5	789.3	789.3	16.3	308.3
1100	1561.3	1561.3	8.6	609.9	1104.1	1104.1	12.1	431.3	829.3	829.3	16.2	323.9
1150	1636.6	1636.6	8.6	639.3	1157.4	1157.4	12.1	452.1	869.3	869.3	16.2	339.6
1200	1711.9	1711.9	8.6	668.7	1210.8	1210.8	12.1	473.0	909.3	909.3	16.2	355.2
1250	1787.2	1787.2	8.6	698.1	1264.1	1264.1	12.1	493.8	949.3	949.3	16.2	370.8
1300	1862.5	1862.5	8.6	727.5	1317.4	1317.4	12.1	514.6	989.3	989.3	16.2	386.4
1350	1937.8	1937.8	8.6	757.0	1370.8	1370.8	12.1	535.5	1029.3	1029.3	16.2	402.1
1400	2013.1	2013.1	8.6	786.4	1424.1	1424.1	12.1	556.3	1069.3	1069.3	16.2	417.7

Recommended Lens (Kowa Optical Inc. 8M Pixel Lens)

Focal Length (mm)	Model
8	LM8XC2
12	LM12XC2
16	LM16XC2
25	LM25XC2
35	LM35XC2
50	LM50XC2

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
120	24.3	24.3	38.2	9.5	16.3	16.3	62.4	6.4	—	—	—	—
140	34.6	34.6	34.3	13.5	23.7	23.7	53.9	9.2	9.3	9.3	118.5	3.7
160	44.8	44.8	32.1	17.5	31.0	31.0	49.5	12.1	14.5	14.5	94.2	5.7
180	55.0	55.0	30.8	21.5	38.3	38.3	46.7	15.0	19.6	19.6	82.7	7.7
190	60.2	60.2	30.3	23.5	41.9	41.9	45.7	16.4	22.1	22.1	78.9	8.7
200	65.3	65.3	29.9	25.5	45.6	45.6	44.8	17.8	24.7	24.7	75.9	9.7
210	70.4	70.4	29.5	27.5	49.3	49.3	44.1	19.2	27.3	27.3	73.5	10.7
220	75.5	75.5	29.2	29.5	52.9	52.9	43.5	20.7	29.8	29.8	71.5	11.7
230	80.6	80.6	29.0	31.5	56.6	56.6	42.9	22.1	32.4	32.4	69.8	12.7
240	85.8	85.8	28.7	33.5	60.2	60.2	42.4	23.5	34.9	34.9	68.3	13.7
260	96.0	96.0	28.3	37.5	67.5	67.5	41.6	26.4	40.1	40.1	66.0	15.7
280	106.2	106.2	28.0	41.5	74.9	74.9	41.0	29.2	45.2	45.2	64.2	17.7
300	116.5	116.5	27.7	45.5	82.2	82.2	40.5	32.1	50.3	50.3	62.7	19.7
350	142.1	142.1	27.3	55.5	100.5	100.5	39.5	39.2	63.1	63.1	60.1	24.7
400	167.7	167.7	26.9	65.5	118.7	118.7	38.8	46.4	75.9	75.9	58.4	29.7
450	193.3	193.3	26.7	75.5	137.0	137.0	38.3	53.5	88.7	88.7	57.2	34.7
500	218.9	218.9	26.5	85.5	155.3	155.3	37.9	60.7	101.5	101.5	56.3	39.7
550	244.5	244.5	26.3	95.5	173.6	173.6	37.6	67.8	114.3	114.3	55.6	44.7
600	270.1	270.1	26.2	105.5	191.9	191.9	37.3	75.0	127.1	127.1	55.0	49.7
650	295.7	295.7	26.1	115.5	210.2	210.2	37.1	82.1	139.9	139.9	54.6	54.7
700	321.3	321.3	26.0	125.5	228.5	228.5	37.0	89.2	152.7	152.7	54.2	59.7
750	346.9	346.9	25.9	135.5	246.7	246.7	36.8	96.4	165.5	165.5	53.9	64.7
800	372.5	372.5	25.9	145.5	265.0	265.0	36.7	103.5	178.3	178.3	53.6	69.7
850	398.1	398.1	25.8	155.5	283.3	283.3	36.6	110.7	191.1	191.1	53.3	74.7
900	423.7	423.7	25.8	165.5	301.6	301.6	36.5	117.8	203.9	203.9	53.1	79.7
950	449.3	449.3	25.7	175.5	319.9	319.9	36.4	125.0	216.7	216.7	53.0	84.7
1000	474.9	474.9	25.7	185.5	338.2	338.2	36.3	132.1	229.5	229.5	52.8	89.7
1050	500.5	500.5	25.6	195.5	356.5	356.5	36.3	139.2	242.3	242.3	52.6	94.7
1100	526.1	526.1	25.6	205.5	374.7	374.7	36.2	146.4	255.1	255.1	52.5	99.7
1150	551.7	551.7	25.6	215.5	393.0	393.0	36.1	153.5	267.9	267.9	52.4	104.7
1200	577.3	577.3	25.6	225.5	411.3	411.3	36.1	160.7	280.7	280.7	52.3	109.7
1250	602.9	602.9	25.5	235.5	429.6	429.6	36.0	167.8	293.5	293.5	52.2	114.7
1300	628.5	628.5	25.5	245.5	447.9	447.9	36.0	175.0	306.3	306.3	52.1	119.7
1350	654.1	654.1	25.5	255.5	466.2	466.2	36.0	182.1	319.1	319.1	52.0	124.7
1400	679.7	679.7	25.5	265.5	484.5	484.5	35.9	189.2	331.9	331.9	51.9	129.7

[2] Lens for IV-S300C7/C8

(1) Lens (Sharp Corporation)

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
60	11.3	12.0	9.9	23.4	8.6	9.1	15.7	17.8	6.6	7.0	22.4	13.8
65	12.9	13.8	9.6	26.9	9.7	10.3	15.3	20.1	7.4	7.9	21.7	15.5
70	14.6	15.5	9.5	30.3	10.8	11.5	14.9	22.4	8.3	8.8	21.1	17.2
75	16.2	17.3	9.3	33.8	11.9	12.6	14.7	24.7	9.1	9.7	20.7	18.9
80	17.9	19.0	9.2	37.2	13.0	13.8	14.4	27.0	9.9	10.6	20.3	20.6
85	19.5	20.8	9.1	40.6	14.1	15.0	14.3	29.3	10.7	11.4	19.9	22.3
90	21.2	22.6	9.0	44.1	15.2	16.2	14.1	31.6	11.6	12.3	19.7	24.1
95	22.8	24.3	8.9	47.5	16.3	17.3	13.9	33.9	12.4	13.2	19.4	25.8
100	24.5	26.1	8.9	50.9	17.4	18.5	13.8	36.2	13.2	14.1	19.2	27.5
120	31.1	33.1	8.7	64.7	21.8	23.2	13.5	45.3	16.5	17.6	18.6	34.4
140	37.7	40.2	8.6	78.4	26.2	27.9	13.2	54.5	19.8	21.1	18.1	41.3
160	44.3	47.2	8.5	92.2	30.6	32.6	13.0	63.7	23.1	24.6	17.8	48.1
180	50.9	54.2	8.4	105.9	35.0	37.3	12.9	72.8	26.4	28.2	17.6	55.0
190	54.2	57.8	8.4	112.8	37.2	39.6	12.9	77.4	28.1	29.9	17.5	58.4
200	57.5	61.3	8.4	119.7	39.4	42.0	12.8	82.0	29.7	31.7	17.4	61.9
210	60.8	64.8	8.3	126.6	41.6	44.3	12.8	86.6	31.4	33.4	17.3	65.3
220	64.1	68.3	8.3	133.4	43.8	46.7	12.7	91.2	33.0	35.2	17.3	68.8
230	67.4	71.8	8.3	140.3	46.0	49.0	12.7	95.7	34.7	37.0	17.2	72.2
240	70.7	75.4	8.3	147.2	48.2	51.4	12.7	100.3	36.3	38.7	17.2	75.6
260	77.3	82.4	8.3	160.9	52.6	56.1	12.6	109.5	39.6	42.2	17.1	82.5
280	83.9	89.4	8.3	174.7	57.0	60.8	12.6	118.7	42.9	45.8	17.0	89.4
300	90.5	96.5	8.2	188.4	61.4	65.4	12.5	127.8	46.2	49.3	16.9	96.3
350	107.0	114.1	8.2	222.8	72.4	77.2	12.4	150.7	54.5	58.1	16.8	113.4
400	123.5	131.7	8.2	257.2	83.4	88.9	12.4	173.7	62.7	66.9	16.7	130.6
450	140.0	149.3	8.2	291.6	94.4	100.6	12.3	196.6	71.0	75.7	16.6	147.8
500	156.5	166.9	8.1	325.9	105.4	112.4	12.3	219.5	79.2	84.5	16.5	165.0
550	173.0	184.5	8.1	360.3	116.4	124.1	12.3	242.4	87.5	93.3	16.5	182.2
600	189.5	202.1	8.1	394.7	127.4	135.8	12.2	265.3	95.7	102.1	16.4	199.4
650	206.0	219.7	8.1	429.1	138.4	147.6	12.2	288.2	104.0	110.9	16.4	216.6
700	222.5	237.3	8.1	463.4	149.4	159.3	12.2	311.2	112.2	119.7	16.4	233.8
750	239.0	254.9	8.1	497.8	160.4	171.0	12.2	334.1	120.5	128.5	16.4	250.9
800	255.5	272.5	8.1	532.2	171.4	182.8	12.2	357.0	128.7	137.3	16.3	268.1
850	272.0	290.1	8.1	566.6	182.4	194.5	12.2	379.9	137.0	146.1	16.3	285.3
900	288.5	307.7	8.1	600.9	193.4	206.2	12.2	402.8	145.2	154.9	16.3	302.5
950	305.0	325.3	8.1	635.3	204.4	218.0	12.2	425.7	153.5	163.7	16.3	319.7
1000	321.5	342.9	8.1	669.7	215.4	229.7	12.1	448.7	161.7	172.5	16.3	336.9
1050	338.0	360.5	8.1	704.1	226.4	241.4	12.1	471.6	170.0	181.3	16.2	354.1
1100	354.5	378.1	8.1	738.4	237.4	253.2	12.1	494.5	178.2	190.1	16.2	371.3
1150	371.0	395.7	8.1	772.8	248.4	264.9	12.1	517.4	186.5	198.9	16.2	388.4
1200	387.5	413.3	8.1	807.2	259.4	276.6	12.1	540.3	194.7	207.7	16.2	405.6
1250	404.0	430.9	8.1	841.6	270.4	288.4	12.1	563.2	203.0	216.5	16.2	422.8
1300	420.5	448.5	8.1	875.9	281.4	300.1	12.1	586.2	211.2	225.3	16.2	440.0
1350	437.0	466.1	8.0	910.3	292.4	311.8	12.1	609.1	219.5	234.1	16.2	457.2
1400	453.5	483.7	8.0	944.7	303.4	323.6	12.1	632.0	227.7	242.9	16.2	474.4

Recommended Lens (Sharp Corporation)

Focal Length (mm)	8	12	16	25	35	50
Model	IV-1B2008	IV-1B2012	IV-1B2016	IV-1B2025	IV-1B2035	IV-1B2050

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
60	3.3	3.5	45.1	6.8	1.5	1.6	95.6	3.2				
65	3.8	4.1	42.3	7.9	1.9	2.0	83.6	4.0				
70	4.3	4.6	40.2	9.0	2.3	2.4	75.6	4.7				
75	4.9	5.2	38.6	10.1	2.7	2.8	69.8	5.5				
80	5.4	5.8	37.2	11.2	3.0	3.2	65.5	6.3	—	—	—	—
85	5.9	6.3	36.1	12.3	3.4	3.6	62.1	7.1				
90	6.5	6.9	35.2	13.4	3.8	4.0	59.4	7.9				
95	7.0	7.4	34.5	14.5	4.2	4.4	57.2	8.7				
100	7.5	8.0	33.8	15.6	4.5	4.8	55.3	9.5				
120	9.6	10.3	31.9	20.0	6.0	6.5	50.3	12.6				
140	11.7	12.5	30.6	24.4	7.6	8.1	47.2	15.7	3.0	3.2	94.6	6.2
160	13.8	14.8	29.8	28.8	9.1	9.7	45.2	18.9	4.0	4.3	82.9	8.4
180	16.0	17.0	29.1	33.2	10.6	11.3	43.7	22.0	5.1	5.4	76.0	10.6
190	17.0	18.1	28.9	35.4	11.3	12.1	43.2	23.6	5.6	6.0	73.6	11.7
200	18.1	19.3	28.7	37.6	12.1	12.9	42.6	25.2	6.1	6.5	71.6	12.8
210	19.1	20.4	28.5	39.8	12.8	13.7	42.2	26.7	6.7	7.1	69.8	13.9
220	20.2	21.5	28.3	42.0	13.6	14.5	41.8	28.3	7.2	7.7	68.4	15.0
230	21.2	22.7	28.1	44.2	14.3	15.3	41.4	29.9	7.7	8.2	67.1	16.1
240	22.3	23.8	28.0	46.4	15.1	16.1	41.1	31.5	8.2	8.8	66.0	17.2
260	24.4	26.0	27.7	50.8	16.6	17.7	40.6	34.6	9.3	9.9	64.2	19.4
280	26.5	28.3	27.5	55.2	18.1	19.3	40.1	37.7	10.3	11.0	62.8	21.6
300	28.6	30.5	27.3	59.6	19.6	20.9	39.7	40.9	11.4	12.2	61.6	23.8
350	33.9	36.2	26.9	70.6	23.4	25.0	38.9	48.7	14.0	15.0	59.4	29.3
400	39.2	41.8	26.7	81.6	27.2	29.0	38.4	56.6	16.7	17.8	57.9	34.8
450	44.5	47.4	26.5	92.6	30.9	33.0	38.0	64.5	19.3	20.6	56.8	40.3
500	49.7	53.1	26.3	103.6	34.7	37.0	37.7	72.3	22.0	23.4	56.0	45.8
550	55.0	58.7	26.2	114.6	38.5	41.0	37.4	80.2	24.6	26.2	55.4	51.3
600	60.3	64.3	26.1	125.6	42.3	45.1	37.2	88.0	27.2	29.1	54.8	56.8
650	65.6	70.0	26.0	136.6	46.0	49.1	37.0	95.9	29.9	31.9	54.4	62.3
700	70.9	75.6	25.9	147.6	49.8	53.1	36.9	103.7	32.5	34.7	54.1	67.8
750	76.1	81.2	25.9	158.6	53.6	57.1	36.7	111.6	35.2	37.5	53.8	73.3
800	81.4	86.9	25.8	169.6	57.3	61.2	36.6	119.5	37.8	40.3	53.5	78.8
850	86.7	92.5	25.8	180.6	61.1	65.2	36.5	127.3	40.4	43.1	53.3	84.3
900	92.0	98.1	25.7	191.6	64.9	69.2	36.4	135.2	43.1	46.0	53.1	89.8
950	97.3	103.8	25.7	202.6	68.7	73.2	36.3	143.0	45.7	48.8	52.9	95.3
1000	102.5	109.4	25.6	213.6	72.4	77.3	36.3	150.9	48.4	51.6	52.7	100.8
1050	107.8	115.0	25.6	224.6	76.2	81.3	36.2	158.7	51.0	54.4	52.6	106.3
1100	113.1	120.6	25.6	235.6	80.0	85.3	36.2	166.6	53.6	57.2	52.5	111.8
1150	118.4	126.3	25.6	246.6	83.7	89.3	36.1	174.5	56.3	60.0	52.3	117.3
1200	123.7	131.9	25.5	257.6	87.5	93.3	36.1	182.3	58.9	62.9	52.2	122.8
1250	128.9	137.5	25.5	268.6	91.3	97.4	36.0	190.2	61.6	65.7	52.1	128.3
1300	134.2	143.2	25.5	279.6	95.1	101.4	36.0	198.0	64.2	68.5	52.1	133.8
1350	139.5	148.8	25.5	290.6	98.8	105.4	35.9	205.9	66.8	71.3	52.0	139.3
1400	144.8	154.4	25.5	301.6	102.6	109.4	35.9	213.7	69.5	74.1	51.9	144.8

(2) Lens (Ricoh Imaging Co., Ltd.) (IV-S300C7/C8)

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
60	7.3	7.8	8.4	15.2	11.8	12.6	10.1	24.6	5.8	6.2	17.9	12.1
65	9.6	10.3	7.9	20.1	13.5	14.4	9.9	28.1	7.1	7.6	16.9	14.8
70	11.9	12.7	7.6	24.8	15.2	16.2	9.7	31.6	8.3	8.9	16.2	17.3
75	14.1	15.1	7.4	29.4	16.8	17.9	9.5	35.0	9.5	10.1	15.7	19.8
80	16.3	17.4	7.2	34.0	18.4	19.7	9.4	38.4	10.6	11.3	15.3	22.2
85	18.5	19.7	7.1	38.6	20.1	21.4	9.3	41.8	11.8	12.6	15.1	24.5
90	20.7	22.1	7.0	43.1	21.7	23.1	9.2	45.2	12.9	13.8	14.8	26.9
95	22.8	24.4	6.9	47.6	23.3	24.9	9.2	48.6	14.0	14.9	14.6	29.2
100	25.0	26.7	6.9	52.1	24.9	26.6	9.1	52.0	15.1	16.1	14.4	31.5
120	33.6	35.8	6.7	70.0	31.4	33.5	8.9	65.4	19.5	20.8	14.0	40.7
140	42.1	45.0	6.6	87.8	37.9	40.4	8.8	78.9	23.9	25.5	13.7	49.8
160	50.7	54.1	6.5	105.6	44.3	47.2	8.7	92.3	28.2	30.1	13.4	58.8
180	59.2	63.2	6.5	123.4	50.7	54.1	8.7	105.6	32.6	34.7	13.3	67.8
190	63.5	67.7	6.5	132.3	53.9	57.5	8.6	112.3	34.7	37.0	13.2	72.3
200	67.8	72.3	6.4	141.2	57.1	60.9	8.6	119.0	36.9	39.3	13.2	76.8
210	72.0	76.8	6.4	150.1	60.3	64.4	8.6	125.7	39.0	41.6	13.1	81.3
220	76.3	81.4	6.4	158.9	63.6	67.8	8.6	132.4	41.2	43.9	13.1	85.8
230	80.6	85.9	6.4	167.8	66.8	71.2	8.6	139.1	43.3	46.2	13.0	90.3
240	84.8	90.5	6.4	176.7	70.0	74.6	8.6	145.8	45.5	48.5	13.0	94.8
260	93.3	99.6	6.4	194.5	76.4	81.5	8.5	159.1	49.8	53.1	12.9	103.8
280	101.9	108.7	6.4	212.2	82.8	88.3	8.5	172.5	54.1	57.7	12.9	112.7
300	110.4	117.7	6.3	230.0	89.2	95.2	8.5	185.8	58.4	62.3	12.8	121.7
350	131.7	140.5	6.3	274.4	105.2	112.3	8.4	219.2	69.2	73.8	12.8	144.1
400	153.0	163.2	6.3	318.7	121.3	129.3	8.4	252.6	79.9	85.2	12.7	166.5
450	174.3	185.9	6.3	363.1	137.3	146.4	8.4	286.0	90.7	96.7	12.7	188.9
500	195.6	208.6	6.3	407.5	153.3	163.5	8.4	319.4	101.4	108.2	12.6	211.3
550	216.9	231.4	6.3	451.9	169.3	180.6	8.4	352.8	112.2	119.6	12.6	233.7
600	238.2	254.1	6.3	496.2	185.3	197.7	8.4	386.1	122.9	131.1	12.6	256.0
650	259.5	276.8	6.3	540.6	201.4	214.8	8.4	419.5	133.6	142.5	12.5	278.4
700	280.8	299.5	6.3	585.0	217.4	231.9	8.3	452.9	144.4	154.0	12.5	300.8
750	302.1	322.2	6.3	629.3	233.4	249.0	8.3	486.2	155.1	165.5	12.5	323.2
800	323.4	344.9	6.2	673.7	249.4	266.0	8.3	519.6	165.9	176.9	12.5	345.5
850	344.7	367.7	6.2	718.1	265.4	283.1	8.3	553.0	176.6	188.4	12.5	367.9
900	366.0	390.4	6.2	762.4	281.4	300.2	8.3	586.3	187.3	199.8	12.5	390.3
950	387.3	413.1	6.2	806.8	297.5	317.3	8.3	619.7	198.1	211.3	12.5	412.7
1000	408.6	435.8	6.2	851.2	313.5	334.4	8.3	653.1	208.8	222.7	12.4	435.0
1050	429.9	458.5	6.2	895.5	329.5	351.5	8.3	686.4	219.6	234.2	12.4	457.4
1100	451.2	481.2	6.2	939.9	345.5	368.5	8.3	719.8	230.3	245.6	12.4	479.8
1150	472.4	503.9	6.2	984.3	361.5	385.6	8.3	753.2	241.0	257.1	12.4	502.1
1200	493.7	526.7	6.2	1028.6	377.5	402.7	8.3	786.6	251.8	268.6	12.4	524.5
1250	515.0	549.4	6.2	1073.0	393.6	419.8	8.3	819.9	262.5	280.0	12.4	546.9
1300	536.3	572.1	6.2	1117.4	409.6	436.9	8.3	853.3	273.2	291.5	12.4	569.3
1350	557.6	594.8	6.2	1161.7	425.6	454.0	8.3	886.7	284.0	302.9	12.4	591.6
1400	578.9	617.5	6.2	1206.1	441.6	471.0	8.3	920.0	294.7	314.4	12.4	614.0

Recommended Lens (Ricoh Imaging Co., Ltd.)

Focal Length (mm)	6	8	12	16
Model	FL-CC0614A-2M	FL-CC0814A-2M	FL-CC1214A-2M	FL-CC1614A-2M

Focal Length (mm)	25	35	50	75
Model	FL-CC2514A-2M	FL-CC3516-2M	FL-CC5024A-2M	FL-CC7528-2M

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (µm)	Field of view (mm)		Focal length (mm)	Resolution (µm)	Field of view (mm)		Focal length (mm)	Resolution (µm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
60	6.3	6.7	22.7	13.2								
65	7.3	7.8	21.8	15.2	—	—	—	—				
70	8.2	8.8	21.1	17.1								
75	9.1	9.7	20.6	19.0	3.6	3.8	44.4	7.5				
80	10.0	10.7	20.2	20.9	4.5	4.8	40.6	9.4	—	—	—	—
85	10.9	11.6	19.9	22.7	5.2	5.6	38.5	10.9				
90	11.8	12.6	19.6	24.5	5.9	6.3	37.1	12.3				
95	12.6	13.5	19.3	26.3	6.5	7.0	36.0	13.6				
100	13.5	14.4	19.1	28.1	7.1	7.6	35.1	14.9	3.8	4.0	57.6	7.9
120	16.9	18.0	18.5	35.2	9.4	10.1	32.8	19.7	6.0	6.4	48.8	12.6
140	20.3	21.6	18.1	42.2	11.6	12.4	31.4	24.2	7.9	8.4	45.4	16.4
160	23.6	25.2	17.8	49.2	13.8	14.7	30.5	28.7	9.6	10.2	43.3	19.9
180	27.0	28.8	17.6	56.2	15.9	17.0	29.9	33.2	11.2	12.0	41.9	23.4
190	28.6	30.5	17.5	59.6	17.0	18.1	29.6	35.4	12.0	12.9	41.4	25.1
200	30.3	32.3	17.4	63.1	18.0	19.2	29.4	37.6	12.9	13.7	40.9	26.8
210	31.9	34.1	17.3	66.6	19.1	20.4	29.2	39.7	13.7	14.6	40.5	28.5
220	33.6	35.8	17.3	70.0	20.1	21.5	29.0	41.9	14.5	15.4	40.1	30.2
230	35.3	37.6	17.2	73.5	21.2	22.6	28.8	44.1	15.3	16.3	39.8	31.8
240	36.9	39.4	17.2	76.9	22.2	23.7	28.7	46.3	16.1	17.2	39.5	33.5
260	40.2	42.9	17.1	83.8	24.3	25.9	28.4	50.6	17.7	18.9	39.0	36.8
280	43.5	46.5	17.0	90.7	26.4	28.2	28.2	55.0	19.3	20.5	38.6	40.1
300	46.9	50.0	16.9	97.6	28.5	30.4	28.0	59.3	20.8	22.2	38.2	43.4
350	55.1	58.8	16.8	114.8	33.7	35.9	27.6	70.1	24.8	26.4	37.6	51.6
400	63.4	67.6	16.7	132.1	38.8	41.4	27.4	80.9	28.7	30.6	37.1	59.8
450	71.6	76.4	16.6	149.3	44.0	46.9	27.2	91.7	32.6	34.8	36.7	68.0
500	79.9	85.2	16.5	166.5	49.2	52.5	27.0	102.5	36.5	39.0	36.4	76.1
550	88.2	94.0	16.5	183.7	54.3	58.0	26.9	113.2	40.4	43.1	36.2	84.3
600	96.4	102.8	16.4	200.9	59.5	63.5	26.8	124.0	44.4	47.3	36.0	92.4
650	104.7	111.6	16.4	218.1	64.7	69.0	26.7	134.7	48.3	51.5	35.8	100.5
700	112.9	120.4	16.4	235.2	69.8	74.5	26.6	145.5	52.2	55.6	35.7	108.6
750	121.2	129.2	16.4	252.4	75.0	80.0	26.5	156.2	56.0	59.8	35.5	116.8
800	129.4	138.0	16.3	269.6	80.1	85.5	26.5	167.0	59.9	63.9	35.4	124.9
850	137.7	146.8	16.3	286.8	85.3	91.0	26.4	177.7	63.8	68.1	35.4	133.0
900	145.9	155.6	16.3	304.0	90.5	96.5	26.4	188.5	67.7	72.2	35.3	141.1
950	154.2	164.4	16.3	321.2	95.6	102.0	26.3	199.2	71.6	76.4	35.2	149.2
1000	162.4	173.2	16.3	338.4	100.8	107.5	26.3	209.9	75.5	80.6	35.1	157.3
1050	170.7	182.0	16.3	355.5	105.9	113.0	26.3	220.7	79.4	84.7	35.1	165.4
1100	178.9	190.8	16.2	372.7	111.1	118.5	26.2	231.4	83.3	88.9	35.0	173.6
1150	187.2	199.6	16.2	389.9	116.2	124.0	26.2	242.2	87.2	93.0	35.0	181.7
1200	195.4	208.4	16.2	407.1	121.4	129.5	26.2	252.9	91.1	97.2	34.9	189.8
1250	203.7	217.2	16.2	424.3	126.5	135.0	26.2	263.6	95.0	101.3	34.9	197.9
1300	211.9	226.0	16.2	441.5	131.7	140.5	26.1	274.4	98.9	105.5	34.9	206.0
1350	220.1	234.8	16.2	458.6	136.8	146.0	26.1	285.1	102.8	109.6	34.8	214.1
1400	228.4	243.6	16.2	475.8	142.0	151.5	26.1	295.8	106.7	113.8	34.8	222.2

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal		
60	—	—	—	—	—	—	—	—
65								
70								
75								
80								
85								
90								
95								
100								
120								
140								
160								
180	4.3	4.6	78.9	8.9				
190	5.1	5.4	74.1	10.6				
200	5.8	6.2	71.0	12.1				
210	6.4	6.9	68.7	13.4				
220	7.1	7.6	66.9	14.8				
230	7.7	8.2	65.4	16.1				
240	8.3	8.9	64.2	17.3				
260	9.5	10.1	62.3	19.8	3.1	3.3	135.7	6.4
280	10.7	11.4	60.8	22.2	4.5	4.8	115.3	9.4
300	11.8	12.6	59.6	24.6	5.5	5.9	107.6	11.5
350	14.6	15.6	57.5	30.5	7.7	8.2	97.8	16.0
400	17.4	18.6	56.1	36.3	9.7	10.3	92.6	20.2
450	20.2	21.5	55.1	42.0	11.6	12.4	89.3	24.2
500	22.9	24.5	54.4	47.8	13.5	14.4	87.0	28.2
550	25.7	27.4	53.8	53.5	15.4	16.4	85.3	32.1
600	28.4	30.3	53.3	59.2	17.3	18.4	83.9	36.0
650	31.1	33.2	52.9	64.9	19.1	20.4	82.8	39.8
700	33.9	36.1	52.6	70.5	21.0	22.4	82.0	43.7
750	36.6	39.0	52.3	76.2	22.8	24.3	81.2	47.5
800	39.3	41.9	52.0	81.9	24.6	26.3	80.6	51.3
850	42.0	44.8	51.8	87.5	26.5	28.2	80.0	55.2
900	44.7	47.7	51.6	93.2	28.3	30.2	79.6	59.0
950	47.5	50.6	51.5	98.9	30.1	32.1	79.2	62.8
1000	50.2	53.5	51.3	104.5	32.0	34.1	78.8	66.6
1050	52.9	56.4	51.2	110.2	33.8	36.0	78.5	70.4
1100	55.6	59.3	51.1	115.8	35.6	38.0	78.2	74.2
1150	58.3	62.2	51.0	121.5	37.4	39.9	77.9	78.0
1200	61.0	65.1	50.9	127.1	39.3	41.9	77.7	81.8
1250	63.7	68.0	50.8	132.8	41.1	43.8	77.5	85.6
1300	66.5	70.9	50.7	138.4	42.9	45.8	77.3	89.4
1350	69.2	73.8	50.6	144.1	44.7	47.7	77.1	93.2
1400	71.9	76.7	50.5	149.7	46.5	49.6	76.9	96.9

[3] Lens for IV-S300C2/C3

(1) Lens (Sharp Corporation)

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
60	19.3	34.2	15.7	17.8	14.9	26.4	22.4	13.8	7.4	13.1	45.1	6.8
65	21.7	38.6	15.3	20.1	16.7	29.7	21.7	15.5	8.6	15.2	42.3	7.9
70	24.2	43.0	14.9	22.4	18.6	33.0	21.1	17.2	9.8	17.4	40.2	9.0
75	26.7	47.4	14.7	24.7	20.4	36.3	20.7	18.9	11.0	19.5	38.6	10.1
80	29.2	51.8	14.4	27.0	22.3	39.6	20.3	20.6	12.1	21.6	37.2	11.2
85	31.6	56.2	14.3	29.3	24.1	42.9	19.9	22.3	13.3	23.7	36.1	12.3
90	34.1	60.6	14.1	31.6	26.0	46.2	19.7	24.1	14.5	25.8	35.2	13.4
95	36.6	65.0	13.9	33.9	27.8	49.5	19.4	25.8	15.7	27.9	34.5	14.5
100	39.1	69.4	13.8	36.2	29.7	52.8	19.2	27.5	16.9	30.0	33.8	15.6
120	49.0	87.0	13.5	45.3	37.1	66.0	18.6	34.4	21.6	38.5	31.9	20.0
140	58.9	104.6	13.2	54.5	44.6	79.2	18.1	41.3	26.4	46.9	30.6	24.4
160	68.8	122.2	13.0	63.7	52.0	92.4	17.8	48.1	31.1	55.4	29.8	28.8
180	78.7	139.8	12.9	72.8	59.4	105.6	17.6	55.0	35.9	63.8	29.1	33.2
190	83.6	148.6	12.9	77.4	63.1	112.2	17.5	58.4	38.3	68.0	28.9	35.4
200	88.6	157.4	12.8	82.0	66.8	118.8	17.4	61.9	40.7	72.3	28.7	37.6
210	93.5	166.2	12.8	86.6	70.5	125.4	17.3	65.3	43.0	76.5	28.5	39.8
220	98.5	175.0	12.7	91.2	74.3	132.0	17.3	68.8	45.4	80.7	28.3	42.0
230	103.4	183.8	12.7	95.7	78.0	138.6	17.2	72.2	47.8	84.9	28.1	44.2
240	108.4	192.6	12.7	100.3	81.7	145.2	17.2	75.6	50.2	89.2	28.0	46.4
260	118.3	210.2	12.6	109.5	89.1	158.4	17.1	82.5	54.9	97.6	27.7	50.8
280	128.2	227.8	12.6	118.7	96.5	171.6	17.0	89.4	59.7	106.1	27.5	55.2
300	138.1	245.4	12.5	127.8	104.0	184.8	16.9	96.3	64.4	114.5	27.3	59.6
350	162.8	289.4	12.4	150.7	122.5	217.8	16.8	113.4	76.3	135.6	26.9	70.6
400	187.6	333.4	12.4	173.7	141.1	250.8	16.7	130.6	88.2	156.8	26.7	81.6
450	212.3	377.4	12.3	196.6	159.6	283.8	16.6	147.8	100.1	177.9	26.5	92.6
500	237.1	421.4	12.3	219.5	178.2	316.8	16.5	165.0	111.9	199.0	26.3	103.6
550	261.8	465.4	12.3	242.4	196.8	349.8	16.5	182.2	123.8	220.1	26.2	114.6
600	286.6	509.4	12.2	265.3	215.3	382.8	16.4	199.4	135.7	241.2	26.1	125.6
650	311.3	553.4	12.2	288.2	233.9	415.8	16.4	216.6	147.6	262.4	26.0	136.6
700	336.1	597.4	12.2	311.2	252.5	448.8	16.4	233.8	159.5	283.5	25.9	147.6
750	360.8	641.4	12.2	334.1	271.0	481.8	16.4	250.9	171.3	304.6	25.9	158.6
800	385.6	685.4	12.2	357.0	289.6	514.8	16.3	268.1	183.2	325.7	25.8	169.6
850	410.3	729.4	12.2	379.9	308.1	547.8	16.3	285.3	195.1	346.8	25.8	180.6
900	435.1	773.4	12.2	402.8	326.7	580.8	16.3	302.5	207.0	368.0	25.7	191.6
950	459.8	817.4	12.2	425.7	345.3	613.8	16.3	319.7	218.9	389.1	25.7	202.6
1000	484.6	861.4	12.1	448.7	363.8	646.8	16.3	336.9	230.7	410.2	25.6	213.6
1050	509.3	905.4	12.1	471.6	382.4	679.8	16.2	354.1	242.6	431.3	25.6	224.6
1100	534.1	949.4	12.1	494.5	401.0	712.8	16.2	371.3	254.5	452.4	25.6	235.6
1150	558.8	993.4	12.1	517.4	419.5	745.8	16.2	388.4	266.4	473.6	25.6	246.6
1200	583.6	1037.4	12.1	540.3	438.1	778.8	16.2	405.6	278.3	494.7	25.5	257.6
1250	608.3	1081.4	12.1	563.2	456.6	811.8	16.2	422.8	290.1	515.8	25.5	268.6
1300	633.1	1125.4	12.1	586.2	475.2	844.8	16.2	440.0	302.0	536.9	25.5	279.6
1350	657.8	1169.4	12.1	609.1	493.8	877.8	16.2	457.2	313.9	558.0	25.5	290.6
1400	682.6	1213.4	12.1	632.0	512.3	910.8	16.2	474.4	325.8	579.2	25.5	301.6

Recommended Lens (Sharp Corporation)

Focal Length (mm)	12	16	25	35	50
Model	IV-1B2012	IV-1B2016	IV-1B2025	IV-1B2035	IV-1B2050

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal		
60	3.4	6.1	95.6	3.2				
65	4.3	7.6	83.6	4.0				
70	5.1	9.1	75.6	4.7				
75	6.0	10.6	69.8	5.5				
80	6.8	12.1	65.5	6.3	—	—	—	—
85	7.7	13.6	62.1	7.1				
90	8.5	15.1	59.4	7.9				
95	9.4	16.7	57.2	8.7				
100	10.2	18.2	55.3	9.5				
120	13.6	24.2	50.3	12.6				
140	17.0	30.2	47.2	15.7	6.7	11.8	94.6	6.2
160	20.4	36.3	45.2	18.9	9.0	16.1	82.9	8.4
180	23.8	42.3	43.7	22.0	11.4	20.3	76.0	10.6
190	25.5	45.3	43.2	23.6	12.6	22.4	73.6	11.7
200	27.2	48.3	42.6	25.2	13.8	24.5	71.6	12.8
210	28.9	51.4	42.2	26.7	15.0	26.6	69.8	13.9
220	30.6	54.4	41.8	28.3	16.2	28.7	68.4	15.0
230	32.3	57.4	41.4	29.9	17.3	30.8	67.1	16.1
240	34.0	60.4	41.1	31.5	18.5	32.9	66.0	17.2
260	37.4	66.4	40.6	34.6	20.9	37.2	64.2	19.4
280	40.8	72.5	40.1	37.7	23.3	41.4	62.8	21.6
300	44.2	78.5	39.7	40.9	25.7	45.6	61.6	23.8
350	52.6	93.6	38.9	48.7	31.6	56.2	59.4	29.3
400	61.1	108.7	38.4	56.6	37.5	66.7	57.9	34.8
450	69.6	123.8	38.0	64.5	43.5	77.3	56.8	40.3
500	78.1	138.8	37.7	72.3	49.4	87.9	56.0	45.8
550	86.6	153.9	37.4	80.2	55.4	98.4	55.4	51.3
600	95.1	169.0	37.2	88.0	61.3	109.0	54.8	56.8
650	103.6	184.1	37.0	95.9	67.2	119.5	54.4	62.3
700	112.0	199.2	36.9	103.7	73.2	130.1	54.1	67.8
750	120.5	214.3	36.7	111.6	79.1	140.7	53.8	73.3
800	129.0	229.4	36.6	119.5	85.1	151.2	53.5	78.8
850	137.5	244.4	36.5	127.3	91.0	161.8	53.3	84.3
900	146.0	259.5	36.4	135.2	96.9	172.3	53.1	89.8
950	154.5	274.6	36.3	143.0	102.9	182.9	52.9	95.3
1000	163.0	289.7	36.3	150.9	108.8	193.5	52.7	100.8
1050	171.4	304.8	36.2	158.7	114.8	204.0	52.6	106.3
1100	179.9	319.9	36.2	166.6	120.7	214.6	52.5	111.8
1150	188.4	335.0	36.1	174.5	126.6	225.1	52.3	117.3
1200	196.9	350.0	36.1	182.3	132.6	235.7	52.2	122.8
1250	205.4	365.1	36.0	190.2	138.5	246.3	52.1	128.3
1300	213.9	380.2	36.0	198.0	144.5	256.8	52.1	133.8
1350	222.4	395.3	35.9	205.9	150.4	267.4	52.0	139.3
1400	230.8	410.4	35.9	213.7	156.3	277.9	51.9	144.8

(2) Lens (Ricoh Imaging Co., Ltd.) (IV-S300C2/C3)

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (µm)	Field of view (mm)		Focal length (mm)	Resolution (µm)	Field of view (mm)		Focal length (mm)	Resolution (µm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
60	16.4	29.1	8.4	15.2	26.6	47.3	10.1	24.6	13.0	23.2	17.9	12.1
65	21.7	38.6	7.9	20.1	30.4	54.0	9.9	28.1	15.9	28.3	16.9	14.8
70	26.8	47.6	7.6	24.8	34.1	60.6	9.7	31.6	18.7	33.2	16.2	17.3
75	31.8	56.5	7.4	29.4	37.8	67.2	9.5	35.0	21.3	37.9	15.7	19.8
80	36.7	65.3	7.2	34.0	41.5	73.8	9.4	38.4	23.9	42.5	15.3	22.2
85	41.6	74.0	7.1	38.6	45.2	80.3	9.3	41.8	26.5	47.1	15.1	24.5
90	46.5	82.7	7.0	43.1	48.8	86.8	9.2	45.2	29.0	51.6	14.8	26.9
95	51.4	91.4	6.9	47.6	52.5	93.3	9.2	48.6	31.5	56.1	14.6	29.2
100	56.2	100.0	6.9	52.1	56.1	99.8	9.1	52.0	34.0	60.5	14.4	31.5
120	75.6	134.3	6.7	70.0	70.7	125.6	8.9	65.4	43.9	78.1	14.0	40.7
140	94.8	168.6	6.6	87.8	85.2	151.4	8.8	78.9	53.7	95.5	13.7	49.8
160	114.1	202.8	6.5	105.6	99.6	177.1	8.7	92.3	63.5	112.9	13.4	58.8
180	133.3	236.9	6.5	123.4	114.1	202.8	8.7	105.6	73.2	130.2	13.3	67.8
190	142.9	254.0	6.5	132.3	121.3	215.7	8.6	112.3	78.1	138.8	13.2	72.3
200	152.5	271.0	6.4	141.2	128.5	228.5	8.6	119.0	83.0	147.5	13.2	76.8
210	162.1	288.1	6.4	150.1	135.8	241.4	8.6	125.7	87.8	156.1	13.1	81.3
220	171.7	305.2	6.4	158.9	143.0	254.2	8.6	132.4	92.7	164.7	13.1	85.8
230	181.2	322.2	6.4	167.8	150.2	267.0	8.6	139.1	97.5	173.4	13.0	90.3
240	190.8	339.3	6.4	176.7	157.4	279.9	8.6	145.8	102.4	182.0	13.0	94.8
260	210.0	373.4	6.4	194.5	171.9	305.5	8.5	159.1	112.1	199.2	12.9	103.8
280	229.2	407.5	6.4	212.2	186.3	331.2	8.5	172.5	121.7	216.4	12.9	112.7
300	248.4	441.6	6.3	230.0	200.7	356.8	8.5	185.8	131.4	233.7	12.8	121.7
350	296.3	526.8	6.3	274.4	236.8	420.9	8.4	219.2	155.6	276.7	12.8	144.1
400	344.2	612.0	6.3	318.7	272.8	485.0	8.4	252.6	179.8	319.7	12.7	166.5
450	392.2	697.2	6.3	363.1	308.9	549.1	8.4	286.0	204.0	362.7	12.7	188.9
500	440.1	782.4	6.3	407.5	344.9	613.2	8.4	319.4	228.2	405.6	12.6	211.3
550	488.0	867.6	6.3	451.9	381.0	677.3	8.4	352.8	252.3	448.6	12.6	233.7
600	535.9	952.8	6.3	496.2	417.0	741.4	8.4	386.1	276.5	491.6	12.6	256.0
650	583.8	1038.0	6.3	540.6	453.1	805.4	8.4	419.5	300.7	534.6	12.5	278.4
700	631.8	1123.1	6.3	585.0	489.1	869.5	8.3	452.9	324.9	577.5	12.5	300.8
750	679.7	1208.3	6.3	629.3	525.1	933.6	8.3	486.2	349.0	620.5	12.5	323.2
800	727.6	1293.5	6.2	673.7	561.2	997.6	8.3	519.6	373.2	663.4	12.5	345.5
850	775.5	1378.7	6.2	718.1	597.2	1061.7	8.3	553.0	397.3	706.4	12.5	367.9
900	823.4	1463.9	6.2	762.4	633.3	1125.8	8.3	586.3	421.5	749.3	12.5	390.3
950	871.3	1549.1	6.2	806.8	669.3	1189.8	8.3	619.7	445.7	792.3	12.5	412.7
1000	919.3	1634.2	6.2	851.2	705.3	1253.9	8.3	653.1	469.8	835.3	12.4	435.0
1050	967.2	1719.4	6.2	895.5	741.4	1318.0	8.3	686.4	494.0	878.2	12.4	457.4
1100	1015.1	1804.6	6.2	939.9	777.4	1382.0	8.3	719.8	518.2	921.2	12.4	479.8
1150	1063.0	1889.8	6.2	984.3	813.4	1446.1	8.3	753.2	542.3	964.1	12.4	502.1
1200	1110.9	1975.0	6.2	1028.6	849.5	1510.2	8.3	786.6	566.5	1007.1	12.4	524.5
1250	1158.8	2060.1	6.2	1073.0	885.5	1574.2	8.3	819.9	590.6	1050.0	12.4	546.9
1300	1206.7	2145.3	6.2	1117.4	921.5	1638.3	8.3	853.3	614.8	1093.0	12.4	569.3
1350	1254.7	2230.5	6.2	1161.7	957.6	1702.4	8.3	886.7	639.0	1135.9	12.4	591.6
1400	1302.6	2315.7	6.2	1206.1	993.6	1766.4	8.3	920.0	663.1	1178.9	12.4	614.0

Recommended Lens (Ricoh Imaging Co., Ltd.)

Focal Length (mm)	6	8	12	16
Model	FL-CC0614A-2M	FL-CC0814A-2M	FL-CC1214A-2M	FL-CC1614A-2M

Focal Length (mm)	25	35	50	75
Model	FL-CC2514A-2M	FL-CC3516-2M	FL-CC5024A-2M	FL-CC7528-2M

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (µm)	Field of view (mm)		Focal length (mm)	Resolution (µm)	Field of view (mm)		Focal length (mm)	Resolution (µm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
60	14.2	25.3	22.7	13.2								
65	16.4	29.2	21.8	15.2	–	–	–	–				
70	18.5	32.9	21.1	17.1								
75	20.6	36.5	20.6	19.0	8.1	14.4	44.4	7.5				
80	22.6	40.1	20.2	20.9	10.1	18.0	40.6	9.4				
85	24.5	43.6	19.9	22.7	11.8	20.9	38.5	10.9				
90	26.5	47.1	19.6	24.5	13.3	23.6	37.1	12.3				
95	28.5	50.6	19.3	26.3	14.7	26.1	36.0	13.6				
100	30.4	54.0	19.1	28.1	16.1	28.5	35.1	14.9	8.5	15.2	57.6	7.9
120	38.0	67.6	18.5	35.2	21.2	37.7	32.8	19.7	13.6	24.1	48.8	12.6
140	45.6	81.1	18.1	42.2	26.2	46.5	31.4	24.2	17.7	31.4	45.4	16.4
160	53.2	94.5	17.8	49.2	31.0	55.1	30.5	28.7	21.5	38.3	43.3	19.9
180	60.7	107.8	17.6	56.2	35.8	63.7	29.9	33.2	25.3	44.9	41.9	23.4
190	64.4	114.5	17.5	59.6	38.2	67.9	29.6	35.4	27.1	48.2	41.4	25.1
200	68.1	121.1	17.4	63.1	40.6	72.1	29.4	37.6	28.9	51.4	40.9	26.8
210	71.9	127.8	17.3	66.6	42.9	76.3	29.2	39.7	30.8	54.7	40.5	28.5
220	75.6	134.4	17.3	70.0	45.3	80.5	29.0	41.9	32.6	57.9	40.1	30.2
230	79.3	141.1	17.2	73.5	47.6	84.7	28.8	44.1	34.4	61.1	39.8	31.8
240	83.1	147.7	17.2	76.9	50.0	88.9	28.7	46.3	36.2	64.3	39.5	33.5
260	90.5	160.9	17.1	83.8	54.7	97.2	28.4	50.6	39.8	70.7	39.0	36.8
280	98.0	174.2	17.0	90.7	59.4	105.6	28.2	55.0	43.3	77.1	38.6	40.1
300	105.4	187.4	16.9	97.6	64.1	113.9	28.0	59.3	46.9	83.4	38.2	43.4
350	124.0	220.5	16.8	114.8	75.7	134.6	27.6	70.1	55.8	99.1	37.6	51.6
400	142.6	253.6	16.7	132.1	87.4	155.4	27.4	80.9	64.6	114.9	37.1	59.8
450	161.2	286.6	16.6	149.3	99.0	176.1	27.2	91.7	73.4	130.5	36.7	68.0
500	179.8	319.6	16.5	166.5	110.7	196.7	27.0	102.5	82.2	146.2	36.4	76.1
550	198.4	352.6	16.5	183.7	122.3	217.4	26.9	113.2	91.0	161.8	36.2	84.3
600	216.9	385.6	16.4	200.9	133.9	238.0	26.8	124.0	99.8	177.4	36.0	92.4
650	235.5	418.7	16.4	218.1	145.5	258.7	26.7	134.7	108.6	193.0	35.8	100.5
700	254.1	451.7	16.4	235.2	157.1	279.3	26.6	145.5	117.3	208.6	35.7	108.6
750	272.6	484.7	16.4	252.4	168.7	300.0	26.5	156.2	126.1	224.2	35.5	116.8
800	291.2	517.7	16.3	269.6	180.3	320.6	26.5	167.0	134.9	239.8	35.4	124.9
850	309.7	550.7	16.3	286.8	191.9	341.2	26.4	177.7	143.6	255.4	35.4	133.0
900	328.3	583.7	16.3	304.0	203.5	361.8	26.4	188.5	152.4	270.9	35.3	141.1
950	346.9	616.7	16.3	321.2	215.1	382.5	26.3	199.2	161.2	286.5	35.2	149.2
1000	365.4	649.6	16.3	338.4	226.7	403.1	26.3	209.9	169.9	302.1	35.1	157.3
1050	384.0	682.6	16.3	355.5	238.3	423.7	26.3	220.7	178.7	317.7	35.1	165.4
1100	402.5	715.6	16.2	372.7	249.9	444.3	26.2	231.4	187.4	333.2	35.0	173.6
1150	421.1	748.6	16.2	389.9	261.5	464.9	26.2	242.2	196.2	348.8	35.0	181.7
1200	439.7	781.6	16.2	407.1	273.1	485.6	26.2	252.9	204.9	364.4	34.9	189.8
1250	458.2	814.6	16.2	424.3	284.7	506.2	26.2	263.6	213.7	379.9	34.9	197.9
1300	476.8	847.6	16.2	441.5	296.3	526.8	26.1	274.4	222.5	395.5	34.9	206.0
1350	495.3	880.6	16.2	458.6	307.9	547.4	26.1	285.1	231.2	411.0	34.8	214.1
1400	513.9	913.6	16.2	475.8	319.5	568.0	26.1	295.8	240.0	426.6	34.8	222.2

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal		
60	–	–	–	–	–	–	–	–
65								
70								
75								
80								
85								
90								
95								
100								
120								
140								
160								
180	9.6	17.1	78.9	8.9				
190	11.4	20.3	74.1	10.6				
200	13.0	23.1	71.0	12.1				
210	14.5	25.8	68.7	13.4				
220	15.9	28.4	66.9	14.8				
230	17.3	30.8	65.4	16.1				
240	18.7	33.3	64.2	17.3				
260	21.4	38.0	62.3	19.8	6.9	12.2	24.3	6.4
280	24.0	42.7	60.8	22.2	10.2	18.1	20.2	9.4
300	26.6	47.3	59.6	24.6	12.4	22.1	18.5	11.5
350	32.9	58.5	57.5	30.5	17.3	30.8	16.1	16.0
400	39.2	69.7	56.1	36.3	21.8	38.8	14.8	20.2
450	45.4	80.7	55.1	42.0	26.2	46.5	13.8	24.2
500	51.6	91.7	54.4	47.8	30.4	54.1	13.1	28.2
550	57.8	102.7	53.8	53.5	34.7	61.6	12.6	32.1
600	63.9	113.6	53.3	59.2	38.8	69.1	12.2	36.0
650	70.0	124.5	52.9	64.9	43.0	76.5	11.8	39.8
700	76.2	135.4	52.6	70.5	47.2	83.9	11.5	43.7
750	82.3	146.3	52.3	76.2	51.3	91.2	11.3	47.5
800	88.4	157.2	52.0	81.9	55.4	98.6	11.1	51.3
850	94.5	168.1	51.8	87.5	59.6	105.9	10.9	55.2
900	100.7	179.0	51.6	93.2	63.7	113.2	10.7	59.0
950	106.8	189.8	51.5	98.9	67.8	120.5	10.6	62.8
1000	112.9	200.7	51.3	104.5	71.9	127.8	10.5	66.6
1050	119.0	211.5	51.2	110.2	76.0	135.1	10.4	70.4
1100	125.1	222.4	51.1	115.8	80.1	142.4	10.3	74.2
1150	131.2	233.3	51.0	121.5	84.2	149.7	10.2	78.0
1200	137.3	244.1	50.9	127.1	88.3	157.0	10.1	81.8
1250	143.4	255.0	50.8	132.8	92.4	164.3	10.0	85.6
1300	149.5	265.8	50.7	138.4	96.5	171.6	9.9	89.4
1350	155.6	276.6	50.6	144.1	100.6	178.9	9.9	93.2
1400	161.7	287.5	50.5	149.7	104.7	186.1	9.8	96.9

[4] Lens for IV-S300C6, IV-S200C6 and IV-C250C8

(1) Lens (Ricoh Imaging Co., Ltd.)

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
55	6.2	6.6	9.8	12.9	13.6	14.5	10.4	28.4	5.8	6.2	19.8	12.1
60	9.8	10.4	8.4	20.4	15.9	17.0	10.1	33.1	7.8	8.3	17.9	16.2
70	16.0	17.1	7.6	33.4	20.4	21.8	9.7	42.5	11.2	11.9	16.2	23.3
80	22.0	23.4	7.2	45.8	24.8	26.5	9.4	51.7	14.3	15.3	15.3	29.8
90	27.8	29.7	7.0	58.0	29.2	31.1	9.2	60.8	17.4	18.5	14.8	36.2
100	33.6	35.9	6.9	70.1	33.6	35.8	9.1	69.9	20.4	21.7	14.4	42.4
120	45.2	48.2	6.7	94.1	42.3	45.1	8.9	88.0	26.3	28.0	14.0	54.7
140	56.7	60.5	6.6	118.1	50.9	54.3	8.8	106.1	32.1	34.3	13.7	66.9
160	68.2	72.7	6.5	142.1	59.6	63.6	8.7	124.1	38.0	40.5	13.4	79.1
180	79.7	85.0	6.5	166.0	68.2	72.8	8.7	142.1	43.8	46.7	13.3	91.2
200	91.2	97.2	6.4	189.9	76.9	82.0	8.6	160.1	49.6	52.9	13.2	103.3
250	119.9	127.8	6.4	249.7	98.5	105.0	8.5	205.1	64.1	68.4	13.0	133.6
300	148.5	158.4	6.3	309.4	120.0	128.0	8.5	250.1	78.6	83.8	12.8	163.7
350	177.2	189.0	6.3	369.1	141.6	151.0	8.4	295.0	93.1	99.3	12.8	193.9
400	205.8	219.6	6.3	428.9	163.1	174.0	8.4	339.9	107.5	114.7	12.7	224.0
450	234.5	250.1	6.3	488.6	184.7	197.0	8.4	384.8	122.0	130.1	12.7	254.1
500	263.2	280.7	6.3	548.3	206.3	220.0	8.4	429.7	136.4	145.5	12.6	284.3
600	320.5	341.8	6.3	667.7	249.4	266.0	8.4	519.5	165.4	176.4	12.6	344.5
700	377.8	403.0	6.3	787.0	292.5	312.0	8.3	609.3	194.3	207.2	12.5	404.7
800	435.1	464.1	6.2	906.4	335.6	357.9	8.3	699.1	223.2	238.0	12.5	464.9
900	492.4	525.2	6.2	1025.8	378.7	403.9	8.3	788.9	252.1	268.9	12.5	525.1
1000	549.7	586.3	6.2	1145.2	421.8	449.9	8.3	878.7	280.9	299.7	12.4	585.3
1100	607.0	647.5	6.2	1264.6	464.9	495.9	8.3	968.5	309.8	330.5	12.4	645.5
1200	664.3	708.6	6.2	1384.0	508.0	541.8	8.3	1058.3	338.7	361.3	12.4	705.7
1300	721.6	769.7	6.2	1503.4	551.1	587.8	8.3	1148.1	367.6	392.1	12.4	765.9
1400	778.9	830.8	6.2	1622.7	594.2	633.8	8.3	1237.8	396.5	423.0	12.4	826.1
1500	836.2	892.0	6.2	1742.1	637.3	679.7	8.3	1327.6	425.4	453.8	12.4	886.3
1600	893.5	953.1	6.2	1861.5	680.4	725.7	8.3	1417.4	454.3	484.6	12.4	946.5
1700	950.8	1014.2	6.2	1980.9	723.5	771.7	8.3	1507.2	483.2	515.4	12.4	1006.7
1800	1008.1	1075.3	6.2	2100.3	766.6	817.7	8.3	1597.0	512.1	546.2	12.4	1066.9
1900	1065.4	1136.5	6.2	2219.6	809.6	863.6	8.3	1686.8	541.0	577.1	12.4	1127.1
2000	1122.7	1197.6	6.2	2339.0	852.7	909.6	8.3	1776.6	569.9	607.9	12.4	1187.3
2500	1409.2	1503.2	6.2	2935.9	1068.2	1139.4	8.3	2225.5	714.4	762.0	12.4	1488.2
3000	1695.8	1808.8	6.2	3532.8	1283.7	1369.3	8.3	2674.4	858.8	916.1	12.3	1789.2
3500	1982.3	2114.4	6.2	4129.7	1499.2	1599.1	8.3	3123.3	1003.3	1070.2	12.3	2090.2
4000	2268.8	2420.0	6.2	4726.6	1714.7	1829.0	8.3	3572.2	1147.7	1224.2	12.3	2391.1
4500	2555.3	2725.6	6.2	5323.5	1930.2	2058.8	8.3	4021.2	1292.2	1378.3	12.3	2692.1
5000	2841.8	3031.2	6.2	5920.4	2145.6	2288.7	8.3	4470.1	1436.7	1532.4	12.3	2993.0
5500	3128.3	3336.9	6.2	6517.3	2361.1	2518.5	8.3	4919.0	1581.1	1686.5	12.3	3294.0
6000	3414.8	3642.5	6.2	7114.2	2576.6	2748.4	8.3	5367.9	1725.6	1840.6	12.3	3594.9
6500	3701.3	3948.1	6.2	7711.1	2792.1	2978.2	8.3	5816.8	1870.0	1994.7	12.3	3895.9
7000	3987.8	4253.7	6.2	8308.0	3007.6	3208.1	8.3	6265.7	2014.5	2148.8	12.3	4196.8
7500	4274.3	4559.3	6.2	8904.9	3223.0	3437.9	8.3	6714.7	2158.9	2302.9	12.3	4497.8

Recommended Lens (Ricoh Imaging Co., Ltd.)

Focal Length (mm)	6	8	12	16
Model	FL-CC0614A-2M	FL-CC0814A-2M	FL-CC1214A-2M	FL-CC1614A-2M

Focal Length (mm)	25	35	50	75
Model	FL-CC2514A-2M	FL-CC3516-2M	FL-CC5024A-2M	FL-CC7528-2M

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
55	7.1	7.6	24.0	14.8								
60	8.5	9.1	22.7	17.7	—	—	—	—				
70	11.1	11.8	21.1	23.1					—	—	—	—
80	13.5	14.4	20.2	28.1	6.1	6.5	40.6	12.6				
90	15.9	16.9	19.6	33.0	7.9	8.5	37.1	16.5				
100	18.2	19.4	19.1	37.9	9.6	10.2	35.1	20.0	5.1	5.4	57.6	10.6
120	22.8	24.3	18.5	47.4	12.7	13.5	32.8	26.4	8.1	8.6	48.8	16.9
140	27.3	29.1	18.1	56.8	15.7	16.7	31.4	32.6	10.6	11.3	45.4	22.0
160	31.8	33.9	17.8	66.2	18.5	19.8	30.5	38.6	12.9	13.7	43.3	26.8
180	36.3	38.7	17.6	75.6	21.4	22.8	29.9	44.6	15.1	16.1	41.9	31.5
200	40.7	43.5	17.4	84.9	24.3	25.9	29.4	50.5	17.3	18.5	40.9	36.1
250	51.9	55.4	17.1	108.1	31.3	33.4	28.5	65.2	22.7	24.2	39.3	47.3
300	63.0	67.2	16.9	131.3	38.3	40.9	28.0	79.8	28.0	29.9	38.2	58.4
350	74.2	79.1	16.8	154.5	45.3	48.3	27.6	94.4	33.3	35.6	37.6	69.5
400	85.3	91.0	16.7	177.7	52.3	55.7	27.4	108.9	38.6	41.2	37.1	80.5
450	96.4	102.8	16.6	200.8	59.2	63.2	27.2	123.4	43.9	46.8	36.7	91.5
500	107.5	114.7	16.5	224.0	66.2	70.6	27.0	137.9	49.2	52.4	36.4	102.4
600	129.7	138.4	16.4	270.2	80.1	85.4	26.8	166.8	59.7	63.7	36.0	124.3
700	151.9	162.1	16.4	316.5	94.0	100.2	26.6	195.7	70.2	74.8	35.7	146.2
800	174.1	185.7	16.3	362.8	107.8	115.0	26.5	224.7	80.7	86.0	35.4	168.0
900	196.3	209.4	16.3	409.0	121.7	129.8	26.4	253.6	91.1	97.2	35.3	189.9
1000	218.5	233.1	16.3	455.2	135.6	144.6	26.3	282.5	101.6	108.4	35.1	211.7
1100	240.7	256.8	16.2	501.5	149.5	159.4	26.2	311.4	112.1	119.6	35.0	233.5
1200	262.9	280.4	16.2	547.7	163.3	174.2	26.2	340.3	122.6	130.7	34.9	255.3
1300	285.1	304.1	16.2	594.0	177.2	189.0	26.1	369.1	133.0	141.9	34.9	277.1
1400	307.3	327.8	16.2	640.2	191.1	203.8	26.1	398.0	143.5	153.1	34.8	298.9
1500	329.5	351.5	16.2	686.4	204.9	218.6	26.1	426.9	154.0	164.2	34.7	320.8
1600	351.7	375.1	16.2	732.7	218.8	233.4	26.0	455.8	164.4	175.4	34.7	342.6
1700	373.9	398.8	16.2	778.9	232.7	248.2	26.0	484.7	174.9	186.6	34.6	364.4
1800	396.1	422.5	16.2	825.1	246.5	263.0	26.0	513.6	185.4	197.7	34.6	386.2
1900	418.3	446.1	16.1	871.4	260.4	277.7	26.0	542.5	195.8	208.9	34.6	408.0
2000	440.4	469.8	16.1	917.6	274.3	292.5	26.0	571.4	206.3	220.0	34.5	429.8
2500	551.4	588.2	16.1	1148.7	343.6	366.5	25.9	715.8	258.6	275.9	34.4	538.8
3000	662.4	706.5	16.1	1379.9	412.9	440.4	25.8	860.2	310.9	331.7	34.3	647.8
3500	773.3	824.9	16.1	1611.0	482.2	514.4	25.8	1004.6	363.3	387.5	34.3	756.8
4000	884.3	943.2	16.1	1842.2	551.5	588.3	25.8	1149.0	415.6	443.3	34.2	865.8
4500	995.2	1061.6	16.1	2073.3	620.8	662.2	25.8	1293.4	467.9	499.1	34.2	974.8
5000	1106.2	1179.9	16.1	2304.5	690.2	736.2	25.8	1437.8	520.2	554.9	34.2	1083.8
5500	1217.1	1298.2	16.1	2535.6	759.5	810.1	25.7	1582.2	572.5	610.7	34.2	1192.7
6000	1328.1	1416.6	16.1	2766.8	828.8	884.0	25.7	1726.6	624.8	666.5	34.1	1301.7
6500	1439.0	1534.9	16.0	2997.9	898.1	958.0	25.7	1871.0	677.1	722.3	34.1	1410.7
7000	1550.0	1653.3	16.0	3229.1	967.4	1031.9	25.7	2015.4	729.5	778.1	34.1	1519.7
7500	1660.9	1771.6	16.0	3460.2	1036.7	1105.8	25.7	2159.8	781.8	833.9	34.1	1628.7

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal		
55	—	—	—	—	—	—	—	—
60								
70								
80								
90								
100								
120								
140								
160								
180	5.8	6.1	78.9	12.0				
200	7.8	8.3	71.0	16.2				
250	12.0	12.8	63.2	25.0				
300	15.9	17.0	59.6	33.1	7.4	7.9	107.6	15.5
350	19.7	21.0	57.5	41.0	10.4	11.0	97.8	21.6
400	23.4	25.0	56.1	48.8	13.0	13.9	92.6	27.2
450	27.2	29.0	55.1	56.6	15.6	16.7	89.3	32.6
500	30.9	32.9	54.4	64.3	18.2	19.4	87.0	37.9
600	38.2	40.8	53.3	79.6	23.2	24.8	83.9	48.4
700	45.6	48.6	52.6	94.9	28.2	30.1	82.0	58.8
800	52.9	56.4	52.0	110.2	33.2	35.4	80.6	69.1
900	60.2	64.2	51.6	125.4	38.1	40.6	79.6	79.3
1000	67.5	72.0	51.3	140.6	43.0	45.9	78.8	89.6
1100	74.8	79.8	51.1	155.8	47.9	51.1	78.2	99.8
1200	82.1	87.6	50.9	171.1	52.8	56.3	77.7	110.0
1300	89.4	95.4	50.7	186.3	57.7	61.6	77.3	120.2
1400	96.7	103.1	50.5	201.5	62.6	66.8	76.9	130.4
1500	104.0	110.9	50.4	216.7	67.5	72.0	76.6	140.6
1600	111.3	118.7	50.3	231.9	72.4	77.2	76.4	150.8
1700	118.6	126.5	50.2	247.0	77.3	82.4	76.1	161.0
1800	125.9	134.3	50.1	262.2	82.2	87.7	75.9	171.2
1900	133.2	142.0	50.1	277.4	87.1	92.9	75.8	181.4
2000	140.5	149.8	50.0	292.6	92.0	98.1	75.6	191.6
2500	176.9	188.7	49.7	368.6	116.4	124.1	75.0	242.5
3000	213.3	227.6	49.6	444.5	140.8	150.2	74.6	293.3
3500	249.8	266.4	49.4	520.4	165.2	176.2	74.3	344.2
4000	286.2	305.3	49.4	596.3	189.6	202.3	74.1	395.1
4500	322.7	344.2	49.3	672.2	214.0	228.3	74.0	445.9
5000	359.1	383.0	49.2	748.1	238.4	254.3	73.9	496.8
5500	395.5	421.9	49.2	824.0	262.9	280.4	73.8	547.6
6000	431.9	460.7	49.2	899.9	287.3	306.4	73.7	598.5
6500	468.4	499.6	49.1	975.8	311.7	332.4	73.6	649.3
7000	504.8	538.5	49.1	1051.7	336.1	358.5	73.6	700.1
7500	541.2	577.3	49.1	1127.6	360.5	384.5	73.5	751.0

[5] Lens for IV-S210C2 and IV-C250C3

(1) Lens (Sharp Corporation)

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (µm)	Field of view (mm)		Focal length (mm)	Resolution (µm)	Field of view (mm)		Focal length (mm)	Resolution (µm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
60	22.5	30.0	9.9	18.8	17.1	22.8	15.7	14.3	13.2	17.6	22.4	11.0
65	25.8	34.4	9.6	21.5	19.3	25.8	15.3	16.1	14.9	19.8	21.7	12.4
70	29.1	38.8	9.5	24.3	21.5	28.7	14.9	17.9	16.5	22.0	21.1	13.8
75	32.4	43.2	9.3	27.0	23.7	31.6	14.7	19.8	18.2	24.2	20.7	15.1
80	35.7	47.6	9.2	29.8	25.9	34.6	14.4	21.6	19.8	26.4	20.3	16.5
85	39.0	52.0	9.1	32.5	28.1	37.5	14.3	23.4	21.5	28.6	19.9	17.9
90	42.3	56.4	9.0	35.3	30.3	40.4	14.1	25.3	23.1	30.8	19.7	19.3
95	45.6	60.8	8.9	38.0	32.5	43.4	13.9	27.1	24.8	33.0	19.4	20.6
100	48.9	65.2	8.9	40.8	34.7	46.3	13.8	28.9	26.4	35.2	19.2	22.0
120	62.1	82.8	8.7	51.8	43.5	58.0	13.5	36.3	33.0	44.0	18.6	27.5
140	75.3	100.4	8.6	62.8	52.3	69.8	13.2	43.6	39.6	52.8	18.1	33.0
160	88.5	118.0	8.5	73.8	61.1	81.5	13.0	50.9	46.2	61.6	17.8	38.5
180	101.7	135.6	8.4	84.8	69.9	93.2	12.9	58.3	52.8	70.4	17.6	44.0
200	114.9	153.2	8.4	95.8	78.7	105.0	12.8	65.6	59.4	79.2	17.4	49.5
220	128.1	170.8	8.3	106.8	87.5	116.7	12.7	72.9	66.0	88.0	17.3	55.0
240	141.3	188.4	8.3	117.8	96.3	128.4	12.7	80.3	72.6	96.8	17.2	60.5
260	154.5	206.0	8.3	128.8	105.1	140.2	12.6	87.6	79.2	105.6	17.1	66.0
280	167.7	223.6	8.3	139.8	113.9	151.9	12.6	94.9	85.8	114.4	17.0	71.5
300	180.9	241.2	8.2	150.8	122.7	163.6	12.5	102.3	92.4	123.2	16.9	77.0
350	213.9	285.2	8.2	178.3	144.7	193.0	12.4	120.6	108.9	145.2	16.8	90.8
400	246.9	329.2	8.2	205.8	166.7	222.3	12.4	138.9	125.4	167.2	16.7	104.5
450	279.9	373.2	8.2	233.3	188.7	251.6	12.3	157.3	141.9	189.2	16.6	118.3
500	312.9	417.2	8.1	260.8	210.7	281.0	12.3	175.6	158.4	211.2	16.5	132.0
550	345.9	461.2	8.1	288.3	232.7	310.3	12.3	193.9	174.9	233.2	16.5	145.8
600	378.9	505.2	8.1	315.8	254.7	339.6	12.2	212.3	191.4	255.2	16.4	159.5
650	411.9	549.2	8.1	343.3	276.7	369.0	12.2	230.6	207.9	277.2	16.4	173.3
700	444.9	593.2	8.1	370.8	298.7	398.3	12.2	248.9	224.4	299.2	16.4	187.0
750	477.9	637.2	8.1	398.3	320.7	427.6	12.2	267.3	240.9	321.2	16.4	200.8
800	510.9	681.2	8.1	425.8	342.7	457.0	12.2	285.6	257.4	343.2	16.3	214.5
850	543.9	725.2	8.1	453.3	364.7	486.3	12.2	303.9	273.9	365.2	16.3	228.3
900	576.9	769.2	8.1	480.8	386.7	515.6	12.2	322.3	290.4	387.2	16.3	242.0
950	609.9	813.2	8.1	508.3	408.7	545.0	12.2	340.6	306.9	409.2	16.3	255.8
1000	642.9	857.2	8.1	535.8	430.7	574.3	12.1	358.9	323.4	431.2	16.3	269.5
1050	675.9	901.2	8.1	563.3	452.7	603.6	12.1	377.3	339.9	453.2	16.2	283.3
1100	708.9	945.2	8.1	590.8	474.7	633.0	12.1	395.6	356.4	475.2	16.2	297.0
1150	741.9	989.2	8.1	618.3	496.7	662.3	12.1	413.9	372.9	497.2	16.2	310.8
1200	774.9	1033.2	8.1	645.8	518.7	691.6	12.1	432.3	389.4	519.2	16.2	324.5
1250	807.9	1077.2	8.1	673.3	540.7	721.0	12.1	450.6	405.9	541.2	16.2	338.3
1300	840.9	1121.2	8.1	700.8	562.7	750.3	12.1	468.9	422.4	563.2	16.2	352.0
1350	873.9	1165.2	8.0	728.3	584.7	779.6	12.1	487.3	438.9	585.2	16.2	365.8
1400	906.9	1209.2	8.0	755.8	606.7	809.0	12.1	505.6	455.4	607.2	16.2	379.5

Recommended Lens (Sharp Corporation)

Focal Length (mm)	8	12	16	25	35	50
Model	IV-1B2008	IV-1B2012	IV-1B2016	IV-1B2025	IV-1B2035	IV-1B2050

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
60	6.6	8.8	45.1	5.5	3.0	4.1	95.6	2.5				
65	7.6	10.2	42.3	6.4	3.8	5.1	83.6	3.2				
70	8.7	11.6	40.2	7.2	4.6	6.1	75.6	3.8				
75	9.7	13.0	38.6	8.1	5.3	7.1	69.8	4.4				
80	10.8	14.4	37.2	9.0	6.1	8.1	65.5	5.1	—	—	—	—
85	11.8	15.8	36.1	9.9	6.8	9.1	62.1	17.8				
90	12.9	17.2	35.2	10.8	7.6	10.1	59.4	19.7				
95	14.0	18.6	34.5	11.6	8.3	11.1	57.2	21.7				
100	15.0	20.0	33.8	12.5	9.1	12.1	55.3	23.7				
120	19.2	25.7	31.9	16.0	12.1	16.1	50.3	31.5				
140	23.5	31.3	30.6	19.6	15.1	20.2	47.2	39.4	5.9	7.9	94.6	4.9
160	27.7	36.9	29.8	23.1	18.1	24.2	45.2	47.2	8.0	10.7	82.9	6.7
180	31.9	42.5	29.1	26.6	21.2	28.2	43.7	55.1	10.1	13.5	76.0	8.4
200	36.1	48.2	28.7	30.1	24.2	32.2	42.6	62.9	12.2	16.3	71.6	10.2
220	40.4	53.8	28.3	33.6	27.2	36.2	41.8	70.8	14.4	19.1	68.4	12.0
240	44.6	59.4	28.0	37.2	30.2	40.3	41.1	78.7	16.5	22.0	66.0	13.7
260	48.8	65.1	27.7	40.7	33.2	44.3	40.6	86.5	18.6	24.8	64.2	15.5
280	53.0	70.7	27.5	44.2	36.2	48.3	40.1	94.4	20.7	27.6	62.8	17.2
300	57.3	76.3	27.3	47.7	39.3	52.3	39.7	102.2	22.8	30.4	61.6	19.0
350	67.8	90.4	26.9	56.5	46.8	62.4	38.9	121.9	28.1	37.5	59.4	23.4
400	78.4	104.5	26.7	65.3	54.3	72.5	38.4	141.5	33.4	44.5	57.9	27.8
450	88.9	118.6	26.5	74.1	61.9	82.5	38.0	161.2	38.6	51.5	56.8	32.2
500	99.5	132.7	26.3	82.9	69.4	92.6	37.7	180.8	43.9	58.6	56.0	36.6
550	110.1	146.7	26.2	91.7	77.0	102.6	37.4	200.4	49.2	65.6	55.4	41.0
600	120.6	160.8	26.1	100.5	84.5	112.7	37.2	220.1	54.5	72.7	54.8	45.4
650	131.2	174.9	26.0	109.3	92.1	122.7	37.0	239.7	59.8	79.7	54.4	49.8
700	141.7	189.0	25.9	118.1	99.6	132.8	36.9	259.4	65.0	86.7	54.1	54.2
750	152.3	203.1	25.9	126.9	107.1	142.9	36.7	279.0	70.3	93.8	53.8	58.6
800	162.9	217.1	25.8	135.7	114.7	152.9	36.6	298.7	75.6	100.8	53.5	63.0
850	173.4	231.2	25.8	144.5	122.2	163.0	36.5	318.3	80.9	107.9	53.3	67.4
900	184.0	245.3	25.7	153.3	129.8	173.0	36.4	337.9	86.2	114.9	53.1	71.8
950	194.5	259.4	25.7	162.1	137.3	183.1	36.3	357.6	91.4	121.9	52.9	76.2
1000	205.1	273.5	25.6	170.9	144.9	193.1	36.3	377.2	96.7	129.0	52.7	80.6
1050	215.7	287.5	25.6	179.7	152.4	203.2	36.2	396.9	102.0	136.0	52.6	85.0
1100	226.2	301.6	25.6	188.5	159.9	213.3	36.2	416.5	107.3	143.1	52.5	89.4
1150	236.8	315.7	25.6	197.3	167.5	223.3	36.1	436.2	112.6	150.1	52.3	93.8
1200	247.3	329.8	25.5	206.1	175.0	233.4	36.1	455.8	117.8	157.1	52.2	98.2
1250	257.9	343.9	25.5	214.9	182.6	243.4	36.0	475.4	123.1	164.2	52.1	102.6
1300	268.5	357.9	25.5	223.7	190.1	253.5	36.0	495.1	128.4	171.2	52.1	107.0
1350	279.0	372.0	25.5	232.5	197.7	263.5	35.9	514.7	133.7	178.3	52.0	111.4
1400	289.6	386.1	25.5	241.3	205.2	273.6	35.9	534.4	139.0	185.3	51.9	115.8

(2) Lens (Ricoh Imaging Co., Ltd.) (IV-S210C2 and IV-C250C3)

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (µm)	Field of view (mm)		Focal length (mm)	Resolution (µm)	Field of view (mm)		Focal length (mm)	Resolution (µm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
60	14.6	19.4	8.4	12.1	23.6	31.5	10.1	19.7	11.6	15.5	17.9	9.7
65	19.3	25.7	7.9	16.1	27.0	36.0	9.9	22.5	14.2	18.9	16.9	11.8
70	23.8	31.8	7.6	19.9	30.3	40.4	9.7	25.3	16.6	22.1	16.2	13.8
75	28.3	37.7	7.4	23.6	33.6	44.8	9.5	28.0	19.0	25.3	15.7	15.8
80	32.7	43.5	7.2	27.2	36.9	49.2	9.4	30.7	21.3	28.4	15.3	17.7
85	37.0	49.4	7.1	30.8	40.1	53.5	9.3	33.5	23.5	31.4	15.1	19.6
90	41.4	55.1	7.0	34.5	43.4	57.9	9.2	36.2	25.8	34.4	14.8	21.5
95	45.7	60.9	6.9	38.1	46.6	62.2	9.2	38.9	28.0	37.4	14.6	23.4
100	50.0	66.7	6.9	41.7	49.9	66.5	9.1	41.6	30.3	40.3	14.4	25.2
120	67.2	89.6	6.7	56.0	62.8	83.8	8.9	52.3	39.0	52.1	14.0	32.5
140	84.3	112.4	6.6	70.2	75.7	100.9	8.8	63.1	47.8	63.7	13.7	39.8
160	101.4	135.2	6.5	84.5	88.6	118.1	8.7	73.8	56.4	75.3	13.4	47.0
180	118.5	157.9	6.5	98.7	101.4	135.2	8.7	84.5	65.1	86.8	13.3	54.3
190	127.0	169.3	6.5	105.8	107.8	143.8	8.6	89.9	69.4	92.6	13.2	57.9
200	135.5	180.7	6.4	112.9	114.3	152.4	8.6	95.2	73.7	98.3	13.2	61.5
210	144.0	192.1	6.4	120.0	120.7	160.9	8.6	100.6	78.1	104.1	13.1	65.0
220	152.6	203.4	6.4	127.1	127.1	169.5	8.6	105.9	82.4	109.8	13.1	68.6
230	161.1	214.8	6.4	134.3	133.5	178.0	8.6	111.3	86.7	115.6	13.0	72.2
240	169.6	226.2	6.4	141.4	139.9	186.6	8.6	116.6	91.0	121.3	13.0	75.8
260	186.7	248.9	6.4	155.6	152.8	203.7	8.5	127.3	99.6	132.8	12.9	83.0
280	203.7	271.6	6.4	169.8	165.6	220.8	8.5	138.0	108.2	144.3	12.9	90.2
300	220.8	294.4	6.3	184.0	178.4	237.9	8.5	148.7	116.8	155.8	12.8	97.4
350	263.4	351.2	6.3	219.5	210.5	280.6	8.4	175.4	138.3	184.5	12.8	115.3
400	306.0	408.0	6.3	255.0	242.5	323.4	8.4	202.1	159.8	213.1	12.7	133.2
450	348.6	464.8	6.3	290.5	274.6	366.1	8.4	228.8	181.3	241.8	12.7	151.1
500	391.2	521.6	6.3	326.0	306.6	408.8	8.4	255.5	202.8	270.4	12.6	169.0
550	433.8	578.4	6.3	361.5	338.6	451.5	8.4	282.2	224.3	299.1	12.6	186.9
600	476.4	635.2	6.3	397.0	370.7	494.2	8.4	308.9	245.8	327.7	12.6	204.8
650	519.0	692.0	6.3	432.5	402.7	537.0	8.4	335.6	267.3	356.4	12.5	222.7
700	561.6	748.8	6.3	468.0	434.8	579.7	8.3	362.3	288.8	385.0	12.5	240.6
750	604.2	805.5	6.3	503.5	466.8	622.4	8.3	389.0	310.2	413.7	12.5	258.5
800	646.8	862.3	6.2	539.0	498.8	665.1	8.3	415.7	331.7	442.3	12.5	276.4
850	689.3	919.1	6.2	574.5	530.9	707.8	8.3	442.4	353.2	470.9	12.5	294.3
900	731.9	975.9	6.2	609.9	562.9	750.5	8.3	469.1	374.7	499.6	12.5	312.2
950	774.5	1032.7	6.2	645.4	594.9	793.2	8.3	495.8	396.2	528.2	12.5	330.1
1000	817.1	1089.5	6.2	680.9	627.0	835.9	8.3	522.5	417.6	556.8	12.4	348.0
1050	859.7	1146.3	6.2	716.4	659.0	878.7	8.3	549.2	439.1	585.5	12.4	365.9
1100	902.3	1203.1	6.2	751.9	691.0	921.4	8.3	575.9	460.6	614.1	12.4	383.8
1150	944.9	1259.9	6.2	787.4	723.1	964.1	8.3	602.5	482.1	642.7	12.4	401.7
1200	987.5	1316.6	6.2	822.9	755.1	1006.8	8.3	629.2	503.5	671.4	12.4	419.6
1250	1030.1	1373.4	6.2	858.4	787.1	1049.5	8.3	655.9	525.0	700.0	12.4	437.5
1300	1072.7	1430.2	6.2	893.9	819.2	1092.2	8.3	682.6	546.5	728.6	12.4	455.4
1350	1115.3	1487.0	6.2	929.4	851.2	1134.9	8.3	709.3	568.0	757.3	12.4	473.3
1400	1157.8	1543.8	6.2	964.9	883.2	1177.6	8.3	736.0	589.4	785.9	12.4	491.2

Recommended Lens (Ricoh Imaging Co., Ltd.)

Focal Length (mm)	6	8	12	16
Model	FL-CC0614A-2M	FL-CC0814A-2M	FL-CC1214A-2M	FL-CC1614A-2M

Focal Length (mm)	25	35	50	75
Model	FL-CC2514A-2M	FL-CC3516-2M	FL-CC5024A-2M	FL-CC7528-2M

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm				Lens focal length f = 16 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal			Vertical	Horizontal		
60	12.6	16.9	22.7	10.5								
65	14.6	19.5	21.8	12.2	–	–	–	–				
70	16.5	21.9	21.1	13.7								
75	18.3	24.4	20.6	15.2	7.2	9.6	44.4	6.0				
80	20.1	26.7	20.2	16.7	9.0	12.0	40.6	7.5	–	–	–	–
85	21.8	29.1	19.9	18.2	10.5	14.0	38.5	8.7				
90	23.6	31.4	19.6	19.6	11.8	15.7	37.1	9.8				
95	25.3	33.7	19.3	21.1	13.1	17.4	36.0	10.9				
100	27.0	36.0	19.1	22.5	14.3	19.0	35.1	11.9	7.6	10.1	57.6	6.3
120	33.8	45.1	18.5	28.2	18.9	25.2	32.8	15.7	12.1	16.1	48.8	10.0
140	40.6	54.1	18.1	33.8	23.3	31.0	31.4	19.4	15.7	20.9	45.4	13.1
160	47.2	63.0	17.8	39.4	27.6	36.8	30.5	23.0	19.1	25.5	43.3	15.9
180	53.9	71.9	17.6	44.9	31.8	42.4	29.9	26.5	22.5	29.9	41.9	18.7
190	57.2	76.3	17.5	47.7	33.9	45.3	29.6	28.3	24.1	32.1	41.4	20.1
200	60.6	80.8	17.4	50.5	36.1	48.1	29.4	30.0	25.7	34.3	40.9	21.4
210	63.9	85.2	17.3	53.2	38.2	50.9	29.2	31.8	27.3	36.5	40.5	22.8
220	67.2	89.6	17.3	56.0	40.3	53.7	29.0	33.5	29.0	38.6	40.1	24.1
230	70.5	94.0	17.2	58.8	42.4	56.5	28.8	35.3	30.6	40.7	39.8	25.5
240	73.8	98.5	17.2	61.5	44.4	59.3	28.7	37.0	32.2	42.9	39.5	26.8
260	80.5	107.3	17.1	67.1	48.6	64.8	28.4	40.5	35.4	47.1	39.0	29.5
280	87.1	116.1	17.0	72.6	52.8	70.4	28.2	44.0	38.5	51.4	38.6	32.1
300	93.7	125.0	16.9	78.1	56.9	75.9	28.0	47.5	41.7	55.6	38.2	34.7
350	110.3	147.0	16.8	91.9	67.3	89.8	27.6	56.1	49.6	66.1	37.6	41.3
400	126.8	169.0	16.7	105.6	77.7	103.6	27.4	64.7	57.4	76.6	37.1	47.9
450	143.3	191.1	16.6	119.4	88.0	117.4	27.2	73.4	65.3	87.0	36.7	54.4
500	159.8	213.1	16.5	133.2	98.4	131.2	27.0	82.0	73.1	97.4	36.4	60.9
550	176.3	235.1	16.5	146.9	108.7	144.9	26.9	90.6	80.9	107.9	36.2	67.4
600	192.8	257.1	16.4	160.7	119.0	158.7	26.8	99.2	88.7	118.3	36.0	73.9
650	209.3	279.1	16.4	174.4	129.3	172.5	26.7	107.8	96.5	128.7	35.8	80.4
700	225.8	301.1	16.4	188.2	139.7	186.2	26.6	116.4	104.3	139.1	35.7	86.9
750	242.3	323.1	16.4	201.9	150.0	200.0	26.5	125.0	112.1	149.5	35.5	93.4
800	258.8	345.1	16.3	215.7	160.3	213.7	26.5	133.6	119.9	159.9	35.4	99.9
850	275.3	367.1	16.3	229.4	170.6	227.5	26.4	142.2	127.7	170.2	35.4	106.4
900	291.8	389.1	16.3	243.2	180.9	241.2	26.4	150.8	135.5	180.6	35.3	112.9
950	308.3	411.1	16.3	256.9	191.2	255.0	26.3	159.4	143.3	191.0	35.2	119.4
1000	324.8	433.1	16.3	270.7	201.5	268.7	26.3	168.0	151.0	201.4	35.1	125.9
1050	341.3	455.1	16.3	284.4	211.9	282.5	26.3	176.5	158.8	211.8	35.1	132.4
1100	357.8	477.1	16.2	298.2	222.2	296.2	26.2	185.1	166.6	222.1	35.0	138.8
1150	374.3	499.1	16.2	311.9	232.5	310.0	26.2	193.7	174.4	232.5	35.0	145.3
1200	390.8	521.1	16.2	325.7	242.8	323.7	26.2	202.3	182.2	242.9	34.9	151.8
1250	407.3	543.1	16.2	339.4	253.1	337.4	26.2	210.9	190.0	253.3	34.9	158.3
1300	423.8	565.1	16.2	353.2	263.4	351.2	26.1	219.5	197.7	263.7	34.9	164.8
1350	440.3	587.1	16.2	366.9	273.7	364.9	26.1	228.1	205.5	274.0	34.8	171.3
1400	456.8	609.0	16.2	380.7	284.0	378.7	26.1	236.7	213.3	284.4	34.8	177.8

Camera installation distance (mm)	Lens focal length f = 8.5 mm				Lens focal length f = 12 mm			
	Field of view (mm)		Focal length (mm)	Resolution (μm)	Field of view (mm)		Focal length (mm)	Resolution (μm)
	Vertical	Horizontal			Vertical	Horizontal		
60	–	–	–	–	–	–	–	–
65								
70								
75								
80								
85								
90								
95								
100								
120								
140								
160								
180	8.6	11.4	78.9	7.1				
190	10.1	13.5	74.1	8.5				
200	11.6	15.4	71.0	9.6				
210	12.9	17.2	68.7	10.7				
220	14.2	18.9	66.9	11.8				
230	15.4	20.6	65.4	12.8				
240	16.6	22.2	64.2	13.9				
260	19.0	25.3	62.3	15.8	6.1	8.1	135.7	5.1
280	21.3	28.4	60.8	17.8	9.0	12.1	115.3	7.5
300	23.6	31.5	59.6	19.7	11.1	14.7	107.6	9.2
350	29.3	39.0	57.5	24.4	15.4	20.5	97.8	12.8
400	34.8	46.5	56.1	29.0	19.4	25.9	92.6	16.2
450	40.4	53.8	55.1	33.6	23.3	31.0	89.3	19.4
500	45.9	61.1	54.4	38.2	27.1	36.1	87.0	22.5
550	51.3	68.5	53.8	42.8	30.8	41.1	85.3	25.7
600	56.8	75.7	53.3	47.3	34.5	46.0	83.9	28.8
650	62.3	83.0	52.9	51.9	38.2	51.0	82.8	31.9
700	67.7	90.3	52.6	56.4	41.9	55.9	82.0	34.9
750	73.2	97.6	52.3	61.0	45.6	60.8	81.2	38.0
800	78.6	104.8	52.0	65.5	49.3	65.7	80.6	41.1
850	84.0	112.1	51.8	70.0	52.9	70.6	80.0	44.1
900	89.5	119.3	51.6	74.6	56.6	75.5	79.6	47.2
950	94.9	126.5	51.5	79.1	60.3	80.4	79.2	50.2
1000	100.3	133.8	51.3	83.6	63.9	85.2	78.8	53.3
1050	105.8	141.0	51.2	88.1	67.6	90.1	78.5	56.3
1100	111.2	148.3	51.1	92.7	71.2	95.0	78.2	59.3
1150	116.6	155.5	51.0	97.2	74.9	99.8	77.9	62.4
1200	122.1	162.7	50.9	101.7	78.5	104.7	77.7	65.4
1250	127.5	170.0	50.8	106.2	82.2	109.5	77.5	68.5
1300	132.9	177.2	50.7	110.8	85.8	114.4	77.3	71.5
1350	138.3	184.4	50.6	115.3	89.4	119.2	77.1	74.5
1400	143.7	191.7	50.5	119.8	93.1	124.1	76.9	77.6

Section 3: Basic Operation

This device is primarily controlled by touching the icons and buttons displayed on each screen to select an item or enter a desired value. This section describes the screens that are commonly used throughout the operation of the device.
(The screens shown below are typical examples)

[1] Screen

(1) Startup Setting Screen

Upon the initial startup of the device, the following screen will be displayed:
The screen is used to set language of the screen, Trigger mode, number of connected cameras and the camera type

Important:
When one of the number of connected cameras, the camera type and trigger mode is changed, all the parameters are initialized. Therefore, it is recommended to set these upon startup of the device and before using this device and before registering an object type.

① Language/言語 drop down list

Select one from “Japanese” and “English” for the language to display on the screens.

② Trigger Mode drop down list

Select one from “1 trigger” and “2 trigger” for the trigger mode.
1 trigger: All the cameras are triggered by the same trigger signal.
2 trigger: A camera is triggered by the Trigger n signal set for the camera. (n = 1 or 2)

③ Connect camera (IV-S310M only) drop down list

Select one from “1-2 unit” and “3-4 unit” for the number of connected cameras of IV-S310M.
[Default Setting]: 3-4 unit

④ Camera Type drop down list

Select one from the drop down list:

Monochrome:

6.5M	・IVS300C5	
2M	・IVS300C2	・IVS210C2
1.3M	・IVS300CD	
0.25M	・IVS300C6	・IVS300C7
	・IVS300CA	・IVS200C6

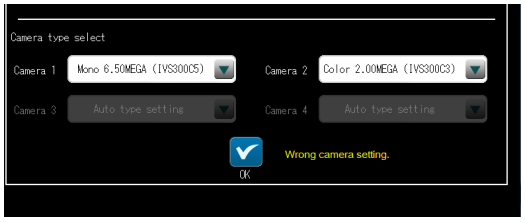
Color:

2M	・IVC250C3	・IVS300C3
0.25M	・IVC250C8	・IVS300C8

[Default Setting]: Not connected

⑤ OK icon

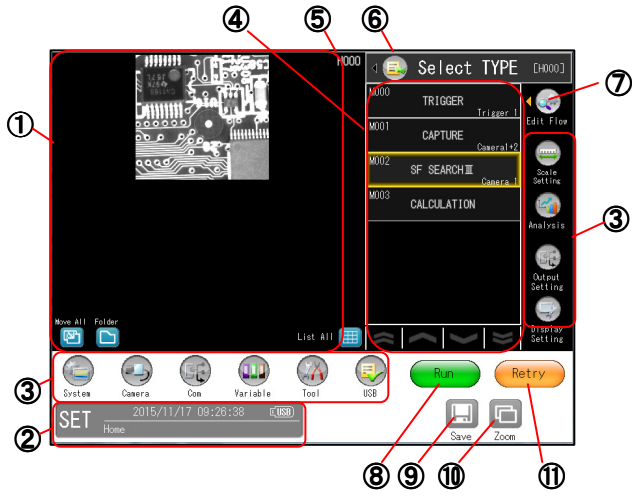
Touch the [OK] icon to store the setting.
The device will reboot.
When an error is found in the setting, the device does not store the setting and displays “Wrong camera setting” on the right of the icon.



Example: Error in setting
Connect camera: **3-4 unit**
Camera Type: IVS300C5 (6.5 M pixels)

(2) SET screen

This screen shows that the device is in the (Home) SET mode.
The screen is used to set and adjust inspection parameters.



① **Image display area**
Displays an image that the settings to be made.

② **Status display area**
Displays the "mode", "date and time", "screen hierarchy of the current screen", etc.

③ **Setting icons**
Touch to go to each setting mode.

④ **Module setting buttons**
Touch to go to setting screen of each module.

⑤ **Object Type and Object Name display**
Displays the Object type and Object Name

⑥ **[Object Type Select] icon**
Touch to go to Object type select screen.

⑦ **[Edit Flow] icon**
Touch to go to the Module flow edit screen.

⑧ **[Run] button**
Touch to go to the Run (or operation) mode.

⑨ **[Save] icon**
Touch to save the changes to the object type settings.

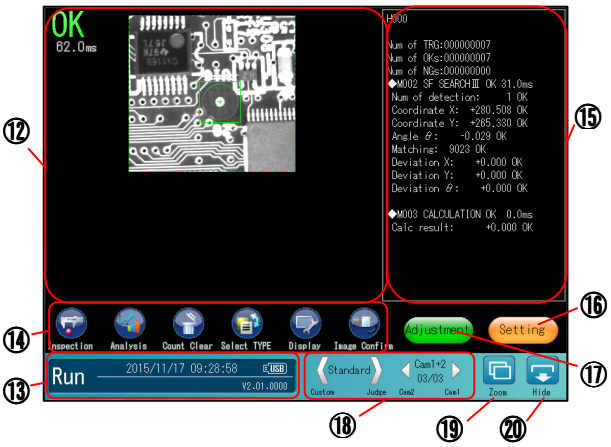
⑩ **[Zoom] icon**
Touch to zoom in or out the displayed image.

⑪ **[Retry] button**
Touch to go to Retry screen.

(3) Run screen

This screen appears when the “Run” button is touched.

・See page 5-1 for details.



⑫ **Image display area**
Displays the image, judgment result, inspection time, etc.

⑬ **Status display area**
Displays the "mode", "date and time" and "program version number".

⑭ **Inspection and Setting icons**
[Inspection] icon
Touch to start the inspection.
[Analysis] icon
Touch to go to analysis screen.
[Count Clear] icon
Touch to clear the count.
[Select TYPE] icon
Touch to select an object type number.
[Display] icon
Touch to set the "image mode", "division mode", "image to display", "text to display", "font size", etc.
[Image Confirm] icon
Touch to check the image.

⑮ **Information display area**
Displays object type number and name, inspection results and statistics.

⑯ **[Setting] button**
Touch to go to the SET screen.

⑰ **[Adjust] button**
Touch to go to the Adjustment screen.

⑱ **Screen Format Change button**
Touch to change items to display on the screen:
See Page 5-5 for details.

⑲ **[Zoom] icon**
Touch to zoom in or out the displayed image.

⑳ **[Hide] icon**
Touch to hide buttons and icons.

[2] Screen Operations

This section describes the user interfaces used on each screen (setting and selection).

① Icons

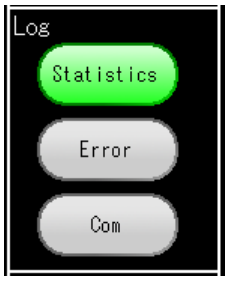
- Round or rectangular icons labeled with a pictorial and screen name to go or function name to execute.
- Touch an icon to go to the screen or activate the function.

② Buttons

- Oval or rounded rectangular buttons labeled with the screen name to go or function name to execute.
- Touch a button to go to the screen or activate the function.

③ Select buttons

- Multiple oval or rounded rectangular buttons labeled with the options for selecting an item.
- Touched button turns green when selected and gray when unselected.
- Only one of the buttons can be selected. Touch a button to select an option.



④ Check box

- Rectangular framed box.
- Alternates between selected (☑) green check mark and Unselected (□) at each touch of the box.
- Touch the box to select or unselect.

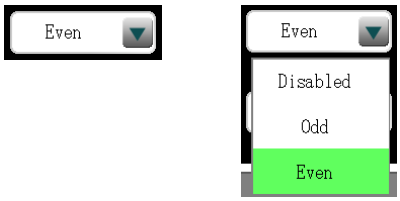
(Selected) (unselected)

⑤ Radio button

- Rectangular box with the buttons labeled with the options for selecting an item.
- Touch a button to select an option.
- Selected button turns blue.
- Only one of the options can be selected.

⑥ Drop down list

- Rectangular frame with ▼ marked button.
- Touch the ▼ button to list menus and then touch a menu to select, and the drop down list will close.
- Selected menu turns green.

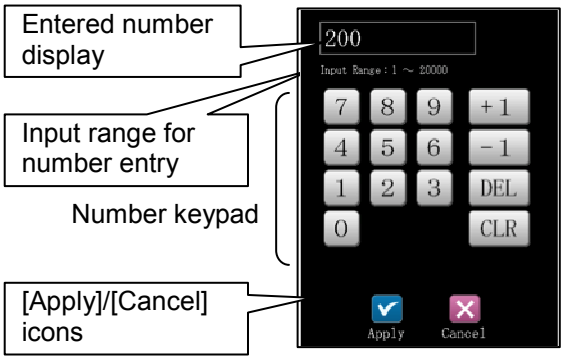


⑦ Combo box

- Rectangular frame box with the list of texts.
- Touch a text line to select.
- The selected text line(s) turns green and unselected text line(s) remains unchanged.
- For certain combo box, only one of the text lines is selectable.
- Use ▲ or ▼ key to scroll up or down the list.

⑧ Data input box

- Rectangular box with a number on a white background.
- Touch the box to display number keypad for data entry.

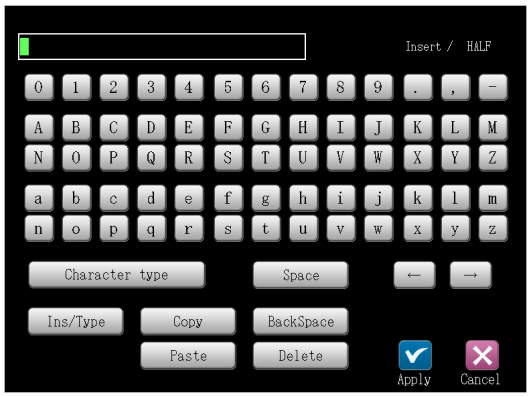


The functions of each key and icon are as follows:

- [0] to [9] keys
  Touch a number.
  The number of the touched key is displayed at the rightmost digit of the "Entered number display".
- [+1] and [-1] keys
  Increments or decrements the number shown on the "Entered number display" by one.
- [DEL] key
  Deletes the rightmost digit of the number shown on the "Entered number display".
- [CLR] key
  Clears the number shown on the "Entered number display".
- [Apply] Icon
  Enters the number shown on the “Entered number display”.
- [Cancel] Icon
  Closes the number keypad.

⑨ [Enter name] icon

- Touch to enter a name for an object type. A keyboard will appear when the icon is touched.

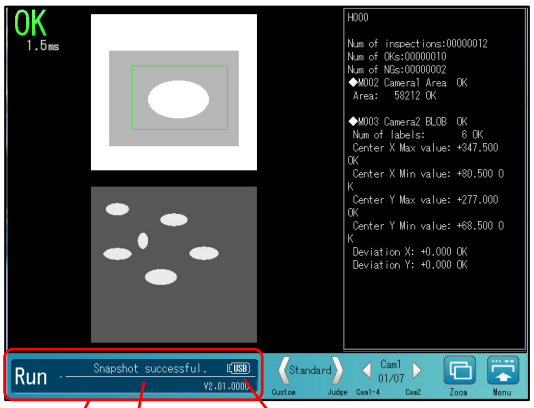


- See page 4-26 for details.

⑩ Snapshot Function

Connect an USB flash drive to the USB port of the controller before using this function.

- This is the function to take a snapshot of the current screen of this device.
- To take a snapshot, connect an USB flash drive to the USB port of this device and touch the status display area on the Run screen or SET screen until "Snapshot successful" message is displayed when the snapshot is saved on the USB flash drive.
- A “SNAPSHOT” folder will be created automatically on the USB flash drive.

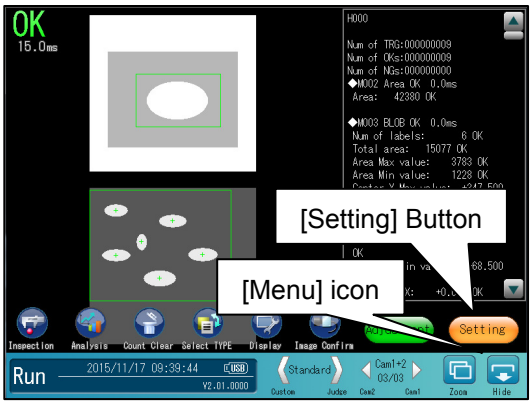


[3] Mode change

This section describes how to switch between the Run mode and SET mode.

(1) Switching from Run mode to SET mode

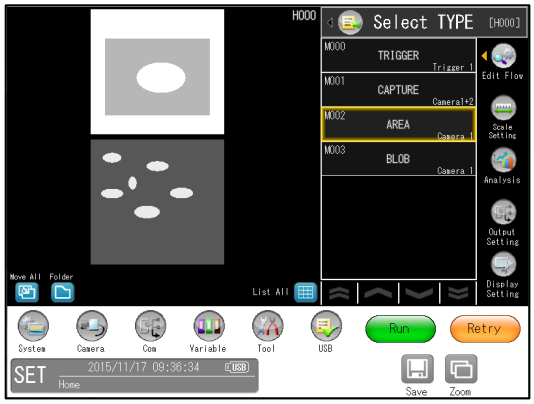
① Touch the [Setting] button on the Run screen. Touch the [Menu] icon if the [Setting] button is not displayed.



② A window will appear to confirm that you want to enter the SET mode (offline). Touch the ☑ icon to enter the SET mode or [Cancel] icon to cancel and close the window.

③ If you have changed the settings on the Run screen, a window will appear to confirm that you want to save the changes. Touch the [Yes], [No] or [Cancel] icon.

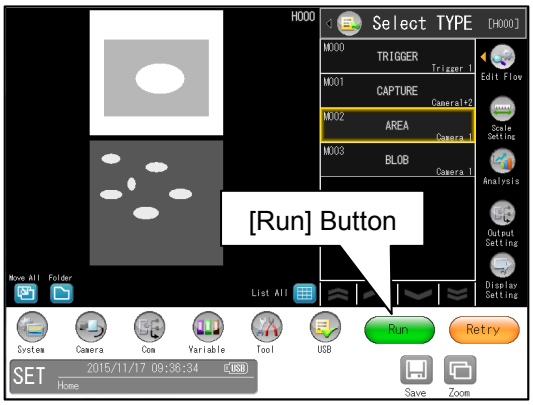
④ (Home) SET screen will appear when [Yes] or [No] icon is touched.



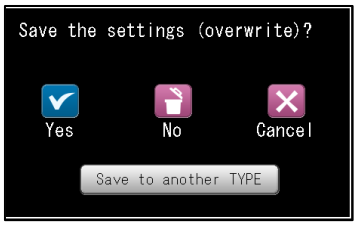
・See page 4-1 for details.

(2) Switching from SET mode to Run mode

① Touch the [Run] button on the SET screen.



② If you have changed the settings on the SET screen, a window will appear to confirm that you want to save the changes (overwrite). Touch the [Yes], [No] or [Cancel] icon.



・You can save the changed setting to a different object type by touching the [Save to another TYPE] button.
See page 3-14.

③ The Run screen without buttons and icons will appear when the [Yes] or [No] icon is touched.

・See page 5-1 for details.

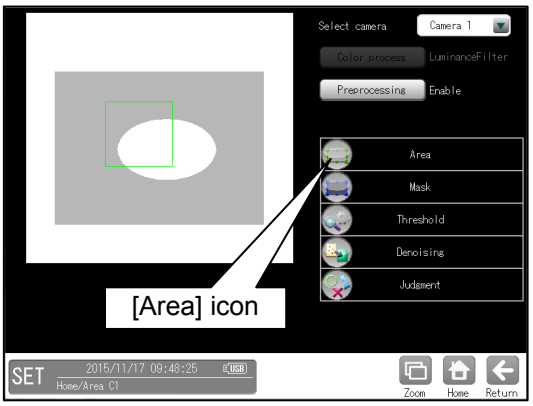
[4] Setting the Inspection area

An inspection area must be set on the SET screen for certain inspection modules, such as the "SF search III module".

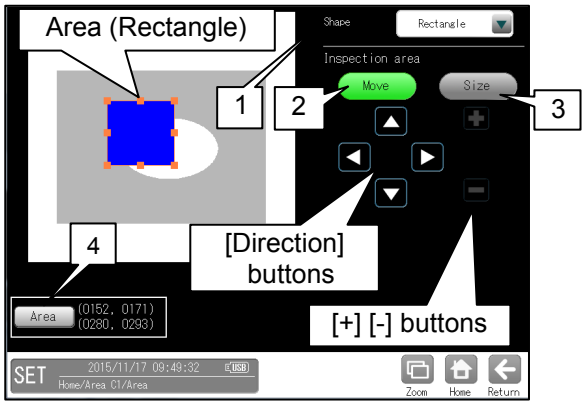
(1) Setting procedure for an Inspection area

Following is the procedure for setting an inspection area for the "SF search III module" as an example. The procedure for setting the inspection area for other modules is identical.

① Touch the [Area] icon.

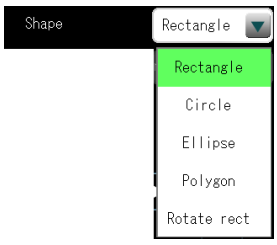


② The area setting screen will appear.
Note: Following screens are the case "Rectangle" is selected for the inspection area as an example.



1. [Shape] drop down list

Select an Inspection area shape from the [Shape] drop down list.
Select "Rectangle".

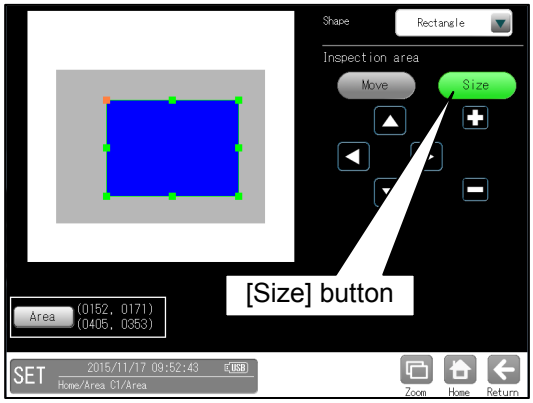


2. [Move] button

Touch the [Move] button to move the area.
An orange square will appear on the screen.
Touch and move the square on the screen for large movement and use the [Direction] buttons for fine adjustment of the position.

3. [Size] button

Touch the [Size] button, and one □ on the rectangle shape becomes orange to indicate it is the target for a shape change.
To select the other □, touch it on the screen.
Touch and drag the orange □ to change the size roughly and use the [Directions] buttons for fine adjustment of the size.

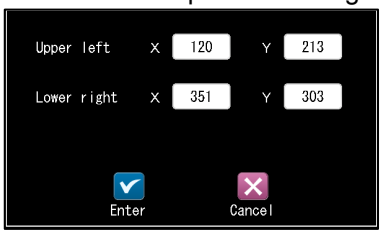


・ [+] and [-] buttons
Touch [+] or [-] button to enlarge or reduce the area of the shape.

4. [Area] button

This button is used when setting the size by coordinates.
Touch the [Model] button, and a window for setting the coordinates of the inspection area will appear.

(When the area shape is "Rectangle")



Touch one of the data input boxes for the Upper left (X/Y) or Lower right (X/Y) coordinates, and a number keypad will appear.
Enter the coordinates with the keypad.

Touch [CLR] key before entering a new number.

The window for entering coordinates, etc. varies with the inspection area shape selected.

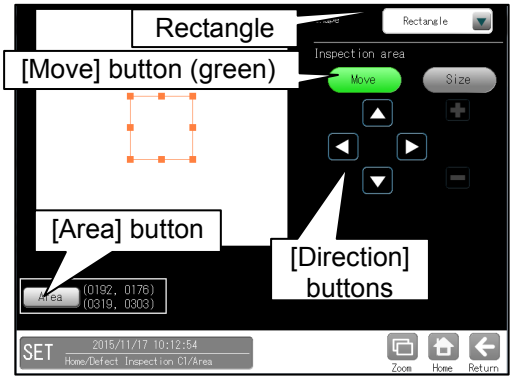
- Circle: Center coordinates (X, Y), Circle radius(R)
- Ellipse: Center coordinates (X, Y), Circle radius (X, Y)
- Poligon: Coordinates (X, Y),
- Rotate rect & Project rotate rect: Upper left (X, Y), Lower right (X, Y), Angle θ

(2) Setting procedure for the Inspection area for each shape:

"Rectangle", "Circle", "Ellipse", "Polygon", "Rotate rectangle", “Arc”, "Line", “Projected rectangle” and “Projected rotate rectangle” are available for setting the Inspection area.
The shape position and the size can be set as described in the previous page.
Note: Following screens are the case of "Defect" module is selected as an example.
The procedure for setting the Inspection area of other modules is identical.

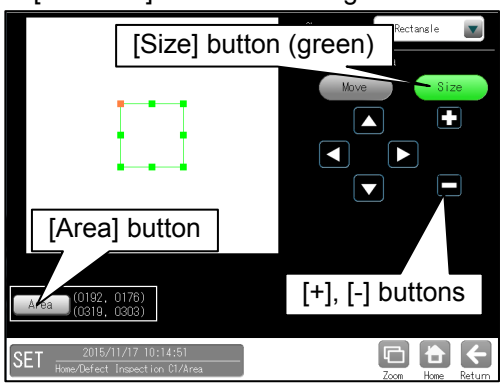
① Rectangle

1. Select the "Rectangle”, and a rectangle will appear. Touch the [Move] button, and 8 orange □s will appear on the rectangle.



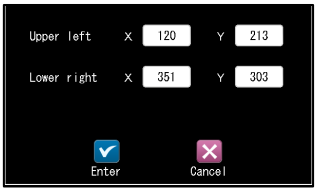
- Position the rectangle by touching and moving it on the screen and using [Direction] buttons.

2. Touch the [Size] button, and one □ of the rectangle becomes orange.
Touch a desired □ for shape change.
   - Touch and drag the □ and use the [Direction] buttons to change the size.



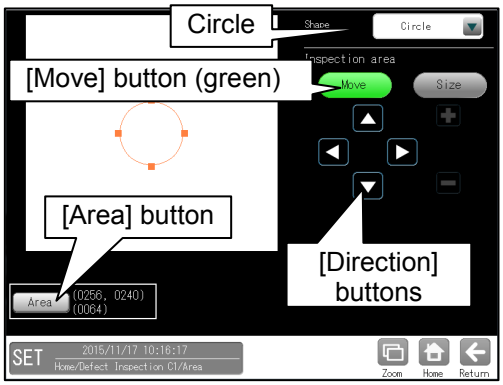
   - Touch [+] or [-] button to enlarge or reduce the rectangular size.

3. When setting size by coordinates, touch the [Area] button and enter Upper left and Lower right coordinates (X, Y) for the rectangle using the data input boxes and number keypad.



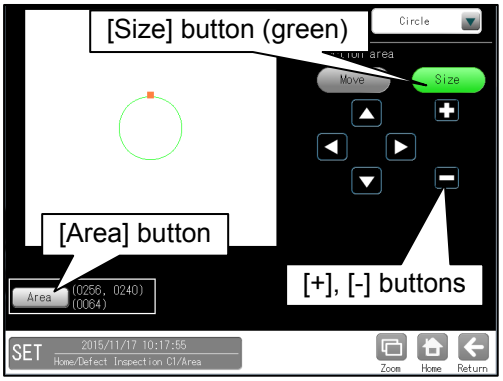
② Circle

1. Select the "Circle" and a circle will appear. Touch the [Move] button, and 4 orange □s will appear on the circle.



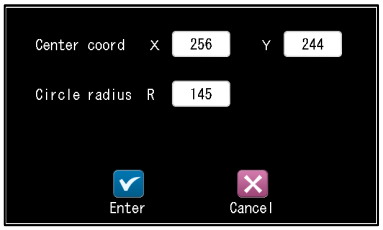
- Position the circle by touching and moving it on the screen and using [Direction] buttons.

2. Touch the [Size] button, and the □ at the top of the circle becomes orange.
   - Touch and drag the □ and use the [Direction] buttons to change the size.



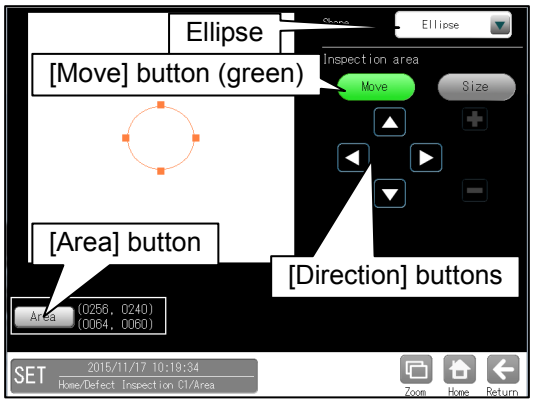
   - Touch [+] or [-] button to enlarge or reduce the circle size.

3. When setting size by coordinates, touch the [Area] button and enter Center coordinates (X, Y) and Circle radius (R) using the data input boxes and number keypad.



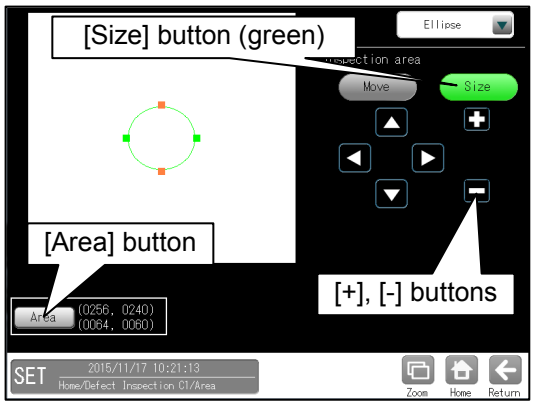
③ Ellipse

1. Select the "Ellipse", and an ellipse will appear. Touch the [Move] button, and 4 orange □s will appear on the ellipse.



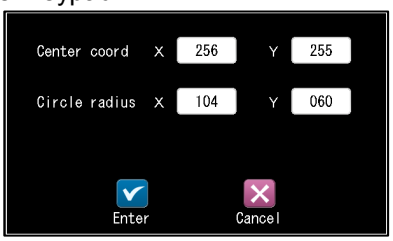
・Position the ellipse by touching and moving it on the screen and using [Direction] buttons.

2. Touch the [Size] button, and two □s at upper and lower positions become orange.
   - Touch the [Size] button to make two □s at both sides orange. Upper/Lower or both sides □s are selected alternately at each touch of the □.
   - Touch and drag the □ and use the [Direction] buttons to change the size.



・ Touch [+] or [-] button to enlarge or reduce the rectangular size.

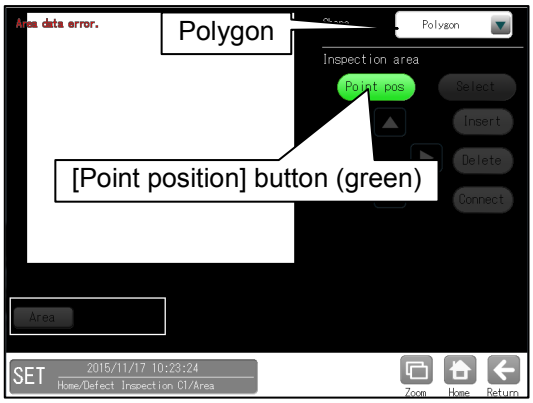
3. Touch the [Area] button, and the window shown below will appear. Enter Center coordinates (X, Y), and Circle radius (R) for the ellipse using the data input boxes and number keypad.



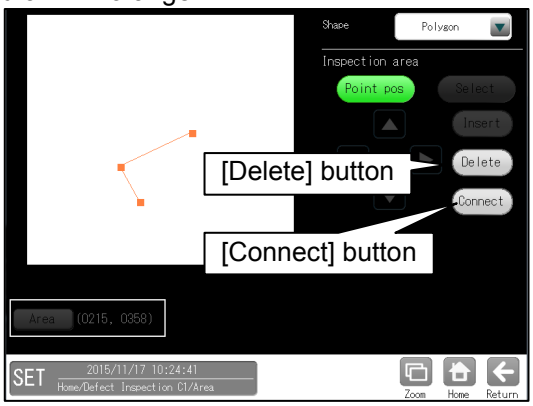
④ Polygon

A polygon with up to 32 vertices (□) can be created.

1. Select the "Polygon", and [Point pos] (Point position) button will appear.

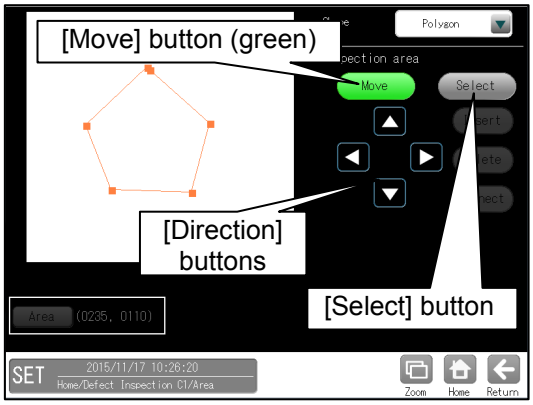


2. Touch any desired points in sequence on the screen, and the vertices (□) and sides will be drawn in orange.



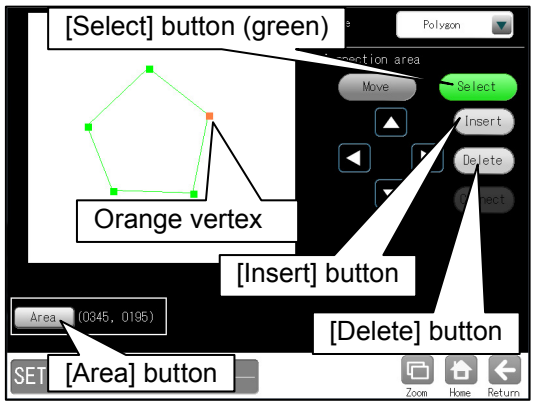
・The [Delete] button is enabled once the first point is drawn. Touch the button to delete the □ and the side to the last drawn point.
・The [Connect] button for connecting the first and last points automatically is enabled after the 3rd point is drawn.

3. Touch the [Connect] button and the [Point pos] button changes to [Move] button and [Direction] buttons and [Select] button are enabled.



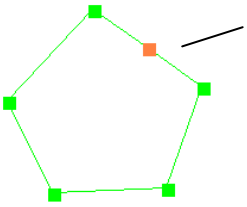
・ Position the polygon by touching and moving it on the screen and using [Direction] buttons.

4. Touch the [Select] button, and the [Insert], [Delete] and [Area] buttons will be enabled. The polygon drawn has only one orange vertex (□).



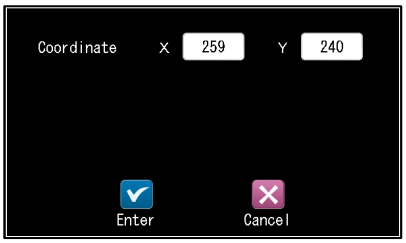
Touch and select a desired □ and the following can be done.

- Position the □ by touching and moving it on the screen and using [Direction] buttons.
- Insert a new □ next to the orange □ by touching the [Insert] button, as necessary.



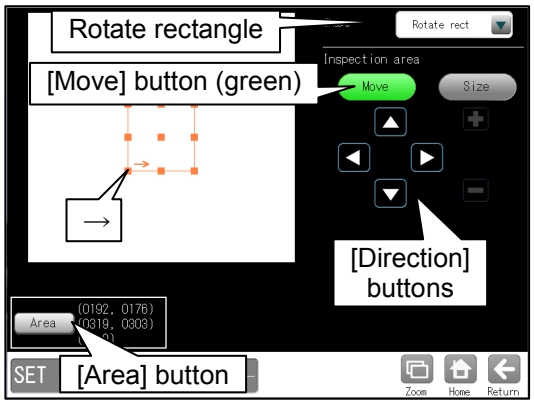
- Delete the □ by touching the [delete] button, as necessary.

- Touch the [Area] button, and the coordinate window for the selected □ will appear. Enter the Coordinates of the vertex (X, Y) using the data input boxes and number keypad.



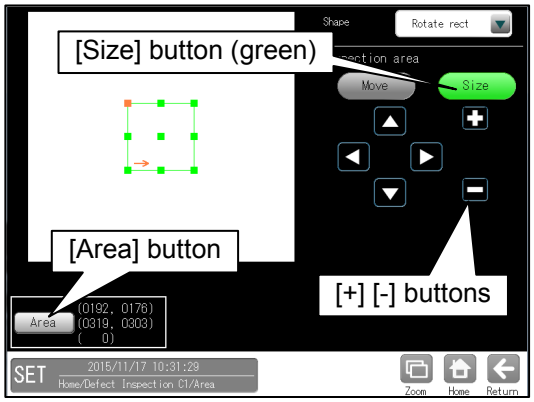
⑤ Rotate rectangle

1. Select the "Rotate rect", and a square with an arrow (→) mark will appear. Touch the [Move] button, and 8 orange □s will appear.

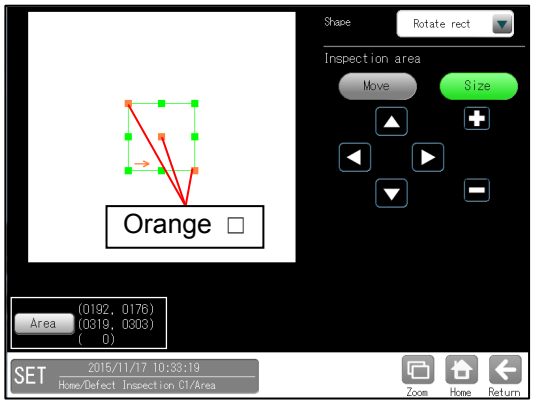


Position the rectangle by touching and moving it on the screen and using [Direction] buttons.

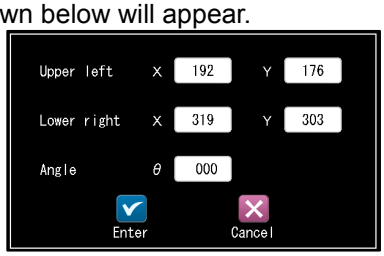
2. Touch the [Size] button, and one □ becomes orange.



- Touch a desired □ for shape change.
- Touch and drag the □ and use the [Direction] buttons to change the size.
- Touch [+] or [-] buttons to enlarge or reduce the square.
- Touch the □ at the center of rectangle, and 3 □s will become orange.
  Touch the △ or ▽ button of the [Direction] buttons to rotate the rectangle CCW or to CW, respectively.



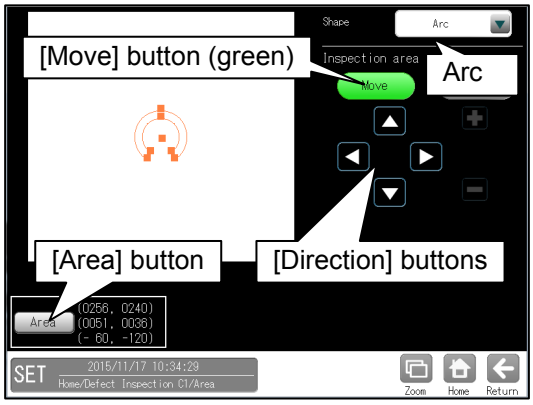
3. Touch the [Area] button, and the window shown below will appear.



・Enter the Upper left, Lower right coordinates (X, Y), and the Angle (θ) of the rectangle using the data input boxes and number keypad.
Note: The coordinates and the angle can not be set at the same time.

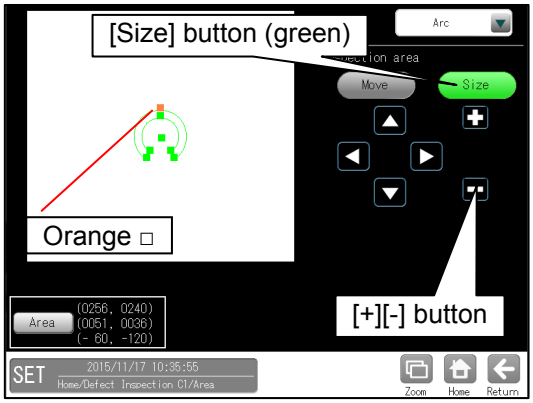
⑥ Arc

1. Select the "Arc" and a horseshoe shape will appear. Touch the [Move] button, and 7 orange □s will appear on the horseshoe shape.



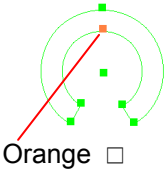
・ Position the horseshoe shape by touching and moving it on the screen and using [Direction] buttons.

2. Touch the [Size] button, and the □ at top of the outer arc becomes orange.



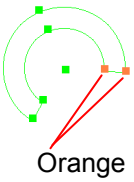
・ Touch a desired □ on the outer arc.
・ Touch and drag the □ to change the size of the outer arc and use the △ or ▽ button of the [Direction] buttons to change the outer arc size.
・Touch [+] or [-] buttons to enlarge or reduce the outer arc size.

3. Touch a desired □ on inner arc.

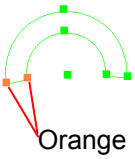


・ Touch and drag the □ to change the size of the inner arc and use the △ or ▽ button of the [Direction] buttons to change the inner arc size.
・Touch [+] or [-] buttons to enlarge or reduce the inner arc.

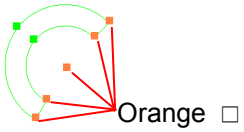
4. The □s to become orange will change at each touch of the [Size] button.
By using the △, ▽, [+], [-] buttons, or by touching the horseshoe shape, the following operations can be done.
・Move the right ends of the arcs CW/CCW.



・Move the left ends of the arcs CW/CCW.

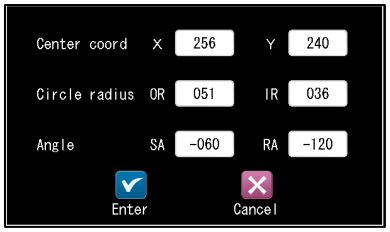


・Turn the horseshoe shape CW/CCW.



Touch the [Size] button to return to the screen of 2 on the left.

5. Touch the [Area] button, and the window shown below will appear.

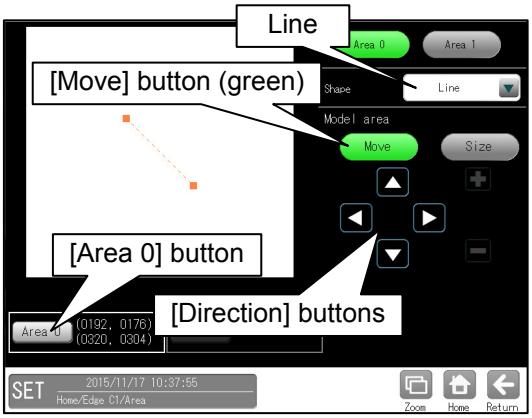


・Enter the Center coordinates (X, Y) of the horseshoe shape, Circle radius and tip Angle of each of the outer and inner arcs (OR, IR and SA, RA, respectively) using the data input boxes and number keypad.

⑦ Line (Straight line)

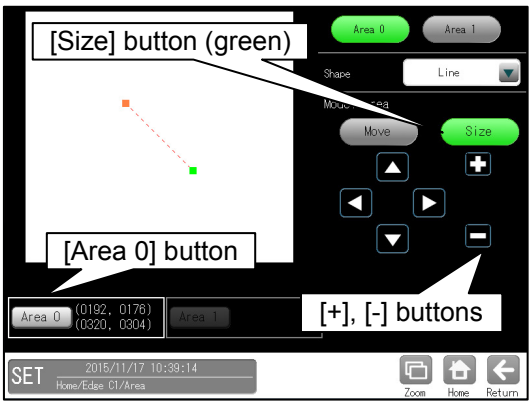
Note: Following screens are the case of "Edge" module is selected as an example. When the edge module is selected, "Line" is selectable from the [Shape] drop down list.

1. Select the "Line" and a straight line will appear. Touch the [Move] button, and 2 orange □s will appear at both ends of the line.



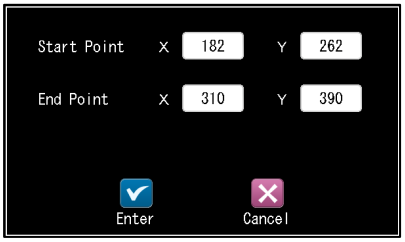
- Position the line by touching and moving it on the screen and using [Direction] buttons.

2. Touch the [Size] button, and one □ becomes orange.



- Touch the [Size] button to make the □ at the other end of the line orange. The □ to become orange on the line changes at each touch of the [Size] button.
- Touch and drag the selected □ to change the size and use the [Direction] buttons to change the size.
- Touch [+] or [-] button to enlarge or reduce the straight line.

3. Touch the [Area0] button, and the window shown below will appear. Enter the Start point and End point coordinates (X, Y) using the data input boxes and number keypad.



⑧ Project rectangle

The procedure is the same as that of Rectangle.

(See page 3-7 ①.)

⑨ Project Rotate rectangle

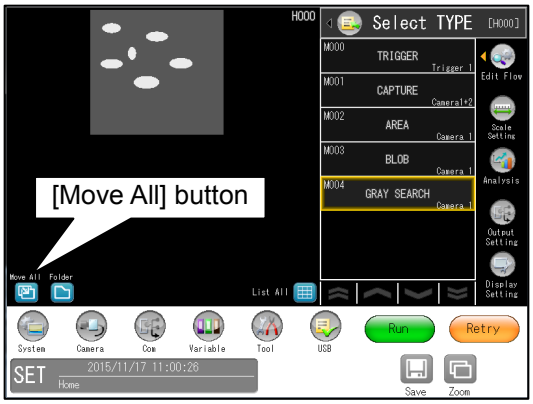
The procedure is the same as that of Rotate rectangle.

(See page 3-9 ⑤.)

(3) Procedure for moving all areas

All the set areas of a module (Inspection, Model, Mask and Search areas) can be moved at a time by the setting as follows:.

① Touch the [Move All] icon on (Home) SET screen.

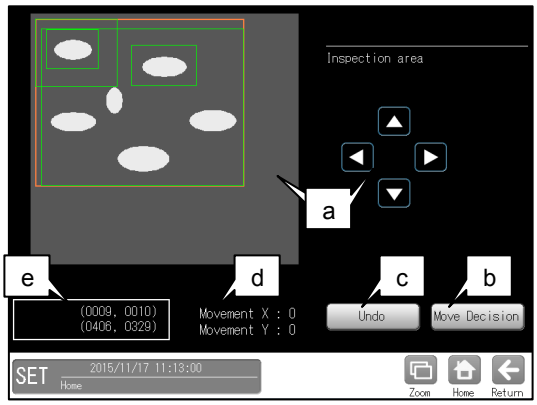


② The Move All screen will appear.

1. **[Select Camera] drop down list**
   Select the Camera which is selected by the module you want to Move All:
   "Camera 1" or "Camera 2".
2. **Move Module List**
   Select the module you want to Move All by checking the check box.
3. **[Mask Area also Move] check box**
   Check the box to Move All including mask area.
4. **[Select All] button**
   Touch this button to select all the modules displayed.
5. **[Unselect All] button**
   Touch this button to unselect all the modules displayed.
6. **[Cancel] button**
   Touch this button to go back to SET screen.

7. **[Move Domain] button**
   Touch this button after selecting a module.
   Screen to set move distance will appear.

Touch the [Move Domain] button.



The circumscribed rectangle of set area is displayed in orange.

a. Setting of Set Areas
The set areas can be moved by dragging the mouse and [Direction] buttons

b. [Move Decision] button
Touch this button to save the areas moved.

c. [Undo] button
Touch this button to move the areas back to the original position.
Once the [Move Decision] button is touched, the areas at the time of the button touch are saved.

d. Movement X/Movement Y Display
Displays the movement distances of the areas in X and Y axes.

e. Coordinates Display
Displays the top-left and bottom-right coordinates of the circumscribed rectangle of all the areas.

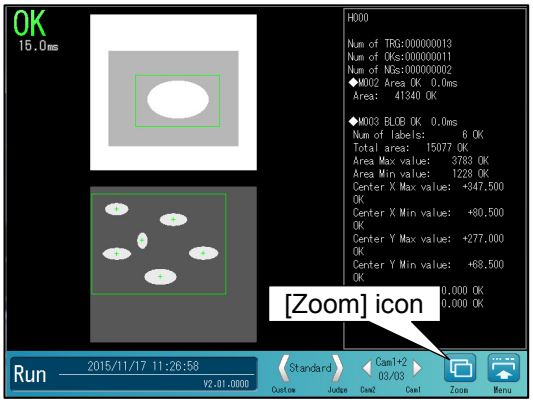
[5] Enlargement or reduction of the displayed image

The [Zoom] icon on the Run and SET screens allows you to enlarge or reduce the image displayed on the screen.

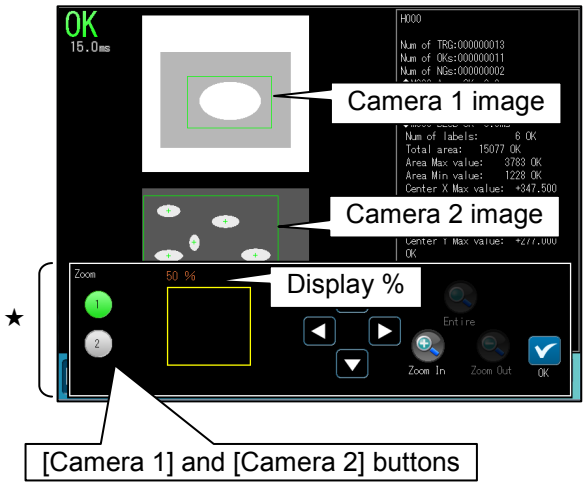
An image is displayed on the following screens of the [SET] screen:
Home screen, System (camera) and each module screen, etc.

Following is the procedure for the zooming of Run screen as an example.
The procedure is the same for other screens.

① Touch the [Zoom] icon on the Run screen.
Note: The screen shown below has the display mode set to "Camera 1 + camera 2," and the Division mode set to "Horizontal."

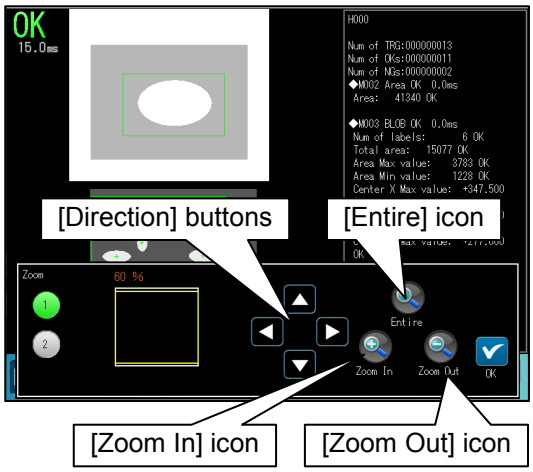


② A zoom operation area (bottom portion of the screen marked by ★) will appear.

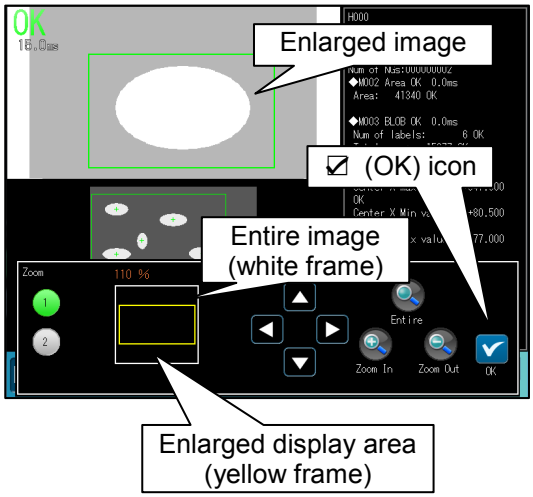


- Touch either the [Camera 1] or [Camera 2] button to select a camera.
  The elected camera's button is displayed in green.
- The enlargement or reduction of the selected camera image is displayed as a percentage.

③ Use the [Zoom In], [Zoom Out] or [Entire] icon and [Direction] buttons to set the size and position of the displayed image.



- [Zoom In] and [Zoom Out] icons
  Touch [Zoom In] icon to enlarge or [Zoom Out] icon to reduce the displayed image.
- [Entire] button
  Touch the button to make display show the entire image from the selected camera.
- [Direction] buttons
  Touch one of the [Direction] buttons to move the position of the enlarged displayed image.



You can identify the enlarged area in the entire camera image (white frame) by referring to the yellow frame.

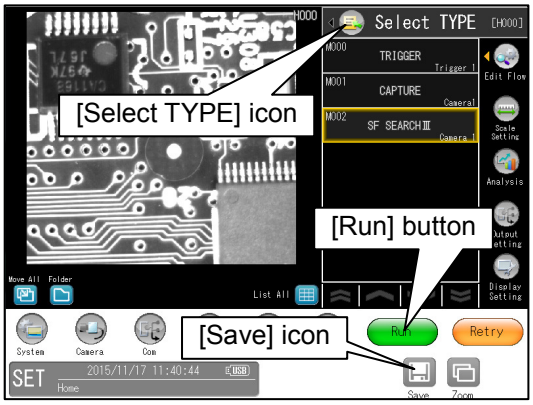
④ Touch the [OK] icon in the zoom operation area and the display will return to the Run screen. The image you set will appear.

[6] Save settings

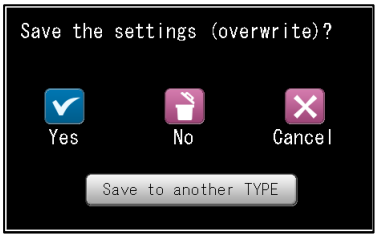
You can save the data you set on the (Home) SET screen and the Run screen.

(1) Save the settings on the SET screen

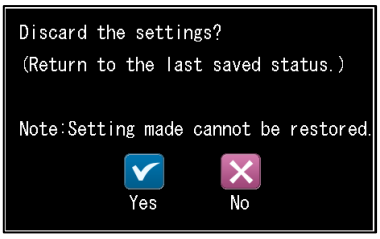
Touch the [Save] icon on the (Home) SET screen. Touching the [Select TYPE] icon or the [Run] button also saves the changed settings.



A window will appear to confirm that you want to save the setting.

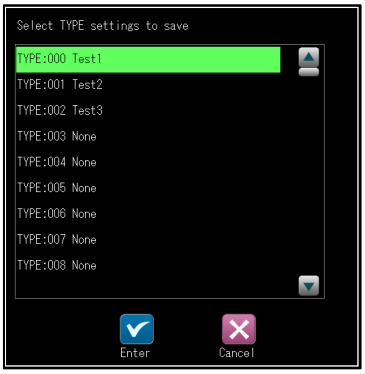


- Touch the [Yes] icon to save the settings (overwrite).
  The device will return to (Home) SET screen.
- Touch the [No] icon and a window will appear to confirm you want to discard the settings you have made.



- Touch [Yes] icon to discard the setting and the last saved settings will be restored and the device will return to (Home) SET screen.
- Touch [No] icon and the device will return to (Home) SET screen.

- To not to overwrite, touch the [Save to another TYPE] button and the "Select TYPE settings to save" combo box will appear.

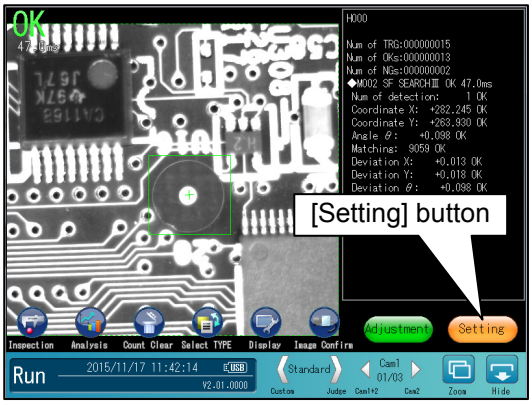


- Touch one of the object types you want to save and then touch the [Enter] icon.
  The setting data will be saved in the selected object type.
  The device will return to (Home) SET screen.

  Note: The original object type which you used to change the setting remains unchanged. (Changes are not applied to the original object type).

(2) Save the settings on the Run screen

If you have changed the display settings on the Run screen, you can save the data you entered on the SET screen by using the [Setting] button.



Touch the [Setting] button.
A window will appear to confirm that you want to save the setting.

The procedure for saving the setting from this step is the same as that for the (1) "Save the settings on the SET screen" on the left of this page.

[7] Navigate the SET screen

This section describes how to move around the screen from one to the other for each setting screen.
You can go to a different screen using the icon on the SET screen. You can return directly to the (Home) SET screen from a screen by touching the [Home] icon, or move back to the previously displayed screen by [Return] icon.

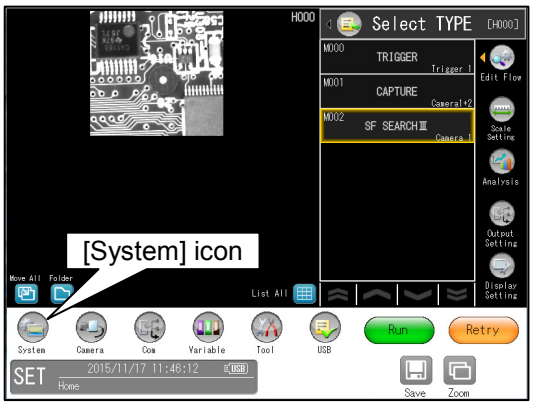
・[Home] icon
Go directly to the (Home) SET screen.

・[Return] icon
Go to the previously displayed screen.

The screen hierarchy is displayed in the status display area.

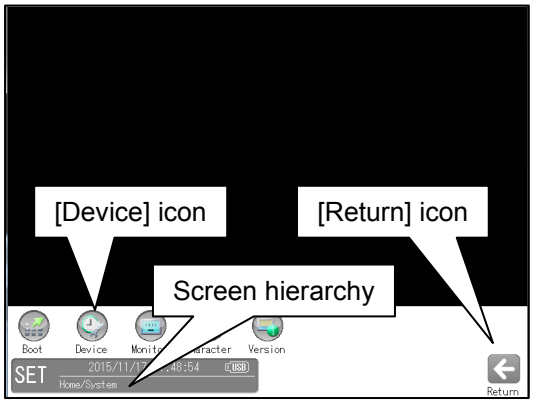
[Example of accessing a screen from the SET (Home) screen]

(Home) SET screen



・Touch the [System] icon and a setting screen for the system will appear.
・The screen hierarchy "Home/System" will be displayed.

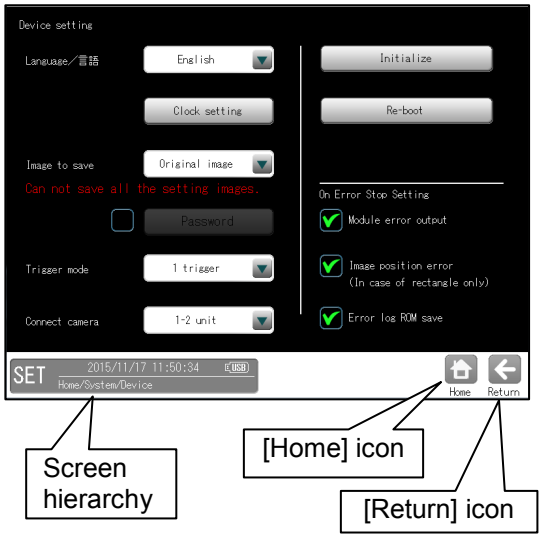
Home/System SET screen



・Touch the [Return] icon to return to the (Home) SET screen.

・Touch the [Device] icon to go to the Device setting screen.
The screen hierarchy "Home/System/Device" will be displayed.

Device setting screen



・Touch the [Home] icon to go to the (Home) SET screen.
・Touch the [Return] icon to go to the Home/System SET screen.

[8] Parameter Compatibility between IV-S300J/IV-S300M and IV-310M

Following is the compatibility between IV-S300J/IV-S300M and IV-310M with respect to reading parameters from USB to the controller.

Trigger Mode	Camera Count	Copy from	Copy to	IV-S300C5 Condition	Compatibility
1 Trigger	1	IV-S300J IV-S300M	IV-S310M	---	YES
	2	IV-S310M	IV-S300J IV-S300M	---	YES
		IV-S300J IV-S300M	IV-S310M	---	YES
		IV-S310M	IV-S300J IV-S300M	Not connected	YES
				Connected	NO
	3-4	IV-S310M	IV-S300J IV-S300M	---	NO
2 Trigger	1	IV-S300J IV-S300M	IV-S310M	---	YES
	2	IV-S310M	IV-S300J IV-S300M	---	YES
		IV-S300J IV-S300M	IV-S310M	---	YES
		IV-S310M	IV-S300J IV-S300M	Not connected	YES
				Connected	NO
	3-4	IV-S310M	IV-S300J IV-S300M	---	NO

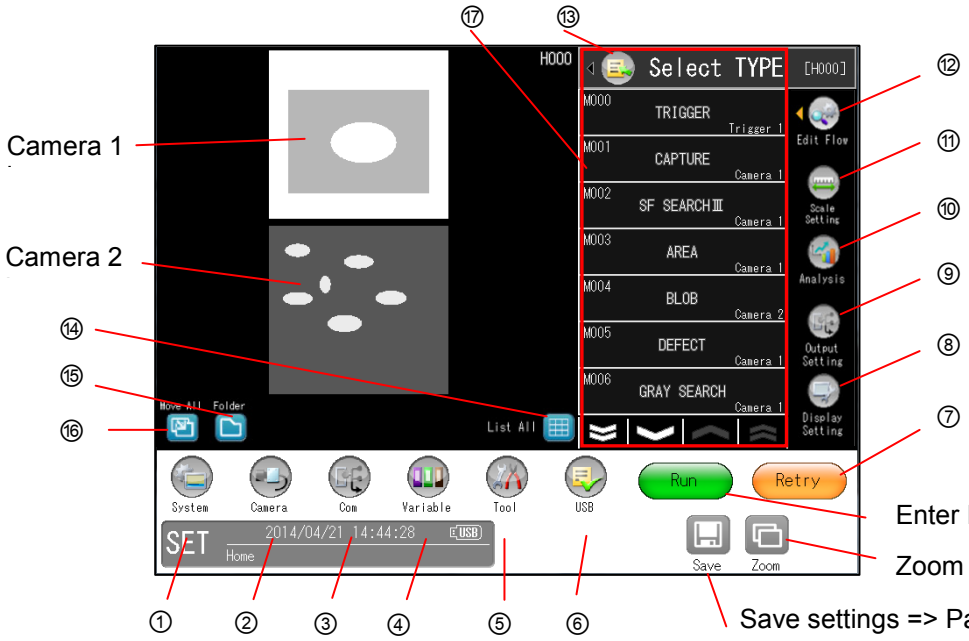
Section 4: Inspection Setting

4-1 Configuration of SET screens

Each icon and button on the (Home) SET screen configures the following inspection setting.
(Items next to => are the reference section number of this manual)

● **(Home) SET screen**

・The screen shown on the left is an example of typical screen.



Enter Run mode => Page 3-5

Zoom screen => Page 3-13

Save settings => Page 3-14

① System
=> Section 4-2-1

② Camera
=> Section 4-2-2

③ Communication
=> Section 4-2-3

④ Variable
=> Section 4-7

⑤ Tool
=> Section 4-5

⑥ USB
=> Section 4-6

⑦ Retry
=> Section 4-8

⑧ Display Setting
=> Section 4-4-24

⑨ Output Setting
=> Section 4-4-22

⑩ Analysis
=> Section 4-4-25

⑪ Scale Setting
=> Section 4-4-23

⑫ Edit Flow
=> Section 4-4-1

⑬ Select TYPE
=> Section 4-3

⑭ List All
=> Section 4-4-1 [4]

⑮ Folder
=> Section 4-4-1 [3]

⑯ Move All
=> Section 3 [4] (3)

⑰ Module

Trigger
=> Section 4-4-2

Capture
=> Section 4-4-3

SF Search
=> Section 4-4-4

Gray Search
=> Section 4-4-5

Multi Search
=> Section 4-4-6

Area
=> Section 4-4-7

Blob
=> Section 4-4-8

Point
=> Section 4-4-9

Defect Inspection
=> Section 4-4-10

Color
=> Section 4-4-11

Edge
=> Section 4-4-12

Shift Edge
=> Section 4-4-13

Pitch
=> Section 4-4-14

Shape
=> Section 4-4-15

Distance/Angle
=> Section 4-4-16

Calculation
=> Section 4-4-17

Filter
=> Section 4-4-18

Jump
=> Section 4-4-19

Position
=> Section 4-4-20

OCV
=> Section 4-4-21

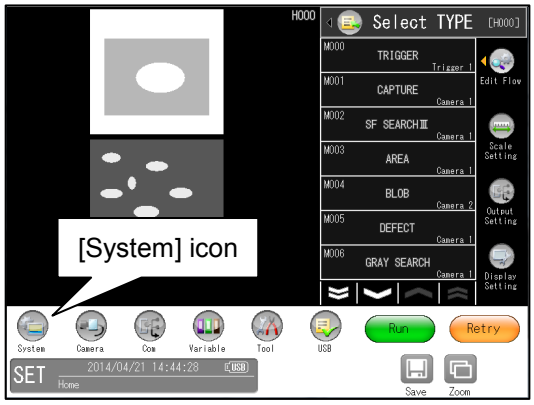
Code Reader and **Text**
=>
See separate manual.

4-2 System/Camera/Communication

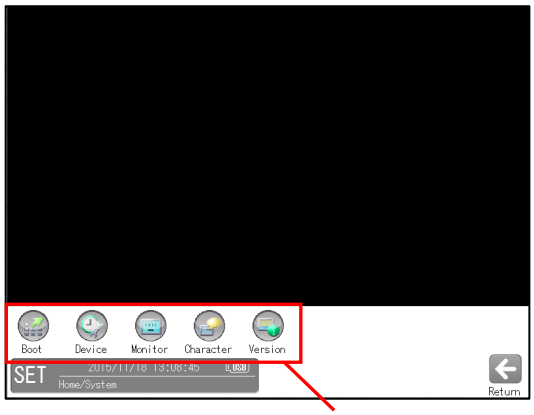
This section describes System setting ("Boot", "Device", "Monitor", "Character" and "Version"), Camera setting and Communication setting that are common to all the object types.
(The screen shown below is a typical example)

4-2-1 System settings

① Touch the [System] icon on the (Home) SET screen.



② The System setting screen will appear.
Touch one of the system setting icons (such as "Boot") and select a setting item for the system.



System setting icons

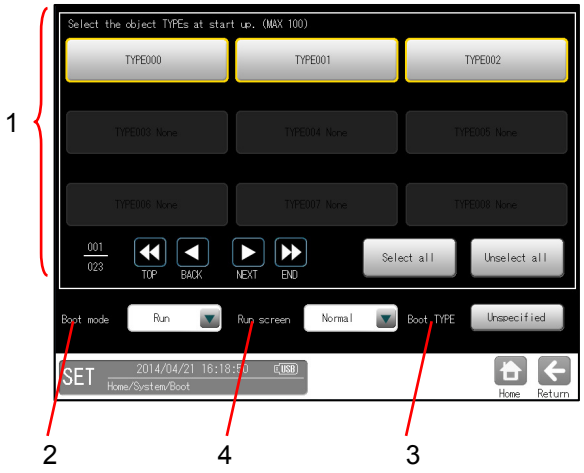
・Boot => [1]
・Device => [2]
・Monitor => [3]
・Character => [4]
・Version => [5]

[1] [Boot] (start up setting) icon

This icon is used to set the mode and object type to use at start up of this device.

① Touch the [Boot] icon on the Setting screen.

② The Setting screen at start up will appear.



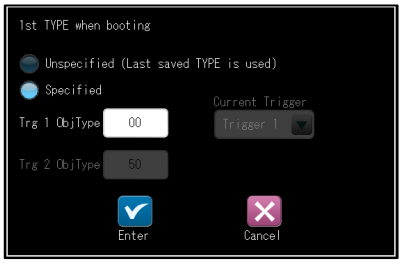
Touch each respective icon to set the following items.

1. Object type to load at start up
You can select up to 200 object types.
Selected one is shown by orange frame.
The object types selected will be loaded at start up of this device so that you can use them immediately.
Switching to not-selected object types after start up takes longer time for the loading.

2. [Boot mode] drop down list
Select the mode (Run or Setting) at start up of this device.

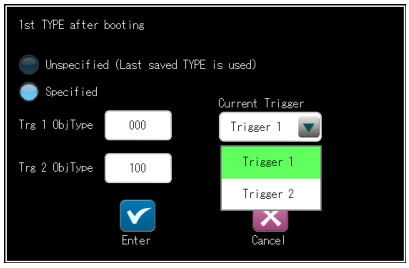
3. [Boot TYPE] (object type) button
Select an object type to execute first at start up of this device.
Unspecified: The last saved object type will be used.
Specified: A selected object type will be used.
Touch [Specified] radio button and the data input box and then enter the object TYPE number using the number keypad.

・1 Trigger Mode



Enter “Trg 1 ObjType”.

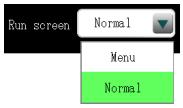
・2 Trigger Mode



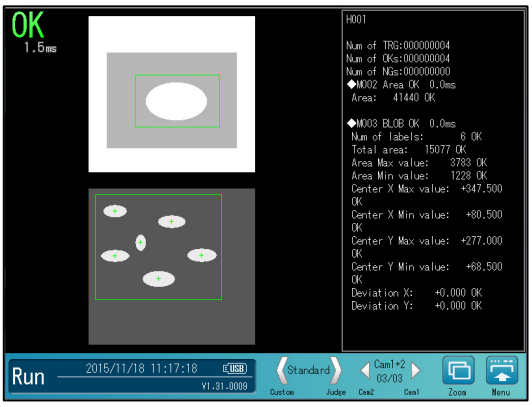
Enter “Trg 1 ObjType” and “Trg 2 ObjType and select “Current Trigger” (1 or 2) to display

4. [Run screen] drop down list

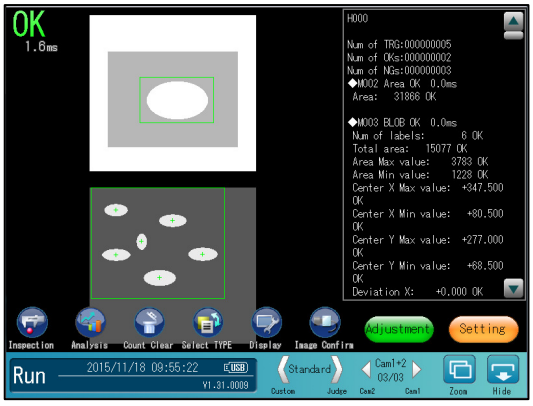
Select either "Menu" or "Normal" for the initial display on the Run screen.



・Normal screen



・Menu screen

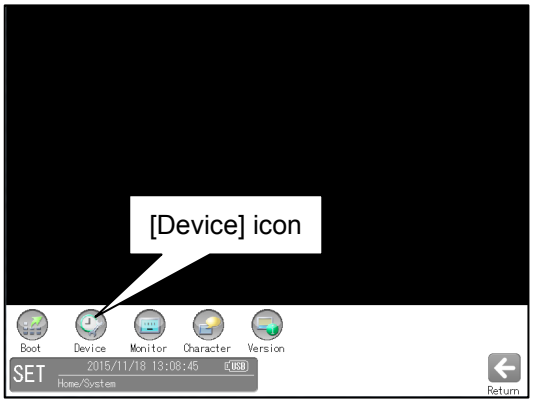


Icons and buttons are displayed on the Menu screen.

[2] [Device] icon

The "Language", "Clock setting", "Image to save", “Trigger mode” , "Connect camera", "Initialize", "Re-boot", “On Error Stop Setting” and "Password" can be set to this device.

① Touch the [Device] icon on the System setting screen,

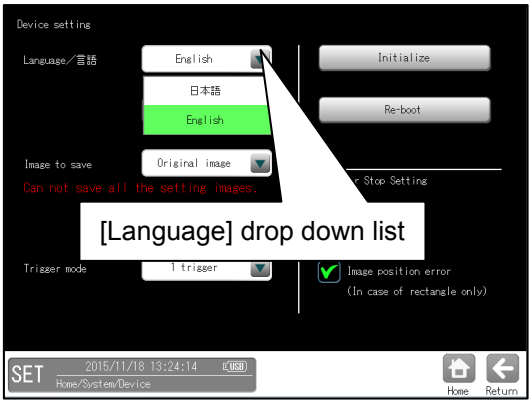


② The Device setting screen will appear. Select an item from the drop down list or touch the button you want to set.

・Language => (1)
・Clock setting => (2)
・Image to save => (3)
・Initialize => (4)
・Re-boot => (5)
・Password => (6)
・Trigger mode => (7)
・On Error Stop Setting => (8)
・Connect camera (IV-S310M only) => (9)

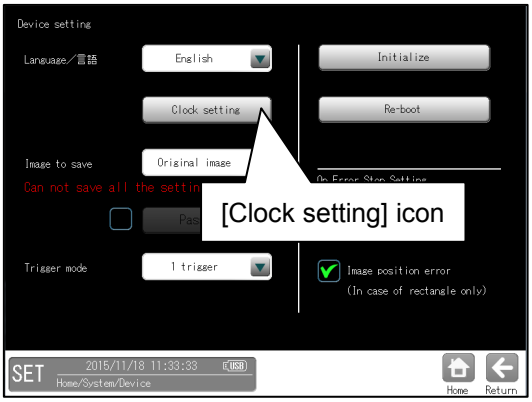
(1) [Language] setting drop down list

Select English or Japanese for the language to be used on the display.

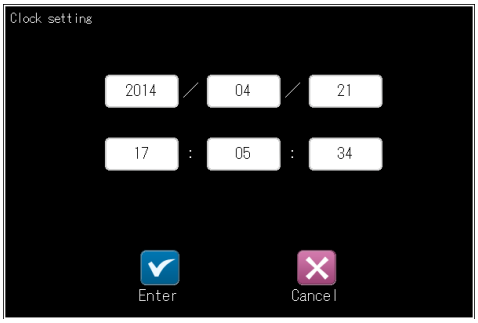


(2) [Clock setting] button

① Touch the [Clock settings] button.



② The "Clock setting" window will appear.



Touch data input box of each "year", "month", "day", “hour”, "minute", and "second" and enter a number using the number keypad.

* The clock precision is ±3 minutes/month. Set the clock time when you use this device for the first time and whenever necessary.

(3) [Image to save] drop down list

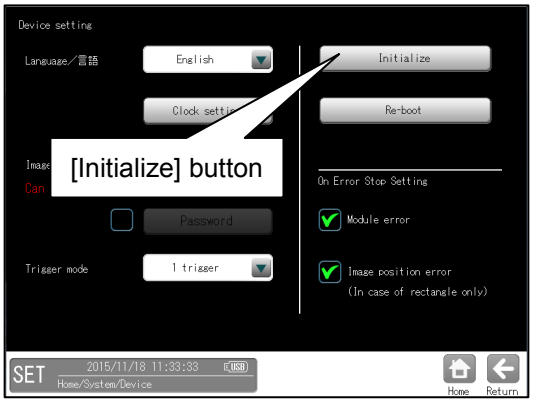
Only "Original image" can be selected.

[Note]

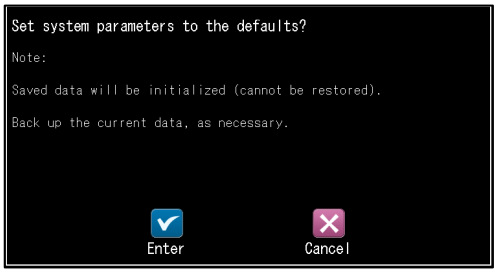
All the images of each camera can be saved but the number of object types that can be saved changes depending on their setting.

(4) [Initialize] button

① This button initializes this device settings (including saved data) to the default values (factory delivery status) and reboot the device. Touch the [Initialize] button to initialize.



② A window will appear to confirm that you want to initialize to the factory default setting.

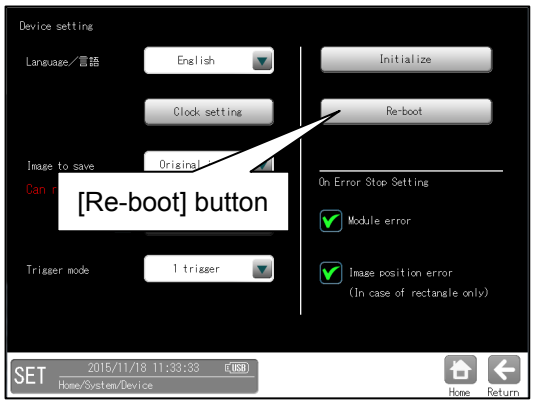


Touch the [Enter] icon to initialize the settings or [Cancel] icon.

(5) [Re-boot] button

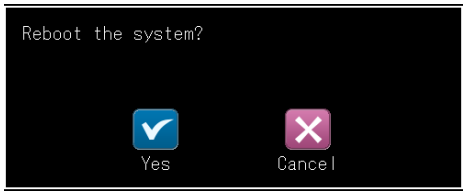
Use this button to restart this device.

① Touch the [Re-boot] button.

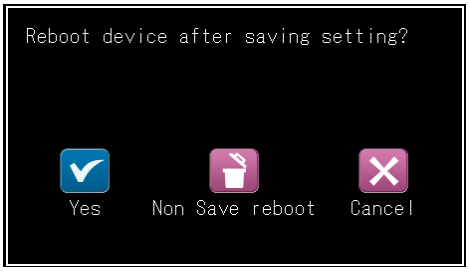


② A window will appear:

- When no changes have been made in the setting, a window to confirm you that you want to reboot the device.



- When a change has been made in the setting, a window to confirm you that you want to reboot after saving the setting:



③ Touch one of the icons:
[Yes]: To reboot after saving settings,
[Non Save reboot]: To reboot without saving the settings or
[Cancel]: Close the screen.

(6) [Password] button

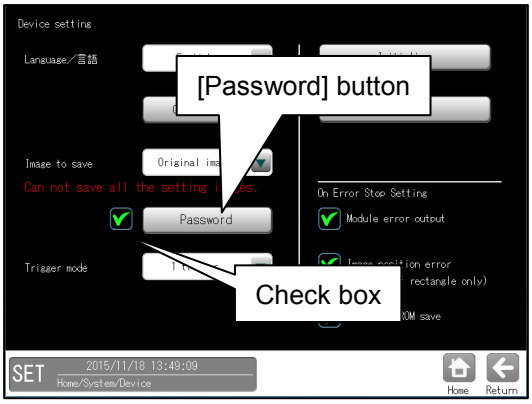
Enter a password to protect the device and prevent other operators than the administrator from changing the parameters of this device inadvertently.

The password protection function works when the following icons and buttons are touched on the Run screen.

1. [Menu] icon
2. [Inspection] icon
3. [Setting] button
4. [Adjustment] button
5. [Hide] icon

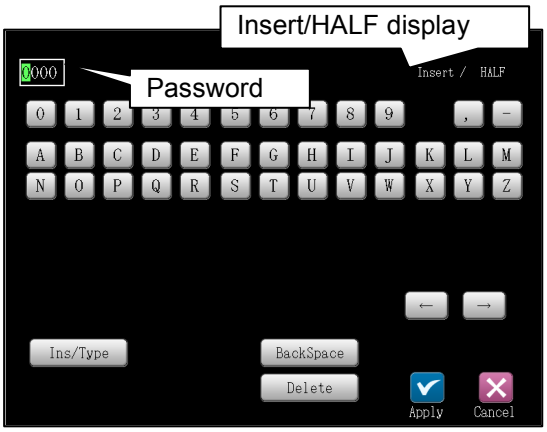
■ **Set Password**

① On the "Device setting" screen, touch the [Password] check box to show ☑, and the password protection function becomes effective.
(Default password: 0000)



If the check box is unchecked (□), the password protection function does not work.

② To set or change a password, touch the [Password] button.
The password setting screen will appear.



③ Enter a password (alphabetical and/or numerical 4 digits), and touch the [Apply] icon.

- **Insert or Type Alphanumeric value**
  To switch between Insert and Type modes, touch the [Ins/Type] key.

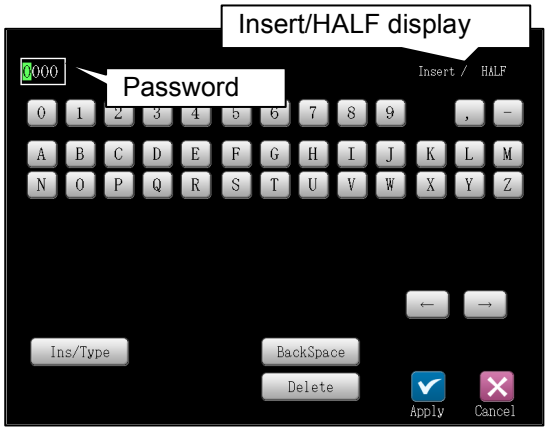
- **Delete an Alphanumeric value**
  To delete an alphanumeric value under the cursor, touch the [Delete] key.
  Cursor position can be changed by using the [←] and [→] keys.
  To delete an alphanumeric value at the next left of the cursor, touch [BackSpace] key.

■ Unlock Password Protection

① When the password protection function is set, the password needs to be entered when the following icons and buttons are touched on the Run screen.
1. [Menu] icon
2. [Inspection] icon
3. [Setting] button
4. [Adjustment] button
5. [Hide] icon

② The following screen will be displayed:
Touch the [Enter password] button.

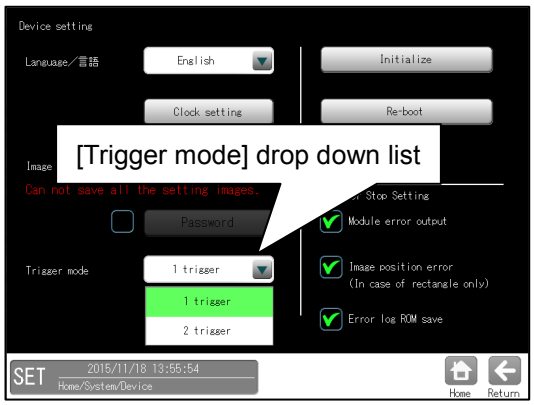
③ The password enter window will appear.



Enter the password (alphabetical and/or numerical 4 digits), and touch the [Apply] icon.

(7) [Trigger mode] drop down list

Two trigger modes are available with this device.
Select one of the two trigger modes.



- **1 Trigger mode (Single Trigger Mode)**
  This is the mode to use one object type for the camera(s) connected.
  IV-S300J/ IV-S300M: 1 to 2 units
  IV-S310M: 1 to 4 units

- **2 Trigger mode**
  (2 Channel Independent Trigger Mode)
  This is the mode to use two different object types for two or more cameras connected.

  IV-S300J/ IV-S300M:
  Camera 1: object type 0 – 99
  Camera 2: object type 100 – 199
  IV-S310M:
  Camera 1/2: object type 0 – 99
  Camera 3/4: object type 100 – 199

  By using this mode, inspections can be done at different trigger timing of each camera making the device as if two controllers in one device.
  Two different inspections can be done at the same time in 2 Trigger mode,

  IV-S300J/ IV-S300M:
  The trigger for Camera 2 can be input while Camera 1 is capturing image or processing the image, however, the image processing is not done in parallel but by time sharing.

  IV-S310M:
  The trigger for Camera 3/4 can be input while Camera 1/2 is capturing image or processing the image, however, the image processing is not done in parallel but by time sharing.

Important:
Trigger mode must be set on this screen before using this device and before registering an object type.
Changing the Trigger mode after registering the object types will initialize their setting.

■ **Notes in using 2 Trigger mode**

Note 1:
"CCD Trigger" cannot be used in 2 Trigger mode.
Only “External Trigger” is allowed.

Note 2:
The output ports are not specifically assigned for Trigger 1 or Trigger 2.
Be sure to assign the output ports each for Trigger 1 and Trigger 2.

Note 3:
The search memory usage of each camera will become a half.
The total search memory usage remains unchanged.

● Trigger mode/Trigger Input/Camera and Object Type

IV-S300J/IV-S300M
(when IV-S300C5 is not connected):

Trigger Mode	Trigger Input	Camera Connected	Selectable ObjType
1 Trigger	TRG	Camera 1 Camera 2	0 to 199
2 Trigger	TRG1	Camera 1	0 to 99
	TRG2	Camera 2	100 to 199

IV-S300J/IV-S300M
(when IV-S300C5 is connected):

Trigger Mode	Trigger Input	Camera Connected	Selectable ObjType
1 Trigger	TRG	Camera 1 Camera 2	0 to 199

IV-S310M (when IV-S300C5 is not connected):

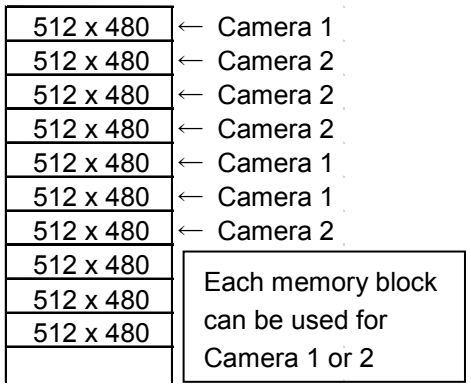
Trigger Mode	Trigger Input	Camera Connected	Selectable ObjType
1 Trigger	TRG	Camera 1 Camera 2 Camera 3 Camera 4	0 to 199
2 Trigger	TRG1	Camera 1 Camera 2	0 to 99
	TRG2	Camera 3 Camera 4	100 to 199

IV-S310M (when IV-S300C5 is connected):

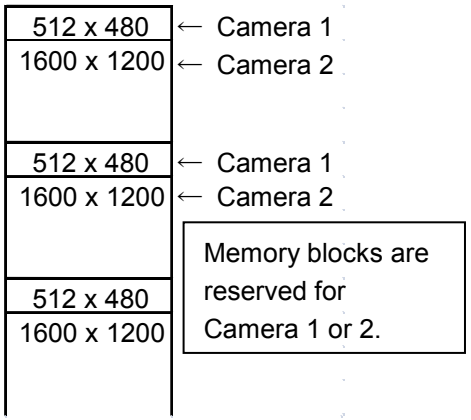
Trigger Mode	Trigger Input	Camera Connected	Selectable ObjType
1 Trigger	TRG	Camera 1 Camera 2	0 to 199
2 Trigger	TRG1	Camera 1	0 to 99
	TRG2	Camera 2	100 to 199

Note 4:
The number of images that can be stored in the image memory depends on the resolution of each camera:

● When the resolutions of the cameras are the same, all the image memory block can be used for inspection.

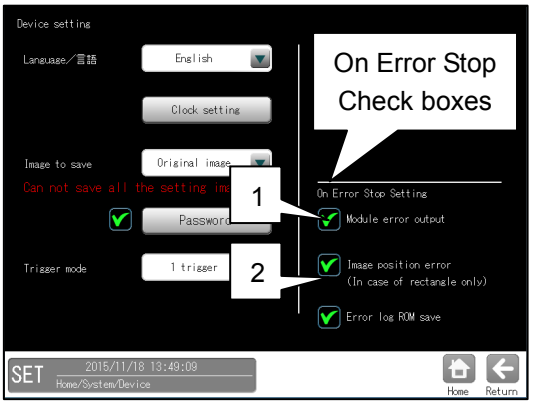


● When the resolutions of the cameras are different between the two cameras, the number of images that can be stored will be reduced because the device reserves Camera 1 + Camera 2 memory area as the memory size for an inspection.



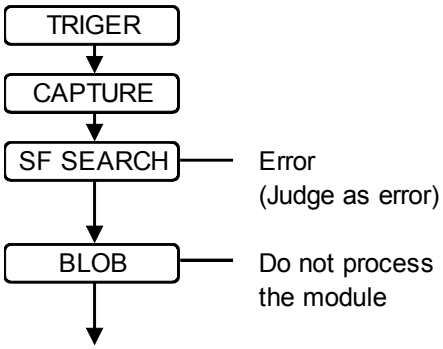
(8) On Error Stop Setting check boxes

Two on error stop related functions (stop the inspection or not) are available.

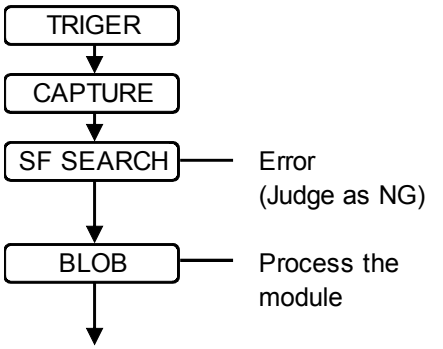


1. "Module error" check box

- When the box is checked.
  The inspection will stop when an error happened in a module.
  The module(s) following the module is not processed.



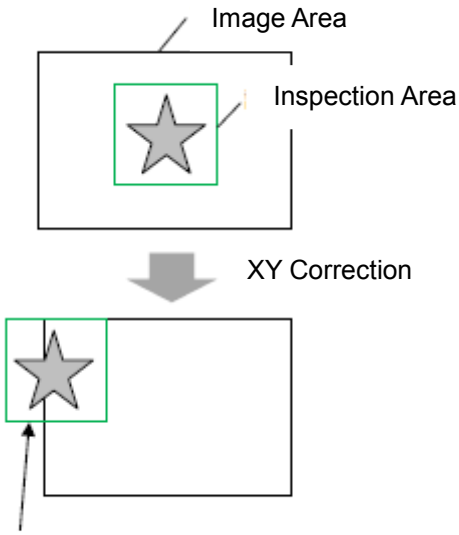
- When the box is unchecked.
  The judgment result of the module that caused an alarm is made as "NG" and processes the module(s) that follow.



2. "Image position error" check box (When the area "Shape" is "Rectangle")

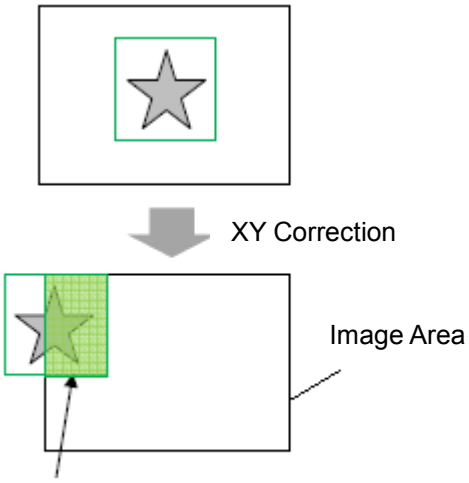
Check this box to stop the inspection when the inspection area goes out of the image area as a result of XY position correction.

- When the box is checked.



Outside of Image Area => Error

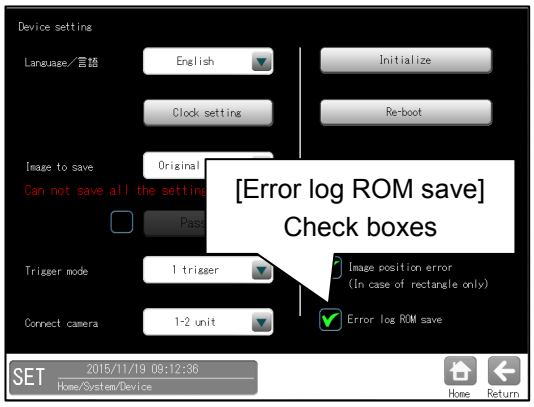
- When the box is unchecked.



Inspect only the image within the Image Area

3. “Error log ROM save” Check Box

Check this box to save an error to ROM when it occurs.



Touch the check box to show ☑ to save an error to ROM.
The error log is kept even if the power is shut off.

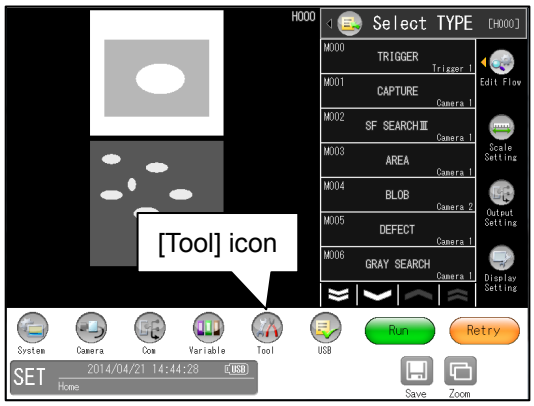
Note: Some of minor errors are not saved.

When the box is not checked, the error is not saved to ROM or the error log is not kept if the power is shut off.

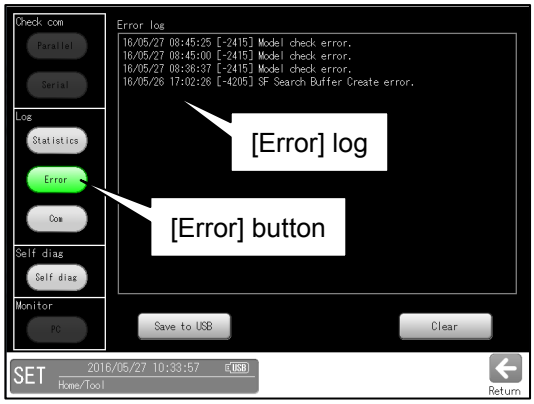
(Default setting: Checked)

To display Error Log

① Touch the [Tool] icon on the (Home) SET screen.

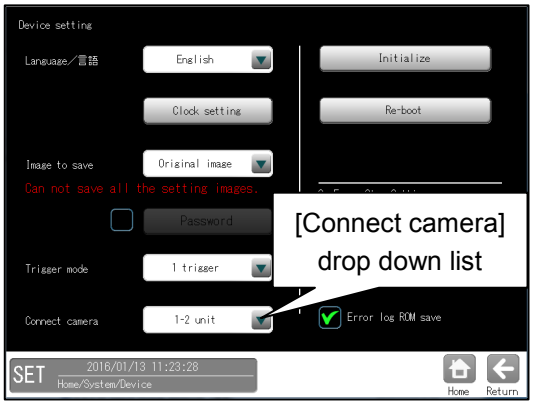


② Tool setting screen will appear.
Touch [Error] button, then the Error Log is displayed.



(9) [Connect camera] drop down list (When IV-S310M is used)

Select the number of cameras to connect to IV-310M from the drop down list.



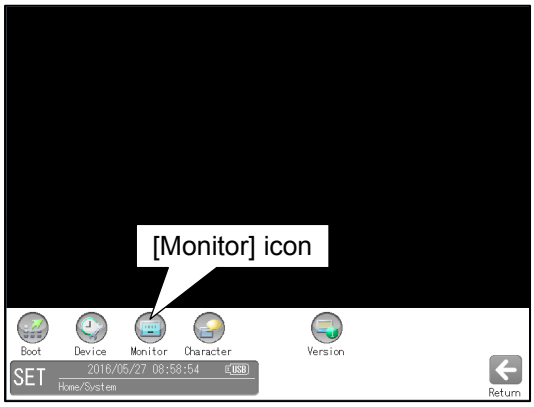
1. 1-2 unit:
   Select this when the number is 1 or 2 units.
2. 3-4 units
   Select this when the number is 3 or 4 units.

Important:
This setting should be set on this screen before using this device and before connecting cameras.
Changing the number of cameras after it is being set will initialize the parameters.

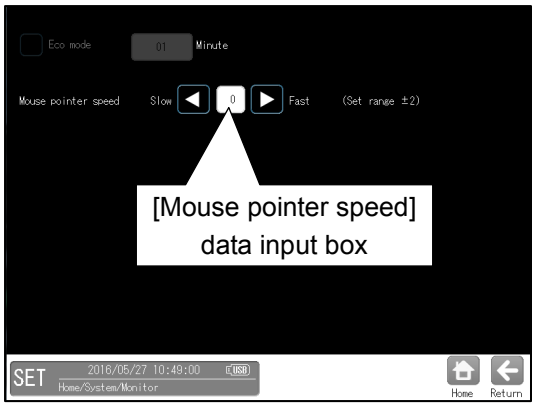
[3] [Monitor] icon

This icon selects a screen for setting mouse pointer speed.

① Touch the [Monitor] icon on the Setting screen.



② The following screen will be displayed.

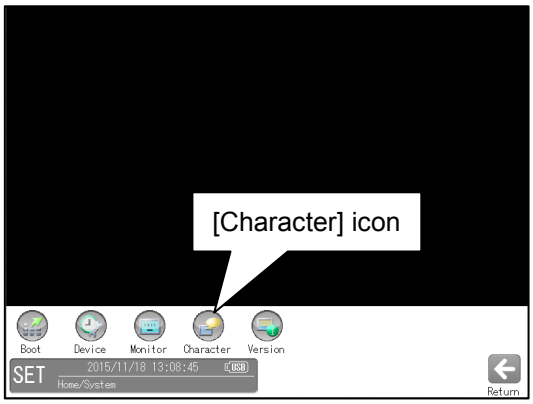


③ Enter a value in the [Mouse pointer speed] data input box with the number keypad or arrow keys.

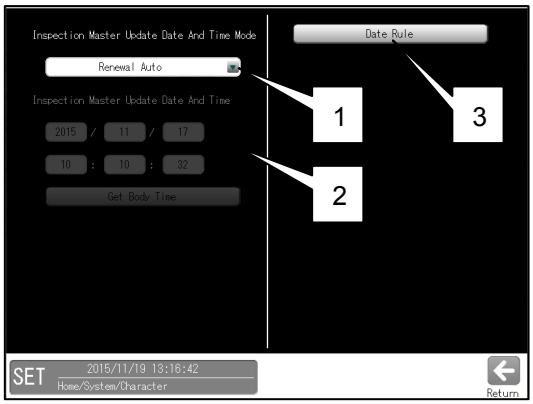
[4] [Character] icon (for OCV module)

Use this icon to set the mode and date and time for the OCV module. (See Section 4-4-21)

① Touch the [Character] icon on the Setting screen.



② The following screen will be displayed



Inspection Master Update Date and Time

The OCV module sets the date and time for inspection based on those set on this screen.

Example:

Master Clock

2020/07/24 20:00

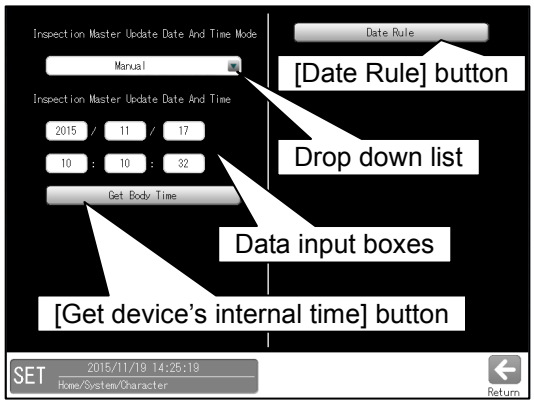
OCV Setting

- Format:
  Year: 4 digits
  Month & Day: No zero suppressing
  Master Clock
- Separator: . (period)
- Offset: Year: 0, Month: 0, Day: +5

The reference character for inspection becomes 2020.07.29.

1. **[Inspection Master Update Date and Time Mode] drop down list**
   Select one from “Renew always”, “Semi-auto” and “Manual”.
   Renew always:
   The master date and time are renewed always based on those of the device’s internal clock.
   Semi-auto:
   The master date and time are renewed only upon start up and when the object Type is changed.
   Manual:
   The master date and time are renewed only when they are set on this screen.

2. **[Inspection Master Update Date and Time Mode] data input boxes**
   The data input boxes appears only when “Semi auto” or “Manual” is selected for the [Inspection Master Update Date and Time Mode] drop down list:



   Touch a data input box and enter date and time with the number keypad.

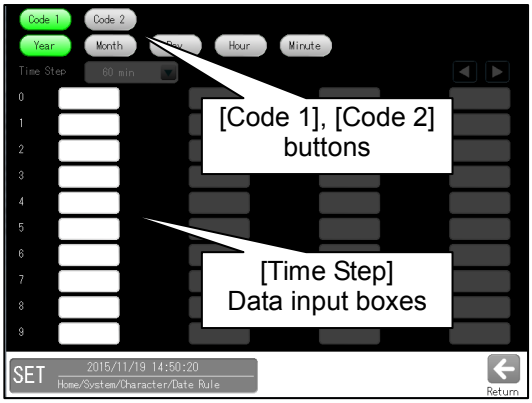
   Touch the [Get device’s internal time] button to get the clock information.

3. **[Date Rule] button**

   Date and time can be converted into arbitrary characters (maximum 7) by OCV module based on the setting on this screen.
   For each year, month, day, hour and minute, 2 types of codes can be set.

   The code to be used is set by the OCV module.

   Touch [Date Rule] button on the screen shown on the left of this page.
   The following screen appears.



   a. [Code 1] and [Code 2] buttons
   Touch either “Code 1” or “Code 2” button.

   b. [Year] button
   Select the [0 to 9] data input box that is equal to the last digit of a year in interest.
   Example: (When current year is 2015)

Data input box	Set Character	Device Clock (year)
0	A	2020
1	B	2021
2	C	2022
3	D	2023
4	E	2024
5	F	2015
6	G	2016
7	H	2017
8	I	2018
9	J	2019

   The device uses “F” as the year for the inspection of 2015.

c. [Month] button

Select the [1 to 12] data input box that is equal to the month in interest.

Example:

Data input box	Set Character	Device Clock (month)
1	A	January
6	F	May
12	L	December

The device uses “L” as the month for the inspection of December.

d. [Day] button

Select the [1 to 31] data input box that is equal to the day in interest.

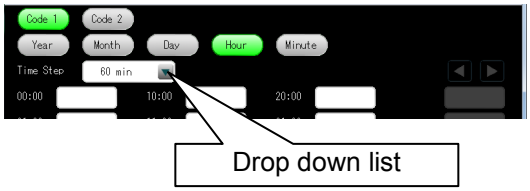
Example:

Data input box	Set Character	Device Clock (day)
1	D1	1
15	D15	15
31	D31	31

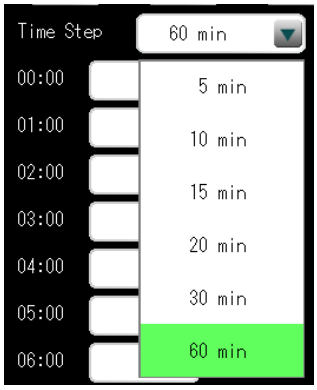
The device uses “D31” as the date for the inspection of day 31th.

e. [Hour] button

[Time Step] drop down list is enabled when this button is touched.



Drop down list



Select one from the list, and then the corresponding number of data input boxes appear.

Example: (When 60 min is selected)

Data input box	Set Character	Device Clock (hour)
00:00	A0	00:00-00:59
12:00	A12	12:00-12:59
23:00	A23	23:00-23:59

The device uses “A12” as the hour for the inspection during 12:00 to 12:59.

f. [Minute] button

Select the [0 to 59] data input box that is equal to the minute in interest.

Example:

Data input box	Set Character	Device Clock (minute)
1	M1	1
30	M30	30
59	M59	59

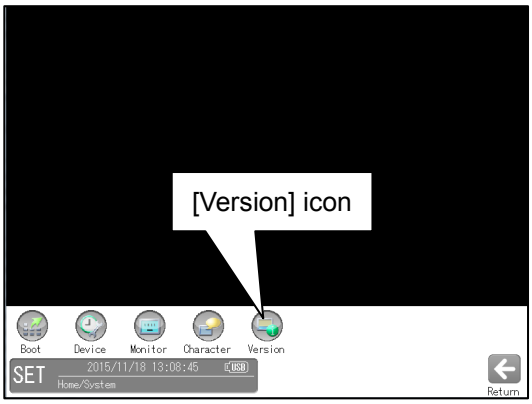
The device uses “M31” as the minute for the inspection of day 31th.

[5] [Version] icon

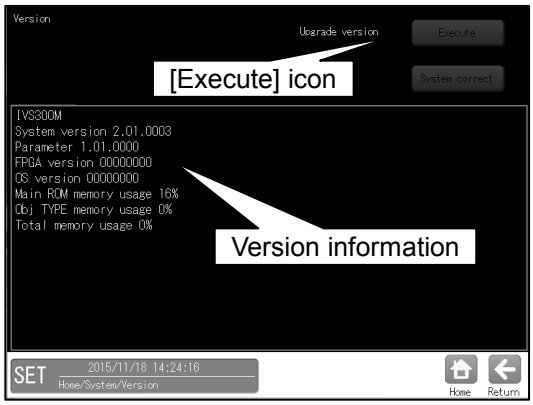
Use this icon to check the software version of this device or to upgrade the version.

Note:
To update the software version of this device, connect an USB flash drive with the updated software version stored to the USB port.

① Touch the [Version] icon on the (Home) Setting screen.



② The Version screen will appear.



Check the version information of this device.
[Version and system information]

- System version
- Parameter
- FPGA version
- FPGA2 version (IV-S310M only)
- OS version
- Main ROM memory usage (%)
- Obj TYPE memory usage (%)
- Total Obj TYPE memory usage (%)

③ To upgrade the software version, check that the USB flash drive is connected and touch the [Execute] button on the right of "Upgrade version".

④ To correct system problem, touch the [System correct] button below the [Execute] button.

The following may occur when a part of the setting made or error log data was damaged:

- Parameter cannot be stored.
- Parameter cannot be read.
- Error log was lost.

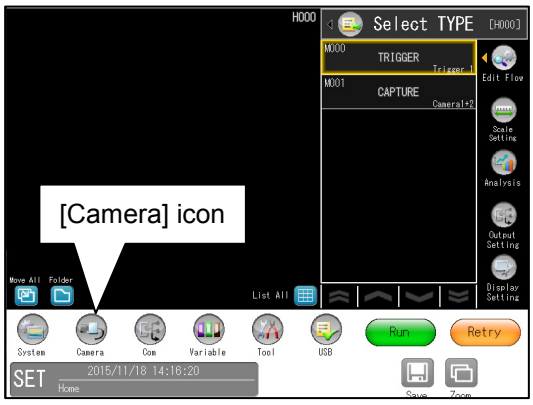
In such a case, press the [System correct] key and the problem may be corrected.

Note:
The files including the damaged data are cleared.

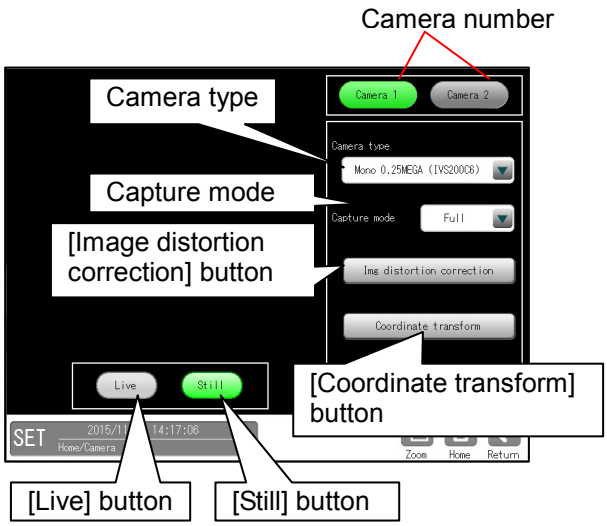
4-2-2 Camera setting

The "Camera type", "Capture mode" and "Live/still" can be set for the connected camera. (The following screens are those of IV-S300M and show only Camera 1 and Camera 2)

① Touch the [Camera] icon on the (Home) SET screen.



② The Camera setting screen will appear.



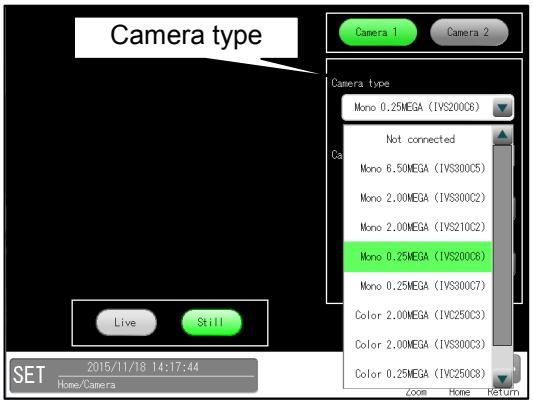
Touch a Camera number button you want to make the setting (camera type, etc.)

- A camera connected to "camera n" connector" becomes "camera n".
  IV-S300J/IV-S300M: n=1, 2,
  IV-S310M: n=1 to 4
- Currently selected camera's button is displayed in green.
- Touch either [Live] or [Still] button for the display image.

- Camera type => (1)
- Capture mode => (2)
  (Only when the monochrome camera, IV-S200C6, is used)
- Image distortion correction => (3)
- Coordinate transform => (4)

[1] [Camera type] drop down list

Select the type of camera connected to each camera connector.



[Camera type]

- Not connected
- Mono 6.5M: IV-S300C5
- Mono 2M: IV-S300C2/ IV-S210C2
- Mono1.3M: IV-S300CD
- Mono0.25M: IV-S300C6/IV-S300C7 IV-S300CA/IV-S200C6
- Color 2M: IV-S300C3/IV-C250C3
- Color 0.25M: IV-S300C8/IV-C250C8

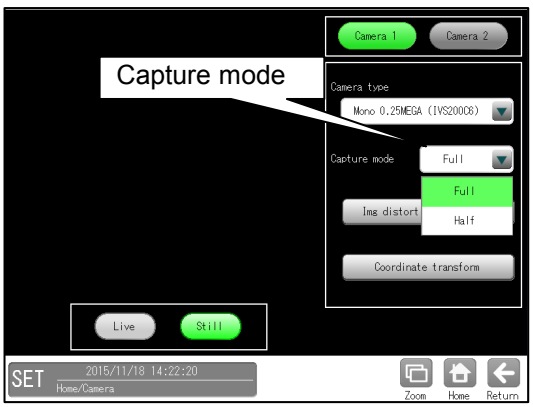
[Important]

Once this setting is changed, all the parameters (for inspection settings, etc.) of the selected camera must be initialized.

[2] [Capture mode] drop down list (Only when the monochrome camera, IV-S200C6, is used)

The capture mode refers precision of the image when scanning an image.
With the "Full" mode, the camera scans all the lines.
With the "Half" mode, it scans every other line.
By selecting the "Half" mode, scanning time of the image can be shortened although the captured image will become coarse.

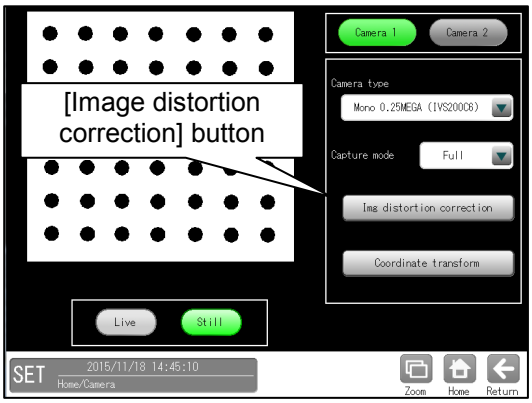
Select either "Full" or "Half".



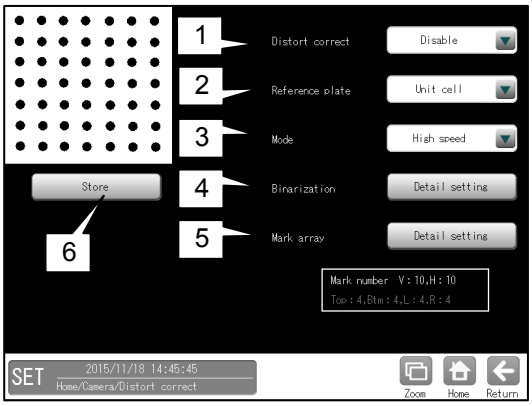
[3] [Image distortion correction] button

This corrects distortion in an image.

① Touch the [Image distortion correction] button.



② The image distortion correction setting screen will appear.



・ For 1. [Distort correct], 2. [Reference plate] and 3. [Mode] drop down lists, select an option from the list.

・ For 4. [Binarization] and 5. [Mark array (arrangement)] buttons, touch the respective [Detail Setting] button to display the setting screen.

・ For 6. [Store] (Teaching) button, touch the button to start the store mode (store the setting made by the following 1 to 5 drop down lists and buttons).

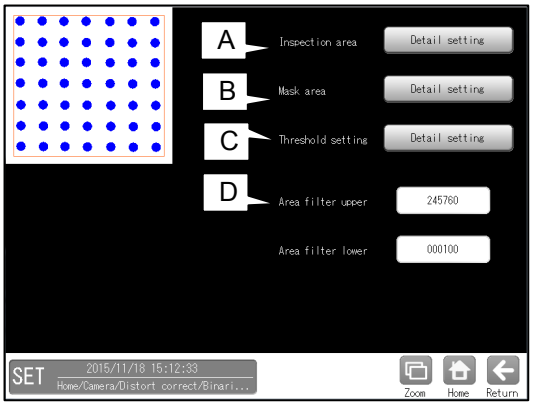
Note:
Be sure to touch [Store] button (Item 6 below) to store the setting to be made by the following steps 1 to 5.

1. **[Distortion correction] drop down list**
   Select "Disable" or "Enable" for the distortion correction function.
   (Default setting: Disable)

2. **[Reference plate] drop down list**
   Select "Unit cell" or "Complex cell ".
   (Default setting: Unit cell)

3. **[Mode] drop down list**
   Select "High speed" or "High precision".
   (Default setting: High speed)

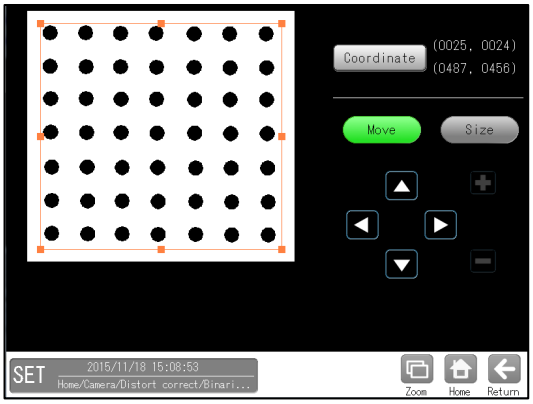
4. **[Binarization] button**
   Touch the [Detail setting] button of the "Binarization" and the Binarization setting screen will appear.
   Binarize such that only the grids for teaching become white.



・ For A. [Inspection area], B. [Mask area] and C. [Threshold setting] drop down lists, touch the [Detail setting] button to display the setting screen.
・ For D [Area filter upper] and [Area filter lower] data input boxes, enter the limit values using the number keypad.

A. [Inspection area] button

Touch the [Detail setting] button of "Inspection area" and the screen to set binarization inspection area will appear.

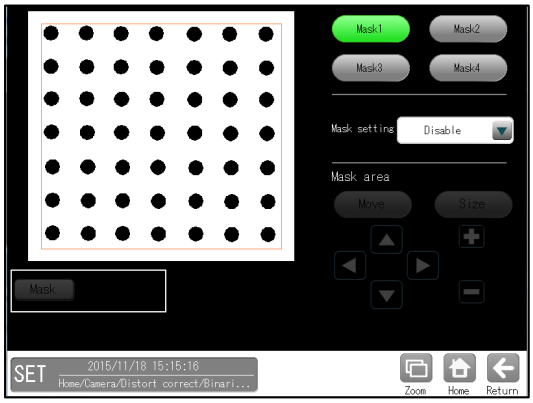


・ See page 3-6 for creating an inspection area.

B. [Mask area] button

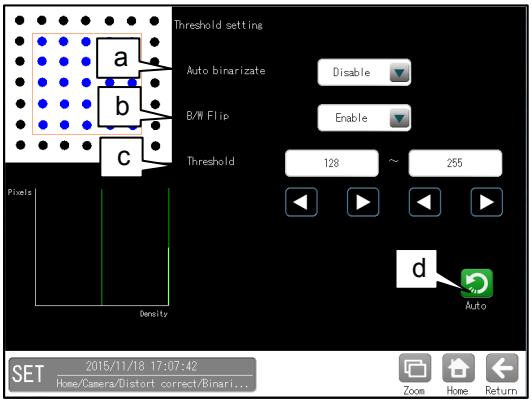
When "Complex cell" is selected from the drop down list of the "Reference plate", the Mask area button is enabled and touching the button displays the screen for setting the binarization mask area.

・ See page 3-6 for creating a mask area.



C. [Threshold setting] button

Touch the [Detail setting] button of “Threshold setting” and the screen for setting the binarization threshold will appear.



a. [Auto binarization] drop down list

Select "Disable" or "Enable".

Enable:

The device automatically sets threshold values for binarization for each image captured, and the settings of all others, except the "W/B flip", are not required.

Disable:

The setting of threshold values is required.

b. [B/W flip] drop down list

Select "Disable" or "Enable".

Enable:

The device will invert the black and white binary converted image.

c. [Threshold] data input boxes

Threshold values can be set automatically. (See item d. [Auto] setting icon below)

To enter the threshold values (upper and lower limits) manually, touch the data input boxes and enter threshold values. (0 – 255)

The arrow buttons under the data input boxes allows you to increment or decrement the threshold value by one at each touch.

d. [Auto] setting icon

The threshold values are set automatically.

D. [Area filter upper] data input box

This device does not inspect white pixel areas which size exceeds the upper limit set by this button.

(Setting range: 100 to 245760)

[Area filter lower] data input button

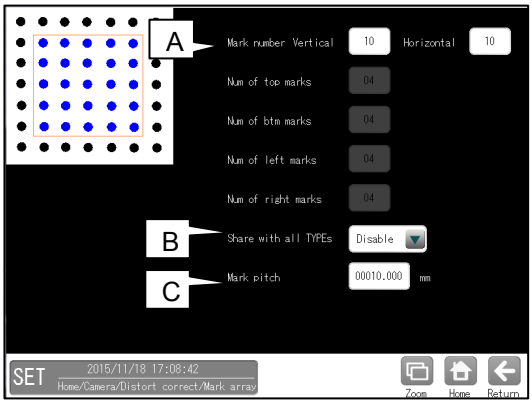
This device does not inspect white pixel areas which size is smaller than the lower limit set by this button.

(Setting range: 0 to 245760)

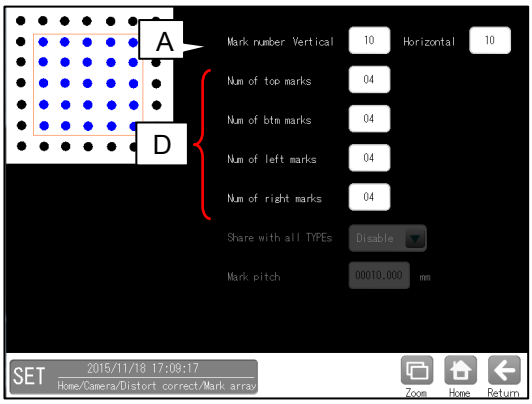
5. [Mark array] button

Touch the [Detail setting] button of the "Mark array" and the Mark array setting screen will appear.

・When “Reference plate” is “Unit cell”:



・When “Reference plate” is “Complex cell”:



A. Mark number data input boxes ("Vertical", "Horizontal")

Touch the respective box and enter a number of marks (0 to 40) for each "Vertical" and "Horizontal".

(Default setting: 10 each)

B. Share with all TYPEs drop down list

(when the reference plate is “Unit cell”)

Select "Disable" or "Enable".

C. Mark pitch

(when the reference plate is “Unit cell”)

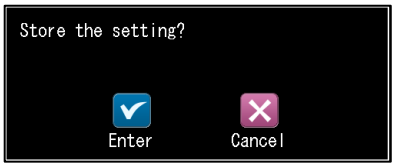
Enter the pitch between the marks.

D. Num of xxxx marks data input boxes

Enter the number of marks. (0 – 40)

6. [Store] (Teaching) button

Touch the [Store] button and the window as shown below will appear.
Touch the [Enter] icon to store the setting to be made by above 1 to 5 drop down list and buttons and start teaching.
Touch [X] icon to cancel.

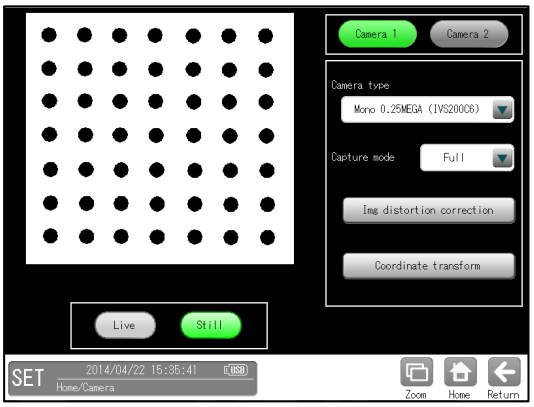


When the reference plate is “Unit cell” and “Share with all TYPEs” is enabled, Scale setting will be made.
=> See Section 4-4-23 Scale Setting.

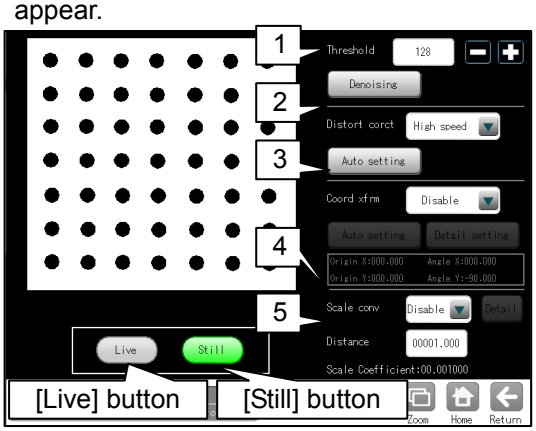
[4] [Coordinate Transformation] button

The origin and X/Y axes can be changed by utilizing the Calibration Sheet attached to the end of this manual. This function enables the user to get desired coordinate information

① Prepare the Camera Calibration Sheet.
② Capture the image of the sheet on the screen, touch [Live] and then [Still] buttons and touch [Coordinate transformation] button.



③ Coordinate transformation setting screen will appear.

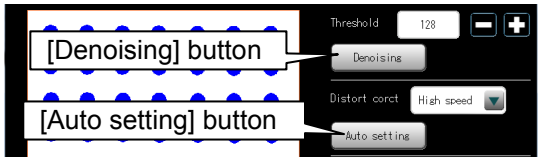


1. [Threshold] data input button

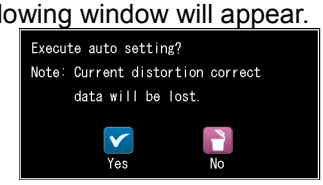
Set a value for binarization within 0 to 255.
The area of an image having below the set value is extracted.

2. [Distortion correction] drop down list

Select from "Disable", "High speed" and "High accuracy".
When one of the last two is selected, set either “Auto setting” or “Denoising”.

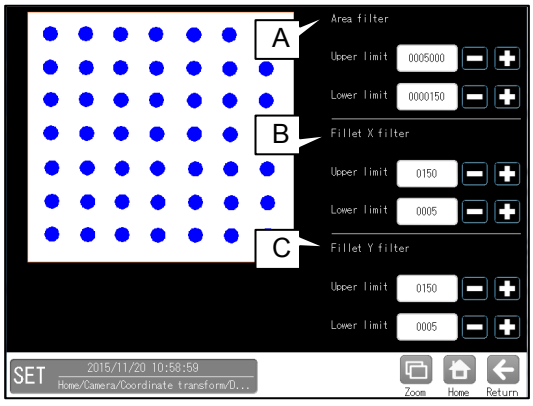


● [Auto setting] button
Noise will be corrected automatically.
The following window will appear.



Touch [Yes] icon to execute or [NO] icon.

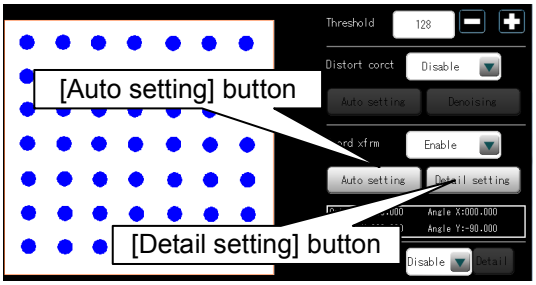
● [Denoising] button
The following screen will appear.



Enter the values for the desired filter:
A. [Area filter] data input boxes
("Upper limit", "Lower limit")
B. [Feret X filter] data input boxes
("Upper limit", "Lower limit")
C. [Feret Y filter] data input boxes
("Upper limit", "Lower limit")
The Area or Feret X/Y out of the limits is neglected as noise.

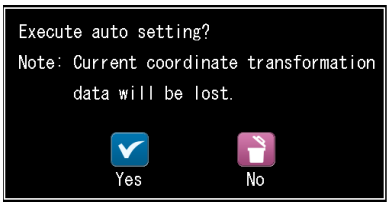
3. [Coord xfrm] drop down list

Select either "Disable" or "Enable".
When enabled, set either “Auto setting” or “Detail setting”.

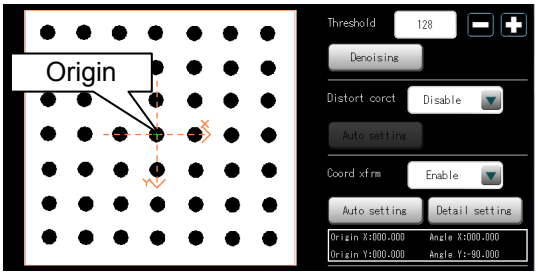


● [Auto setting] button

When the [Auto setting] button is touched, the following screen will appear.

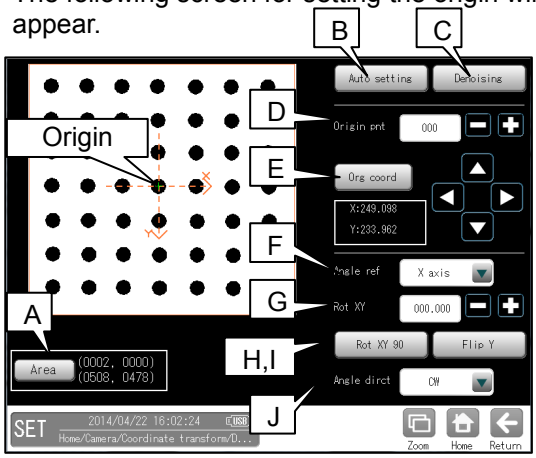


Touch [Yes] icon to execute or [NO] icon. The center of the image with the largest area among other extracted images is automatically set to origin (0, 0) when the coordinate is output.



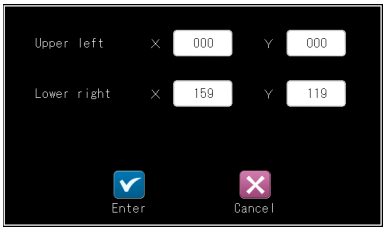
● [Detail setting] button

The following screen for setting the origin will appear.



A. [Area] button

Coordinate setting window will appear.



Set the “Upper left” and “Lower right” coordinates of the object area using the data input boxes.

[NOTE]

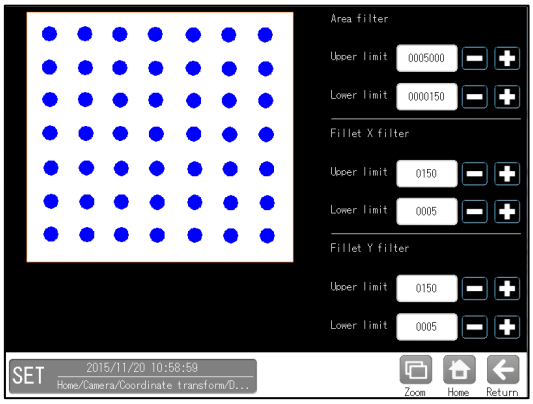
Set the coordinates such that 8 or more extracted images exist around the origin.

B. [Auto setting] button

The center of the image with the largest area among other extracted images is automatically set to origin (0, 0).

C. [Denosing] button

The following screen for setting the Area and Feret X/Y filters will appear.



D. [Origin point] data input box

Set the number of the origin.

E. [Origin coordinates] button

Set the coordinates of origin.

[Important]

All of the following will change the angle output once they are changed.

F. [Angle ref] drop down list

Select from “No change”, “X axis” and “Y axis”.

G. [Rot XY] data input box

Set the rotation angle of XY axes.

H. [Rot XY 90] button

The rotation angle of XY axes changes by 90 degree at each touch of this button.

I. [Flip Y] button

The ordinate of Y axis is flipped at each touch of this button.

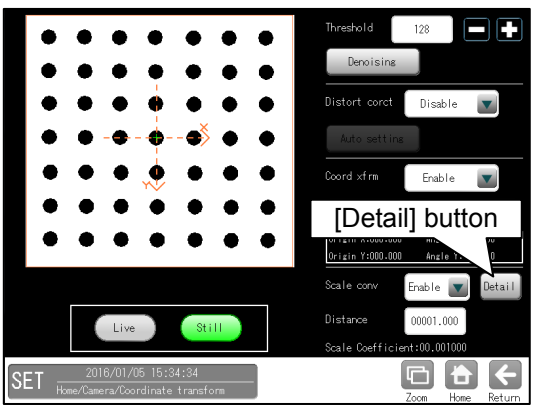
J. [Angle direction] button

Set to either “CCW” or “CW” for the direction of the angle of the inspected angle and image to be displayed.

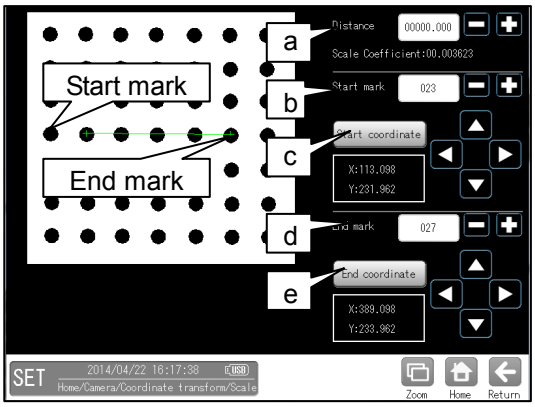
4. [Scale conv] drop down list

Select either “Disable” or “Enable”.

When “Enable” is selected, set the details.



The following screen will appear when the [Detail] button is touched.



a. [Distance] data input box
Enter the actual distance in mm, inch, etc. (00000.001～99999.999)

b. [Start mark] data input box
Enter the number of start mark.

c. [Start coordinate] box
Set the XY coordinates of start mark.

d. [End mark] data input box
Enter the number of end mark.

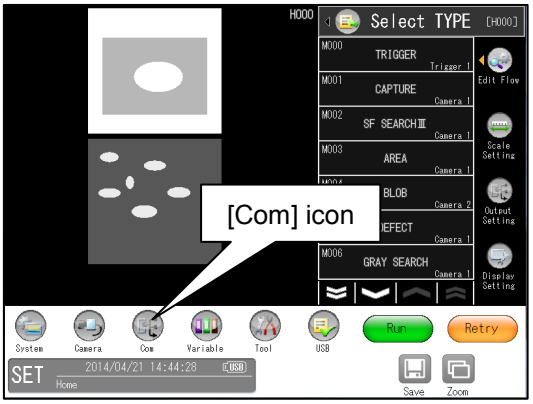
e. [End coordinate] button
Set the XY coordinates of end mark.

5. [Distance] data input box
Enter the actual distance in mm, inch, etc. (00000.001～99999.999)

4-2-3 Communication (Com) settings

Select from "Serial", "Ethernet", "Ext terminal", "PLC link" and “CC-Link” for the communication system.

① Touch the [Com] icon on the (Home) SET setting screen.

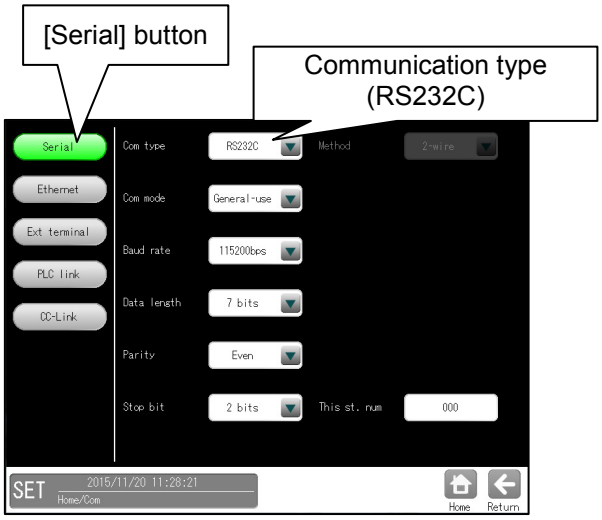


② Communication setting screen will appear. Touch one of the select buttons such as "Serial", and set the item for the communication.
The currently selected item button is displayed in green.

- Serial => (1)
- Ethernet => (2)
- External terminal => (3)
- PLC link => (4)
- CC link => (5)

[1] [Serial] communication button

Set each item such as "Com type" from the drop down list when the device communicates with external equipment by using the serial port (RS-232C/RS-422).
Touch the [Serial] button on the Communication setting screen.



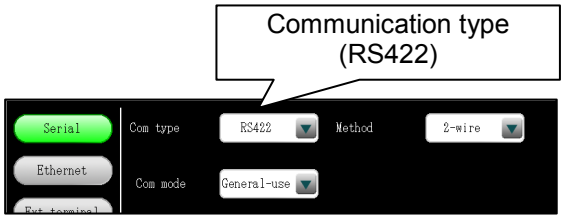
① To communicate via RS-232C

From the [Com type] drop down list, select "RS232C" (as shown in the figure above) and select desired items as follows from the respective drop down list.

- **Com mode**: "General-use", "PLC link"
- **Baud rate (bps)**: "2400", "4800", "9600", "19200", "38400", "57600", "115200"
- **Data length**: "7 bits", "8 bits"
- **Parity**: "Disable", "Odd", "Even"
- **Stop bit**: "1 bit", "2 bits"
- **This st. num**: Enter the station number (0 to 255) allocated to this device using the data input box and number keypad.

② To communicate via RS-422

From the [Com type] drop down list, select "RS422" and select desired items as follows from the respective drop down list.



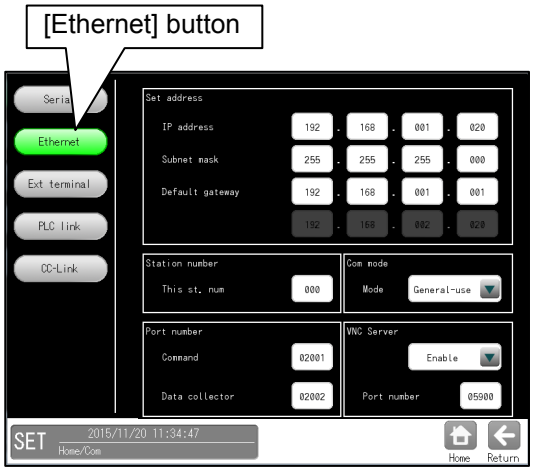
- **Method**: 2-wire, 4-wire

"Com mode", "Baud rate", "Data length", "Parity", "Stop bit", and "This st, num" are the same as those for RS-232C.

The termination resistance is always set to "Enable".

[2] [Ethernet] communication button

When connecting this device to LAN by using an Ethernet cable, set items relating to TCP/IP.
As for the details of the following setting, contact your network administrator.
Touch the [Ethernet] button on the Communication setting screen.



① Address setting

For setting an address, touch each data input box and enter a number with number keypad.
[IP address] data input box
Enter an IP address you want to allocate to this device.
(Default setting: 192.168.001.020)
[Subnet mask] data input box
Enter a subnet mask number.
(Default setting: 255.255.255.000)
[Default gateway] data input box
Enter an IP address for the default gateway.
(Default setting: 192,168,001,001)

② [Station number] data input box

Enter the station number (0 to 255) allocated to this device.

③ [Com mode] drop down list

Select either "General-use" or "PLC".
Set to “PLC” when PLC Link is used.

④ Port number buttons

Set the following items.

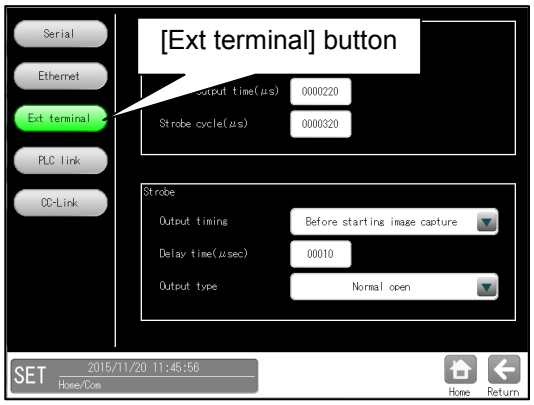
- [Command] data input box
- [Data collector] data input box

"Output timing", "Output method", and "Save mode" for the data collector shall be set on the output.
=> See page 4-229 for the data collector.

Note 1:
Port number 0210 is reserved by this device. Do not use this port number.
Note 2:
Communication will be made only with TCP/IP.

[3] [Ext (External) terminal] communication button

Set I/O (input and output) and Strobe for the external terminals. Touch the [Ext terminal] button on the Communication setting screen.



① [I/O] setting

Set the following items for input and output of the external terminals.

・[Strobe rise time] data input box:

40 to 1000000 μs in 20 μs step.

Set waiting time from the total judgment result output to turning on the strobe signal. The actual strobe output timing may fluctuate.

・[Strobe output time] data input box

40 to 1000000 μs in 20 μs step.

Set the time (duration) for turning on the strobe signal.

・[Strobe cycle] data input box

40 to 1000000 μs in 20 μs step.

Set the time from the last result output to next result output.
Set this time (interval) such that
(Strobe rise time + Strobe output time) ≦ Strobe cycle

② Strobe setting

Set “Output timing”, “Delay time” and “Output type” of the strobe control signal.

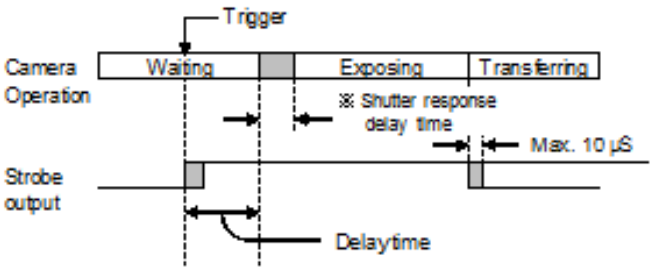
・[Output timing] drop down list

Select "Before starting image capture" or "After started image capture" .

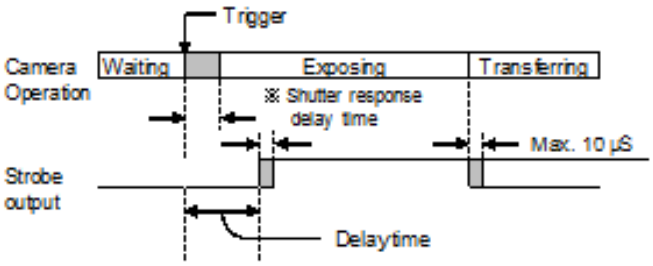
・[Delay time] data input box

When the " Before starting image capture” is set for the strobe Output timing, touch the [Delay time] button and enter the delay time from "turning on the strobe signal" to "turning on the camera trigger output" (start image capture).
When the " After started image capture” is selected for the strobe output timing, touch the [Delay time] data input box and enter the delay time from "turning on the camera trigger signal" (start image capture) to "turning on the strobe signal".
(Setting range: 0～30000μs)

・ Before starting image capture



・ After started image capture



After started image capture, the device does not turn on the strobe output if the delay time is longer than the exposure time.

※ Shutter response delay time

（1） CCD Camera

Camera	Max delay time (μs)
IV-S200C6	31.778
IV-S210C2	40.000
IV-C250C3	40.000
IV-C250C8	31.778
IV-S300C6	15.9

（2） CMOS Camera

Camera	Fixed delay time (μs)
IV-S300C2	0.330
IV-S300C3	0.330
IV-S300C5	55.000
IV-S300C7	0.330
IV-S300C8	0.330
IV-S300CA	6.90
IV-S300CD	6.90

・ [Output type] drop down list

Select "Normal close" or "Normal open" for the strobe output signal type.

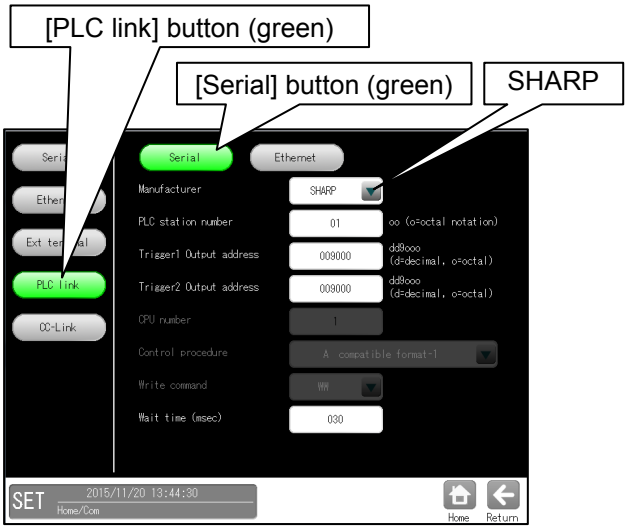
.

Normal open:
The signal level is high when active.
Normal close:
The signal level is low when active.

[4] [PLC link] button

If this device is connected to a PLC (made by Sharp, Mitsubishi Electric, Omron or Yokogawa) by using PLC link, the device can send inspection results to the PLC.
Touch the [PLC link] button on the Communication setting screen.
=> See Section 7 Serial Communication (PLC Link) for PLC Link.

1. When Serial Communication is selected



① **To link with Sharp's PLC**

Select "SHARP" from the [Manufacturer] drop down list (see the above screen) and set the following items with the data input boxes and number keypad.

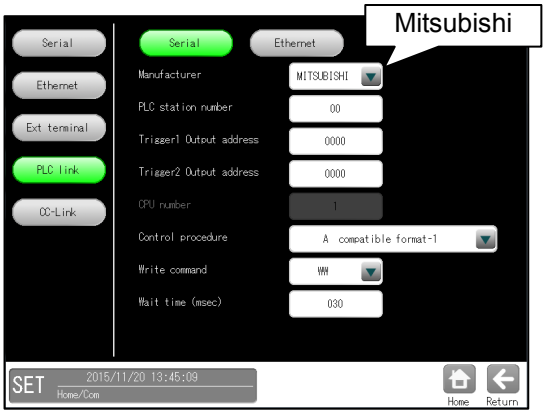
- **[PLC station number] data input box**
  Enter the station number for the communication target PLC.
  (01 to 37: Octal)

- **[Trigger1 Output address] data input box and**
- **[Trigger2 Output address] data input box**
  Enter the top address to write the results.
  (009000 to 389777)

- **Wait time**
  When output data amount is too much and the communication is disconnected due to a time limit of the protocol, provide a waiting time from the last communication response to next output start. (0 to 999 ms)

② **To link with Mitsubishi's PLC**

Select "Mitsubishi" from [Manufacturer] drop down list and set the following items.



- **[PLC station number] data input box**
  Enter the station number for the communication target PLC.
  (00 to 31: decimal)

- **[Trigger1 Output address] data input box and**
- **[Trigger2 Output address] data input box**
  Enter the top address to write the results.
  (0000 to 1023: decimal)

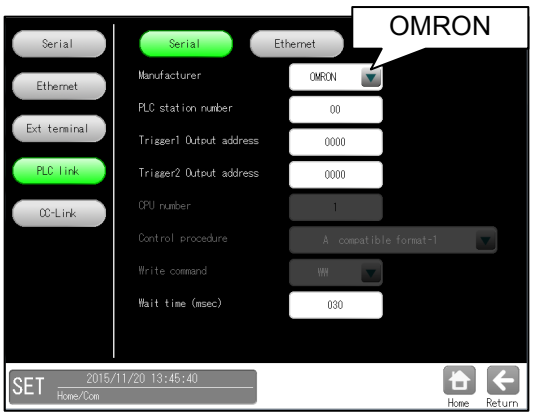
- **[Control procedure] drop down list**
  Select one.
  A compatible format-1:
  for no terminator,
  A compatible format-4:
  for CR+LF terminator,
  QnA compatible format-5:
  for Form-5 (binary communication) of "QnA compatible 4C frame".

- **[Write command] drop down list**
  Select the data write address range:
  WW: for D0000 to D1023 or
  QW: for D000000 to D008191.

- **[Wait time] data input box**
  When output data amount is too much and the communication is disconnected due to a time limit of a protocol, provide a waiting time from the last communication response to next output start. (0 to 999 ms)

③ To link with Omron's PLC

Select "OMRON" from [Manufacturer] drop down list and set the following items.



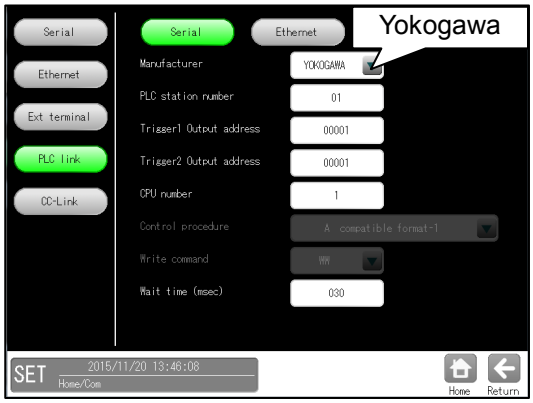
- **[PLC station number] data input box**
  Enter the station number for the communication target PLC.
  (00 to 31: decimal)

- **[Trigger1 Output address] data input box and**
- **[Trigger2 Output address] data input box**
  Enter the top address to write the results.
  (0000 to 9999: decimal)

- **[Wait time] data input box**
  When the communication is divided due to heavy output data, set the wait time from first communication response to output start of the next communication.
  (0 to 999 ms)

④To link with Yokogawa's PLC

Select "Yokogawa" from [Manufacturer] drop down list and set the following items.



- **[PLC station number] data input box**
  Enter the station number for the communication target PLC.
  (01 to 32: decimal)

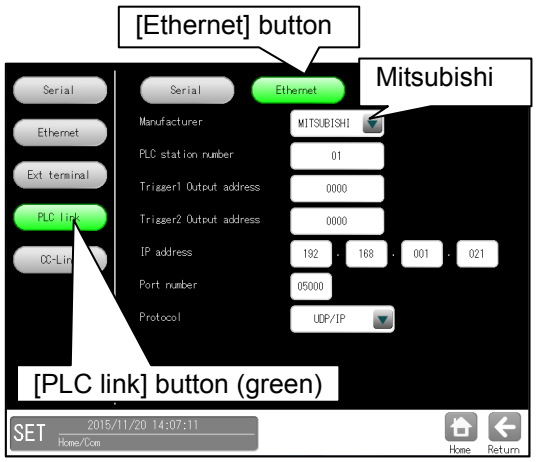
- **[Trigger1 Output address] data input box and**
- **[Trigger2 Output address] data input box**
  Enter the top address to write the results.
  (000001 to 16384: decimal)

- **[CPU number] data input box**
  Enter CPU number (1 to 4).

- **[Wait time] data input box**
  When the communication is divided due to heavy output data, set the wait time from first communication response to output start of the next communication.
  (0 to 999 ms)

2. When Ethernet is selected

When connecting this device with a Mitsubishi's PLC with Ethernet, set as follows:



- **[Manufacturer] drop down list**
  "Mitsubishi" is selected automatically.

- **[PLC station number] data input box**
  Enter the station number for the communication target PLC.
  (00 to 31: decimal)

- **[Trigger1 Output address] data input box and**
- **[Trigger2 Output address] data input box**
  Enter the top address to write the results.
  (0000 to 8191: decimal)

- **[IP address] data input box**
  Enter an IP address to allocate to this device using the number keypad.
  (Default setting: 192,168,001,021)

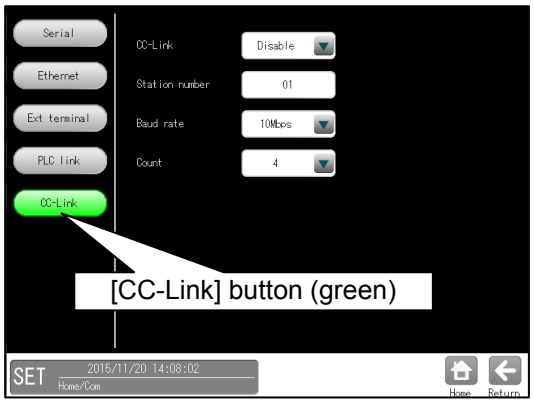
- **[Port number] data input box**
  Enter a number within 0 to 65535.
  (Default setting: 05000)

- **[Communication protocol] drop down list**
  Select either "UDP/IP" or "TCP/IP".

- **Setting required on PLC side**
  Binary communication (Not ASCII)
  Protocol: MC protocol
  (QnA compatible 3E flame)
  Sub header in protocol: 50 00
  Q Header in protocol
  ① Network No.: 00
  ② PC No.: FF
  ③ Required unit: I/O FF 03
  ④ CPU Monitor timer: 10 00
  Command in protocol: 01 14
  Sub command in protocol: 00 00

[5] [CC-Link] button

When connecting this device with a Mitsubishi's PLC with CC-Link, set as follows:



- **[CC-Link] drop down list**
  Select "Disable" or "Enable".

- **[Station number] data input box**
  Enter the station number for the a
  (01 to 64: decimal)

- **[Baud rate] drop down list**
  Select one from "156 Kbps", "625 Kbps", "2.5Mbps", "5 Mbps" and "10Mbps".

- **[Count] (of stations) drop down list**
  Select either "2", "3" or "4".

4-3 Object Type

This section describes the image object type used on the controller.
(The screens shown below are typical examples)

[1] What is an object type?

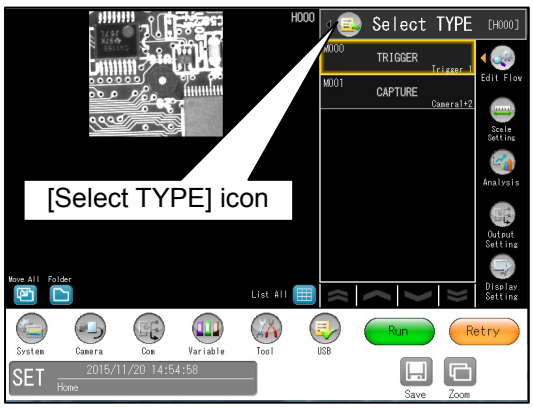
To inspect an image, you need to adjust the image captured with a camera and set an inspection area, inspection items, results output method, etc. On the device, a set of these setting details is referred as "object type."
These settings are registered under an object type (maximum 200).
Note: 0 to 199 can be assigned to an object type. The number of object types that can be actually registered may vary depending on the setting.

[2] Register/select an object type

This section describes how to register or select an object type.
Object type (TYPE) numbers: 000 to 199.

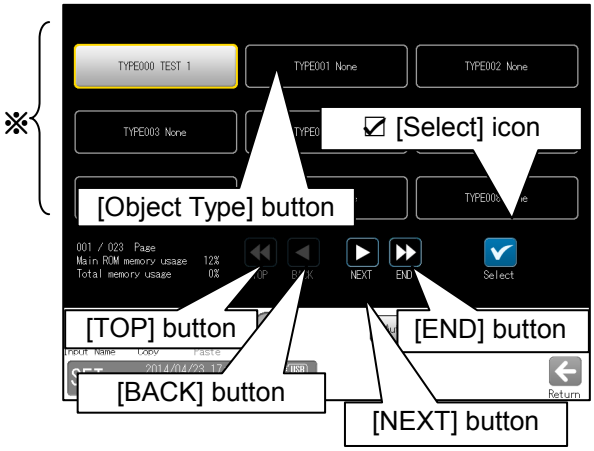
(1) Register an object type

① Touch the [Select TYPE] icon on the (Home) SET screen.



② The "Object type selection" screen will appear.
Touch a new object type button you want to register the image to and touch ☑ [Select] icon.

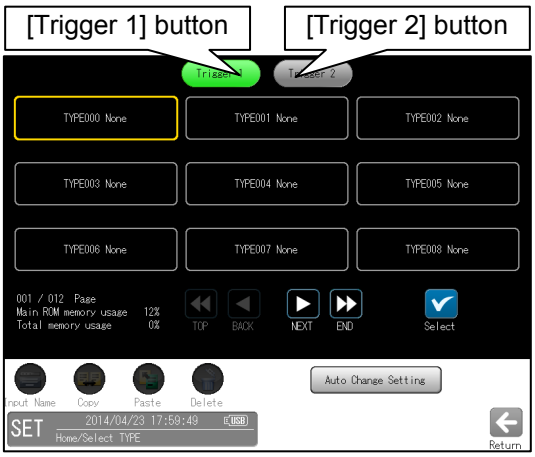
- **When 1 Trigger Mode is selected:**



※ Object type display area

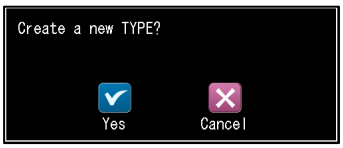
- A maximum of 9 object types can be displayed on one screen.
- Functions of each button on the screen
  [NEXT] button: Displays the next 9 object types
  [BACK] button: Displays the previous 9 object types
  [END] button: Displays the last object type
  [TOP] button: Displays the first object type

- **When 2 Trigger Mode is selected:**

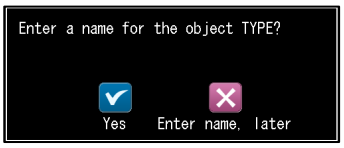


Touch [Trigger 1] button and select an object type, 000 to 099.
Touch [Trigger 2] button and select an object type, 100 to 199.

③ When an object type is selected and the button is touched again, "Create a new TYPE?" window appears.
Touch the ☑ [Yes] icon.



④ "Enter a name for the object TYPE?" window will appear.

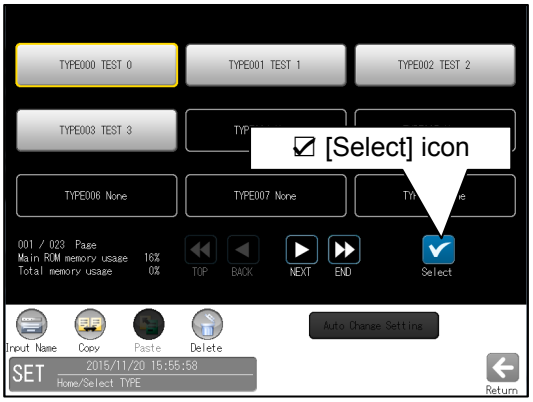


- If you want to assign a name to the object type to be registered, touch the ☑ [Yes] icon. See [3] "Assign a name to an object type" on the right of this page for the detail.
- If you want to assign a name to the object type later, touch the [Enter name, later] icon.

⑤ The selected object type is registered and the display will return to the (Home) SET screen of the created object type.

(2) Select an object type

① Touch the [Select TYPE] icon on the (Home) SET screen to display the object type selection screen.



② Touch and select a desired registered object type and then touch ☑ [Select] icon.
The selected object type is framed in yellow.

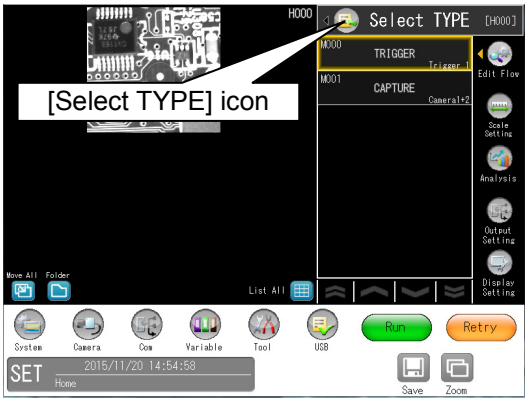
③ The (Home) SET screen of the selected object type will appear.

[3] Assign a name to an object type

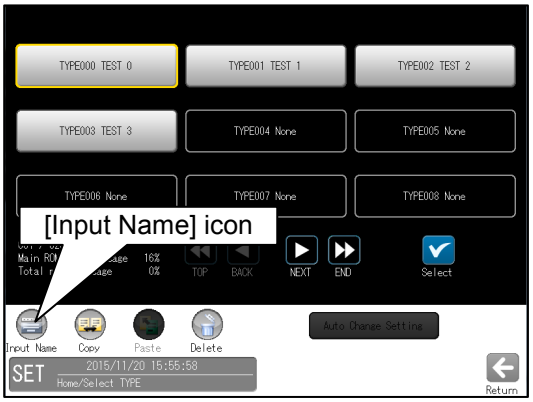
This section describes how to assign a name to an object type.

- At ④ "Enter a name for the object TYPE?" window shown on the left of this page, touch the ☑ [Yes] icon. A keyboard will appear.

① Touch the [Select TYPE] icon on the (Home) SET screen.

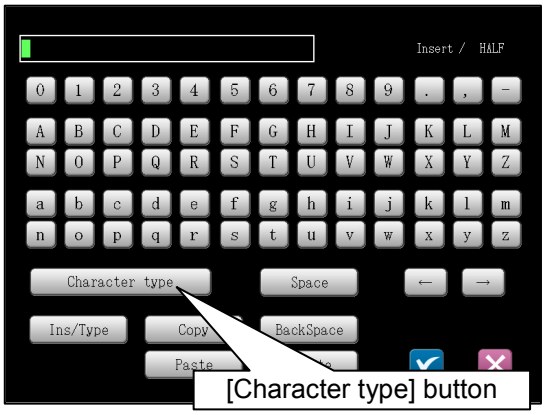


② The "Object type selection" screen will appear.
Select a registered object type you want to assign a name to and then touch the [Input name] icon.

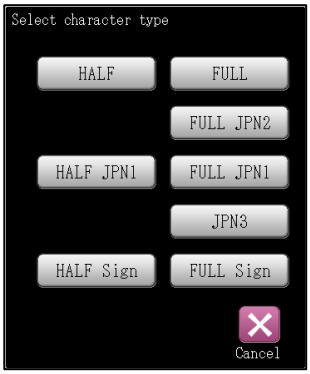


- To register an object type, see (1) "Register an object type" on the previous page.

③ A keyboard will appear.



・ Touch the [Character type] button, and the "Select character type" window will appear.



Touch one of the character buttons and then enter characters on the keyboard.

Note:
For English, select "HALF".

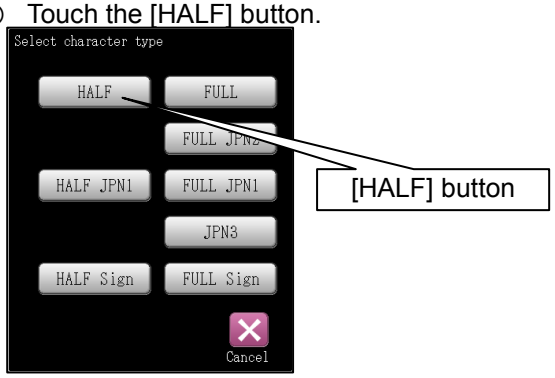
HALF: Half-width Alphanumeric
HALF JPN1: Half-width Japanese Katakana
HALF Sign: Half-width Symbol

FULL: Full-width characters and Alphanumeric
FULL JPN2: Full-width Japanese Katakana
JPN3: Chinese characters
FULL Sign: Full-width Symbol

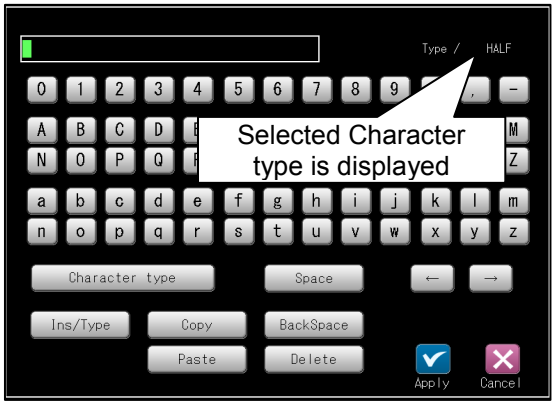
(1) Enter characters

The procedure to enter a word is as follows:
Example: Enter "ABCD".

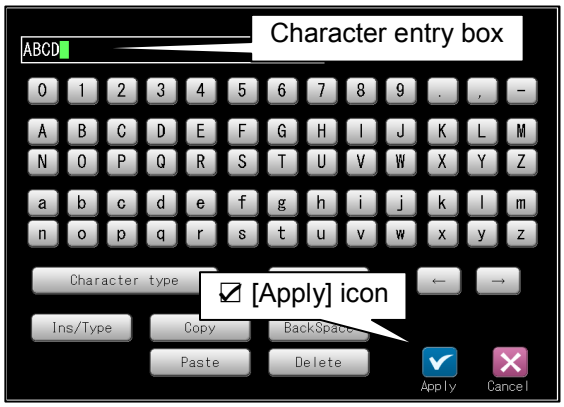
① Touch the [HALF] button.



② The HALF size character keyboard will appear.

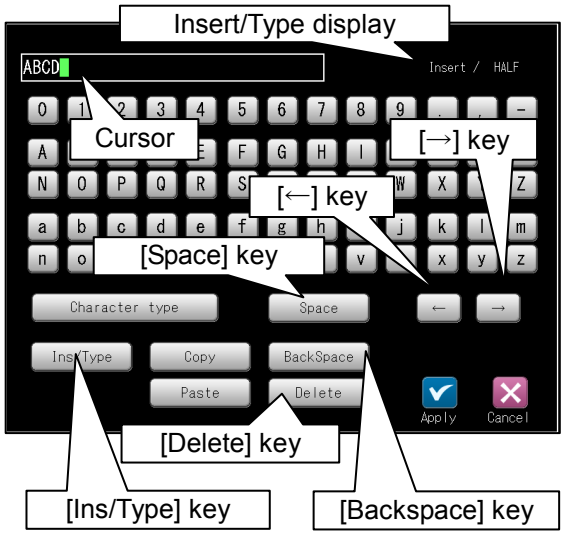


③ Touch ABCD keys in the order and "ABCD" will be displayed in the character input box.
Touch the ☑ [Apply] icon to store the word.



④ The display will return to the object type selection screen and show the name you have entered next to the object type.

(2) Delete and insert characters



- **Insert/overwrite characters**
  Each time you touch the [Ins/Type] key, the mode will alternate between "Insert" and "Type=Overwrite". (Current mode is displayed on the upper right of the window)

- **Delete characters**
  Touch the [Delete] key and the character under the cursor will be deleted.
  Touch the [Backspace] key to delete the character on the left of the cursor.

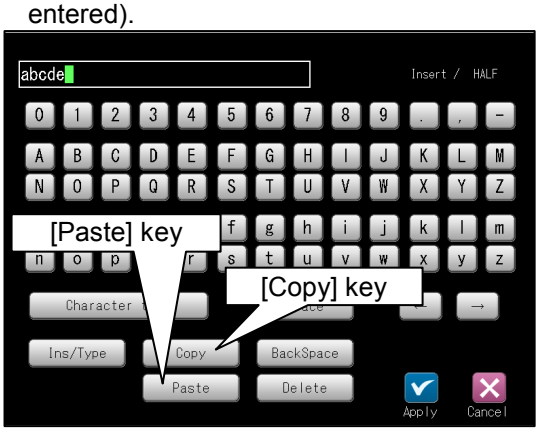
- **Insert a space (blank)**
  Touch the [Space] key, and a space will be inserted to the left of the cursor position and the cursor will move to the right.

* You can move the cursor position (green) with the [←] or [→] key.

(3) Copy character strings

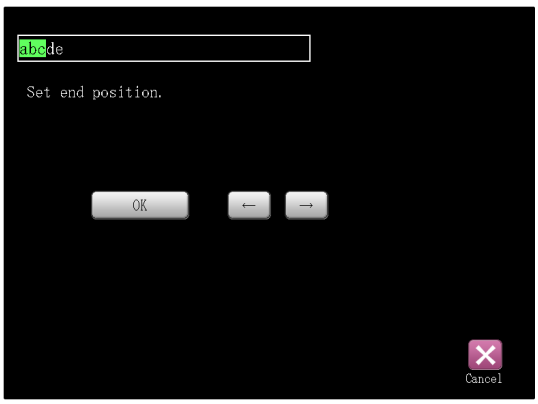
You can copy and store up to 30 character strings.
Shown below is an example of copying a character string "abc".

① Touch the [Copy] key on the character input screen (where the string "abcde" has been entered).



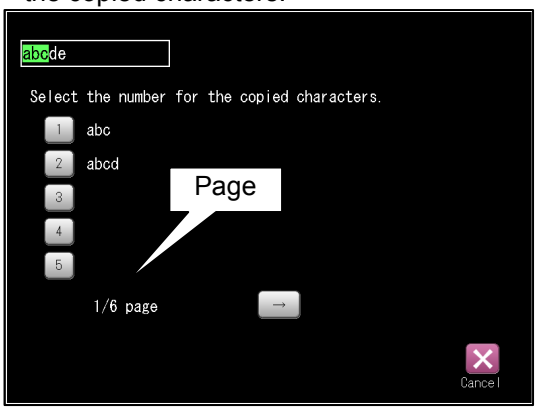
② The "Set start position" window will appear. Touch the [←] or [→] key to move the cursor (green) to the place you want to start copying, "a". Then touch the [OK] key.

③ Then the "Set end position" window will appear.
Move the cursor with the [←] or [→] key until it is over the position, "c", and touch the [OK] key.



・ The characters highlighted in green ("abc") will be copied.

④ The window as follows for assigning a number to the copied characters will appear. Touch the number key you desire for saving the copied characters.



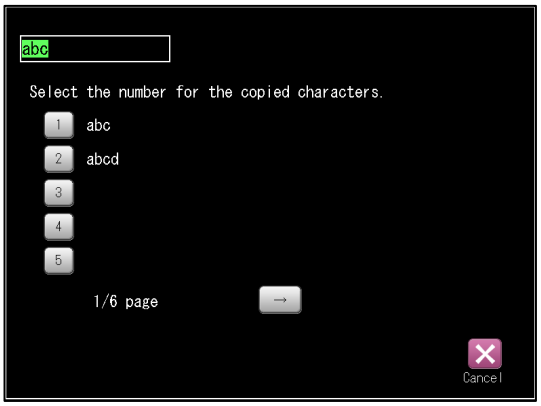
・ To display a number not shown on the screen, touch the [→] key and next page of copy number (1 to 30) will be displayed.

⑤ The character input screen will appear when a number key is touched.

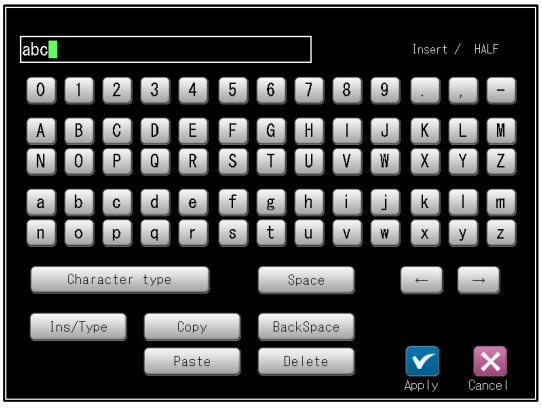
(4) Paste stored characters

① Touch the [Paste] key on the character entry screen. See (3) ① on the left of this page.

② The window shown below for selecting the number of the characters to past will appear. Touch the number key of the characters to paste.



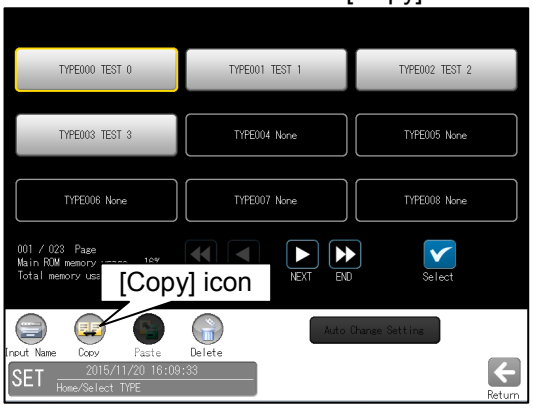
③ The character input screen will appear when a number key is touched.
The pasted characters will be displayed in the character input box.



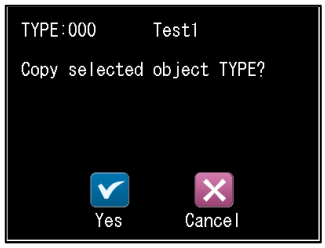
[4] Copy an object type

You can copy registered object type data to another object type.

① Touch the button of a copy source object TYPE on the Select type screen if it is not selected and then touch the [Copy] icon.

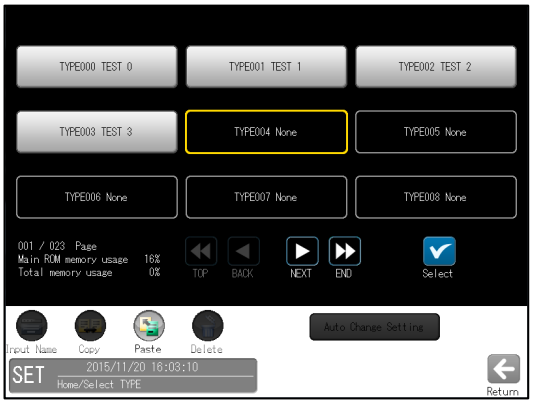


② The copy confirmation window will appear. Touch the ☑ [Yes] icon to copy.

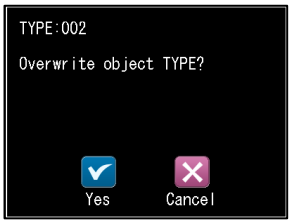


・ The selected object type will be copied.

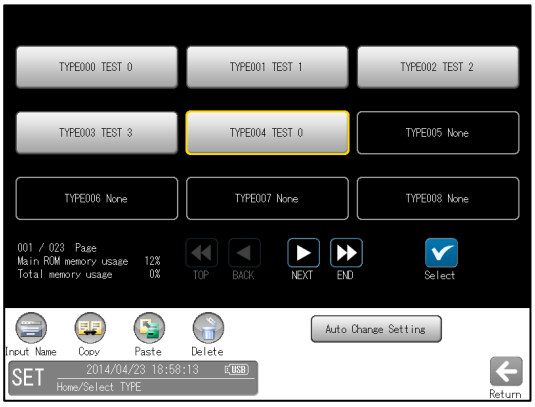
③ Touch the button of destination object type and then touch the [Paste] icon.



④ The paste (overwrite) confirmation window will appear.
Touch the ☑ [Yes] icon to paste or [Cancel] icon to cancel.
Note: The current data of the destination object type will be overwritten.



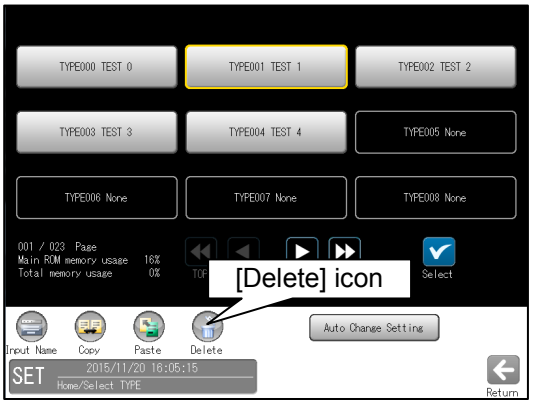
⑤ The copy source object type data will be pasted to the destination object type.



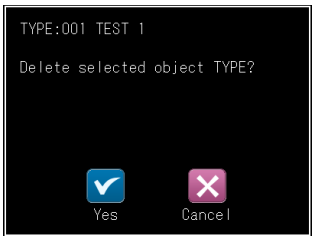
[5] Delete an object type

This function is used to delete registered object type, data, name and contents.

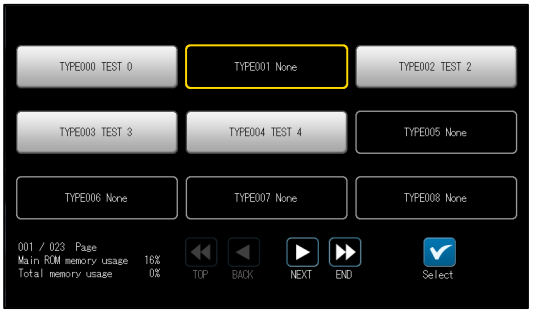
① Touch the button of the object type you want to delete on the Select TYPE screen if it is not selected and then touch the [Delete] icon.



② The delete confirmation window will appear. Touch the ☑ [Yes] icon to delete or [X] for cancel.

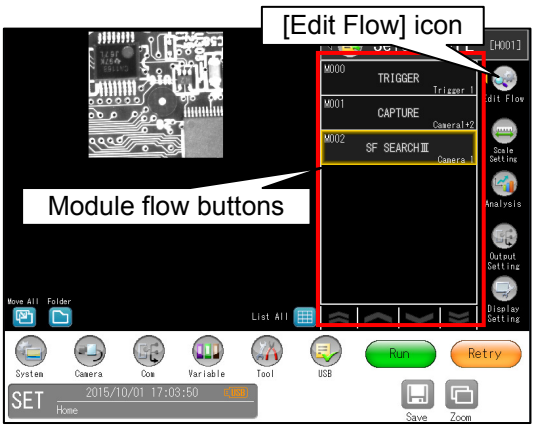


③ The object type name and the data stored for the selected object type will be deleted.



4-4 Setting of each object type

This section describes the editing flow, settings of each module (such as a trigger module), output setting, offline adjustment, and inspection setting that need to be defined for each object type on the SET screen.
(The screens shown below are typical examples)



- Edit Flow => See page 4-31.
- How to set each module
  => Sections 4-4-2 to 21

4-4-1 Edit flow

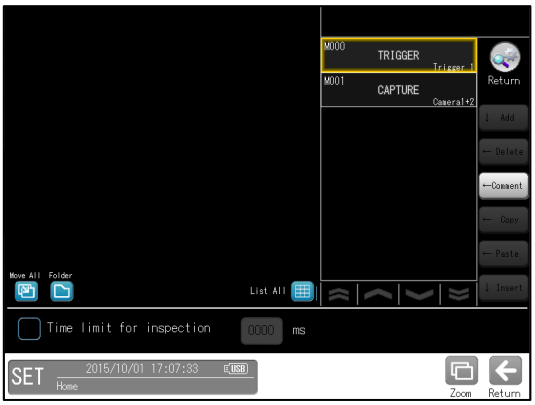
The device is designed to allow you to create programs (module flow) suitable for your application by combining the modules.

[1] What is a module?

On this device, various setting items are classified by their types in order to create an inspection program.
The group of setting items is referred to as a module.

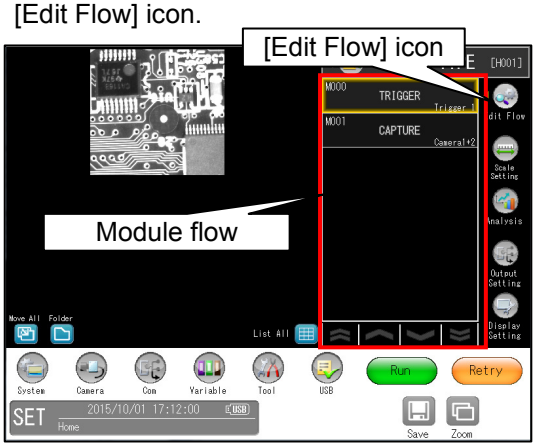
[2] Edit the module flow

The "Trigger" and "Capture" appear in the module flow on the (Home) SET screen when this device is used for the first time.
(Default setting)

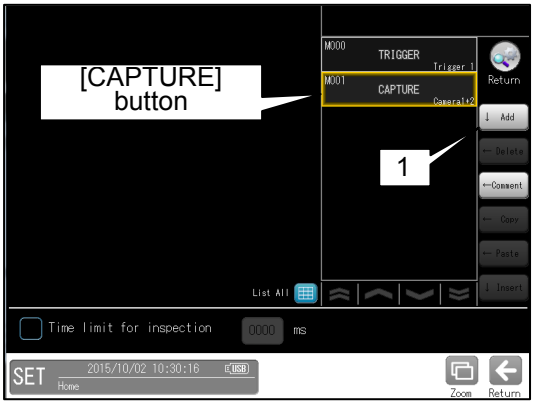


Add modules required for your inspection in the order you want them to process after the “Capture” module.
After setting the module flow, set process details of each module.

① On the (Home) SET screen, touch the [Edit Flow] icon.

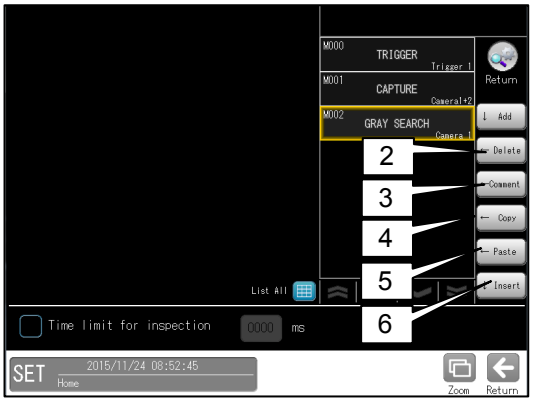


② The Module flow edit screen will appear.



・When the [CAPTURE] button is touched, [ADD] button is enabled and a module can be added.

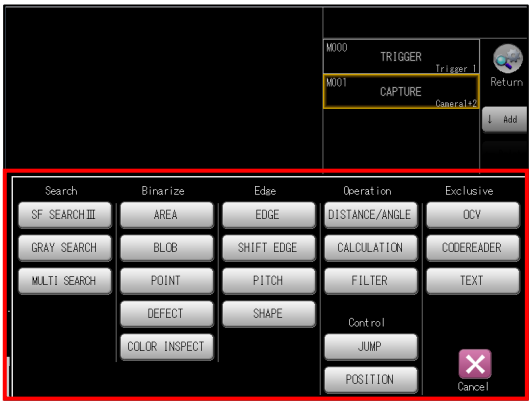
③ After a module is added, other buttons are enabled.



Note:
When the "Trigger module" is selected, only [Comment] button is enabled and when the "Capture module" is selected, only [Add] and [Comment] buttons are enabled

1. [↓Add)] button

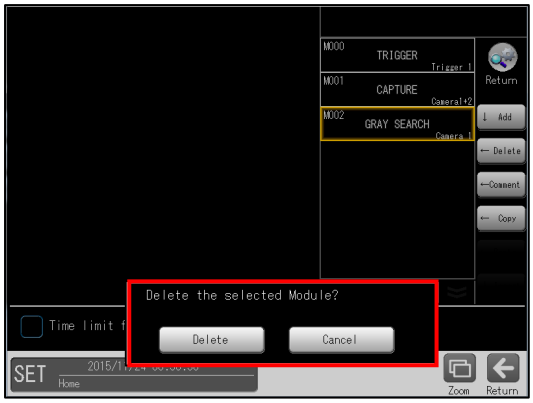
Touch the [↓Add] button and the window as shown below will appear.



Touch the button of the module you want to add to the module flow. The module will be added just after the module selected in the step ③ above.

2. [←Delete] button

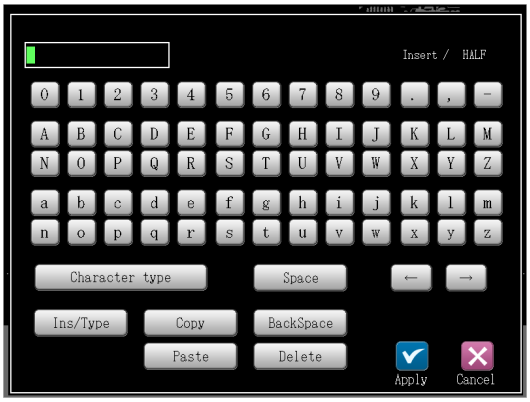
Touch the [←Delete] button and a window will appear to confirm that you want to delete the module.



Touch the [Delete] button on the window to delete, and the selected module will be deleted from the module flow.

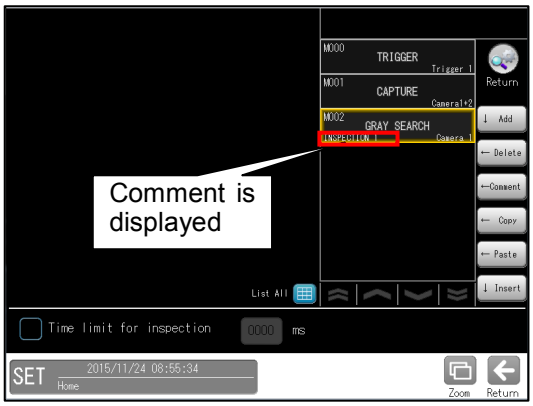
3. [←Comment] button

Touch the [←Comment] button and a keyboard will appear to let you enter a comment.



・See page 4-26 for the procedures for entering characters.
[Number of characters to enter]
HALF size: Up to 16 characters

Your comment will be shown below the module number after the [Apply] icon is touched.

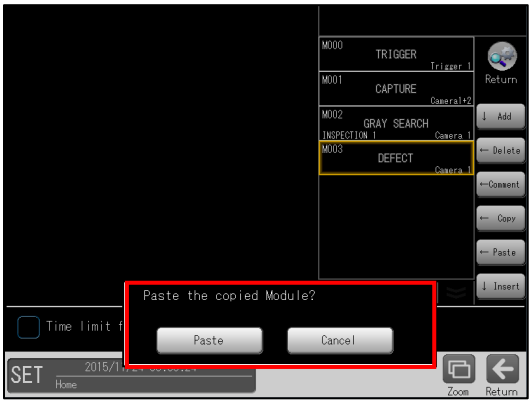


4. [←Copy] button

Touch the [←Copy] button and the selected module will be copied.
The copied module can be pasted and inserted in the module flow.

5. [←Paste] button

Touch and select the module button that you want paste the copied module to and then [←Paste] button. A window will appear to confirm that you want to paste the module.



Touch the [Paste] button to paste, and the module copied in step 4 above will be pasted over the selected module.

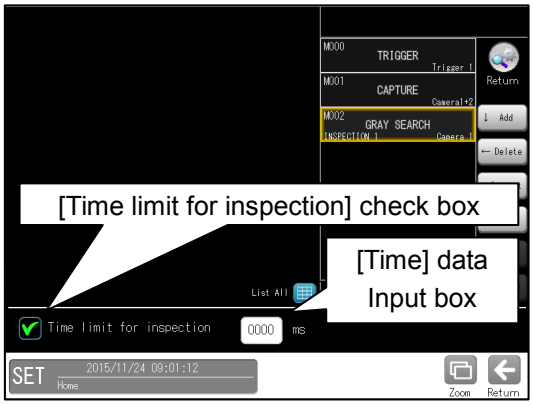
Touching the [Cancel] button displays “Edit Flow” screen.

6. [↓Insert] button

Touch the [↓Insert] button to insert the copied module, and the module copied in step 4 above will be inserted just after the selected module.

● [Time limit for inspection] check box

Touch the check box and enter the time limit for an inspection (0 to 9999 ms).
When an inspection does not finish within the set limit, it is judged as NG.
Note:
This device may not stop the inspection precisely at the set time.

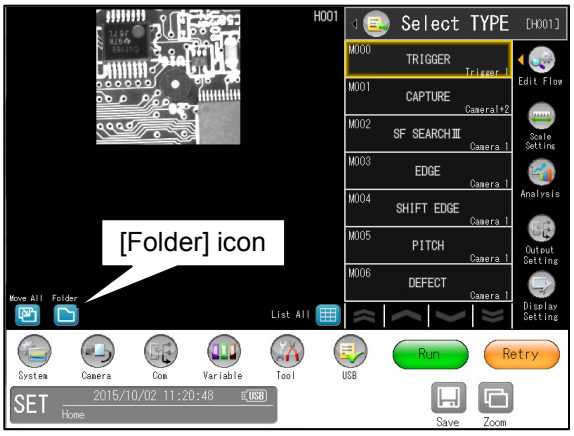


Check the [Time limit for inspection] check box to show (☑) and enter the time to stop inspection in ms unit with the [Time] data input box.

[3] Folder icon

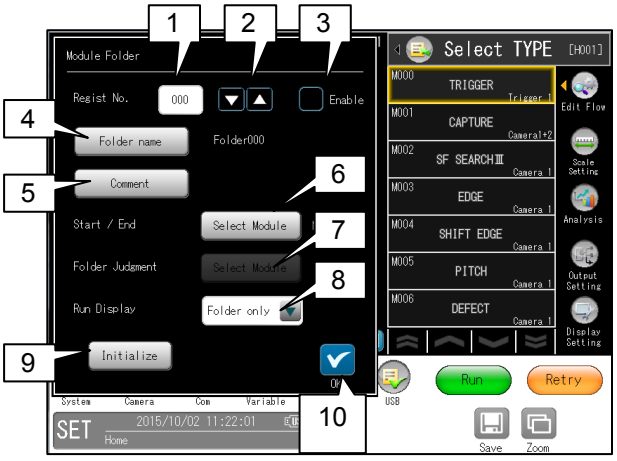
Multiple modules can be organized into a folder for easy identification and judgment on folder basis.

① Touch the [Folder] icon on (Home) SET screen.



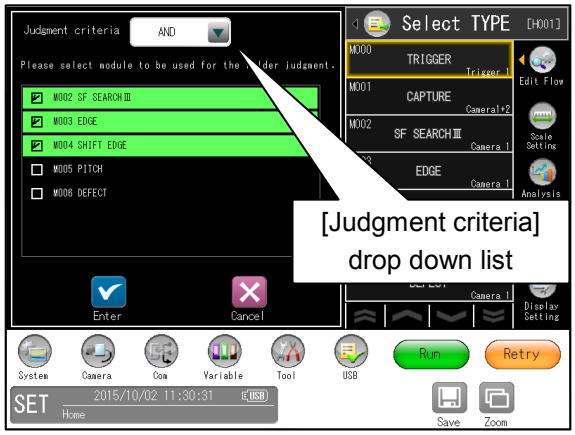
Total 100 (0 to 99) folders can be registered.

② Folder Setting screen will appear.



1. **[Registration No.] data input box**
   Enter the registration number of the folder within 0 and 99.
2. **[Up/Down Arrow] keys (▼▲)**
   Use these keys to change the Registration No.
3. **[Enable] check box**
   Check this box to enable the folder or uncheck it to disable the folder.
4. **[Folder Name] button**
   Set the folder name with the keyboard that appears.
5. **[Comment] button**
   Set the comment of the folder with the keyboard that appears.
6. **Start/End [Select Module] button**
   Screen for organizing modules will appear. Select both Start and End modules to organize in the folder.

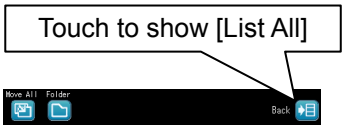
7. **Folder Judgment [Select Module] button**
   The button is enabled when a module is set. Touch this button to select the judgment criteria (AND/OR) for a folder and the module(s) to judge.



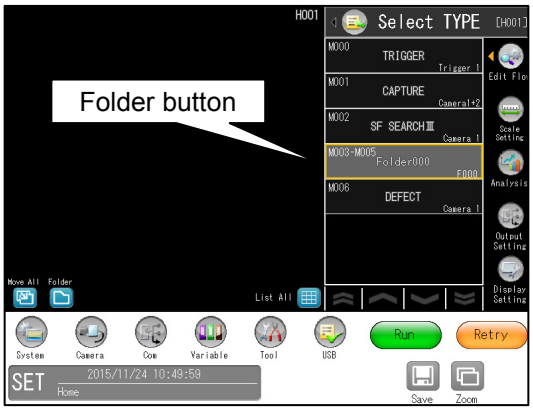
8. **[Run Display] drop down list**
   Select the items to display on Run screen: “Folder only” or “All”.
   Folder only:
   Displays only inspection results of the folder and the inspection time.
   All:
   Displays all the inspection results of the modules and the inspection time.
9. **[Initialize] button**
   Touch this button to initialize the setting for the selected Registration No. folder.
10. **[OK] icon**
    Touch this icon to save the setting and return to (Home) SET screen.

③ Display of modules in a folder

Touch the button to show [List All].



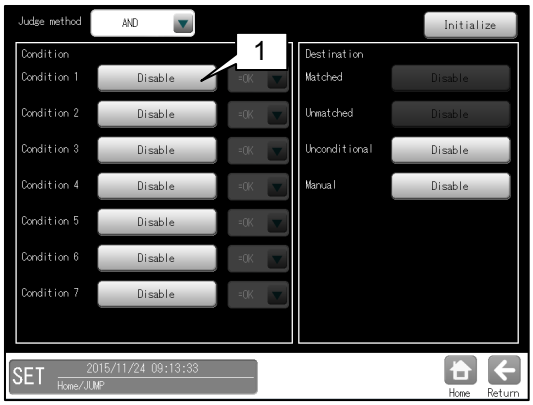
Then, touch the Folder button.



The module list of the touched folder is displayed.

Touch the Folder button again to hide the list.

④ Folder judgment setting on Jump Module



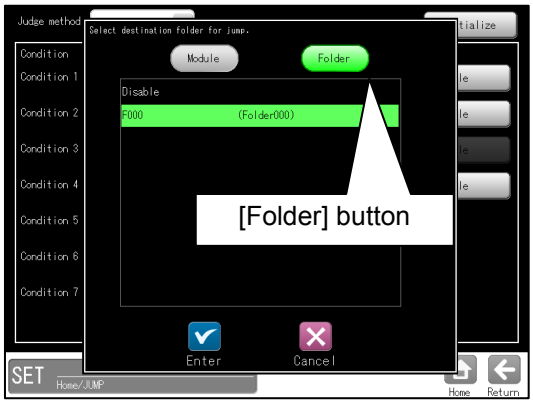
1. **Jump Conditions**

   Conditions 1 to 7 can be used.

   Touch the button right next of the appropriate condition.

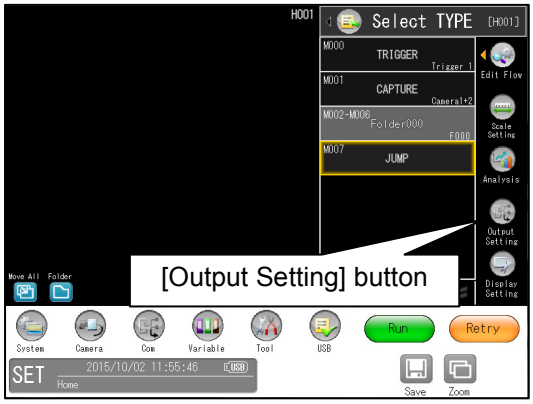
2. **[Folder] button**

   Touch [Folder] button and select the folder name for jump condition.

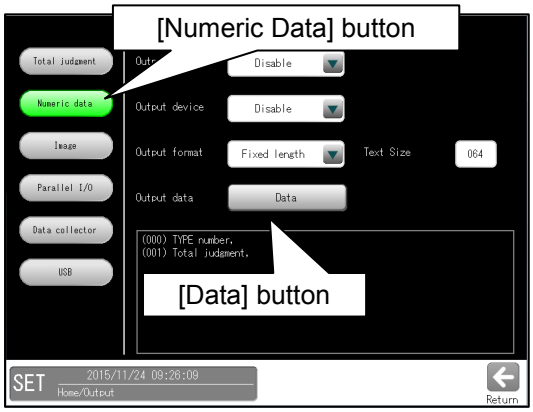


⑤ Output Folder Judgment result by Numeric data.

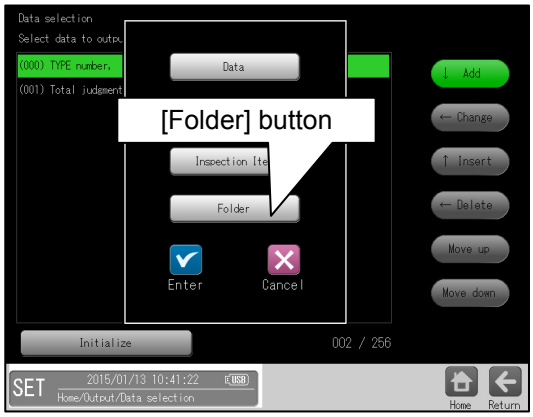
1. Touch the [Output Setting] button on (Home) SET screen.



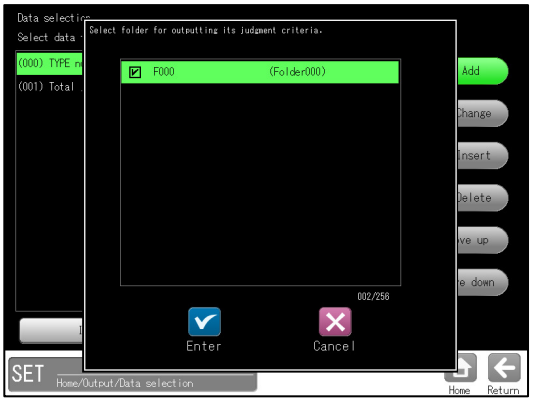
2. Touch [Numeric data] button and then [Data] button.



3. Touch the [Add] button and then [Folder] button.

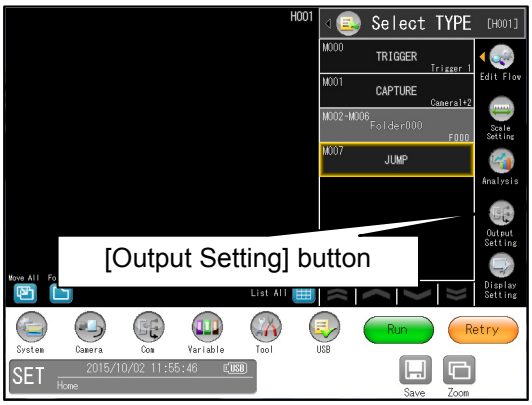


4. Select the Folder Name for outputting the judgment result by checking the check box.

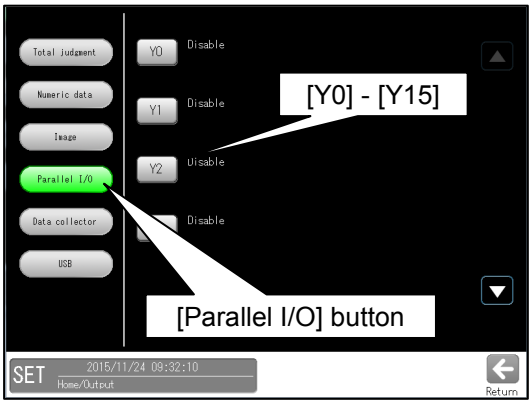


⑥ Output Folder Judgment result by Parallel I/O.

1. Touch the [Output Setting] button on (Home) SET screen.

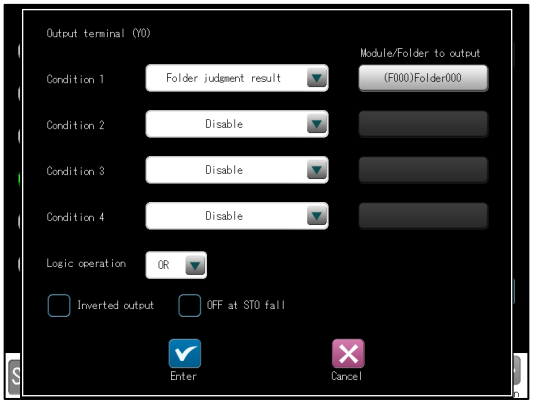


2. Touch the [Parallel I/O] button



A. [Y0] to [Y15] buttons
Touch the appropriate button to set condition.

B. Conditions 1 to 4 drop down list
Set conditions for each output terminal.

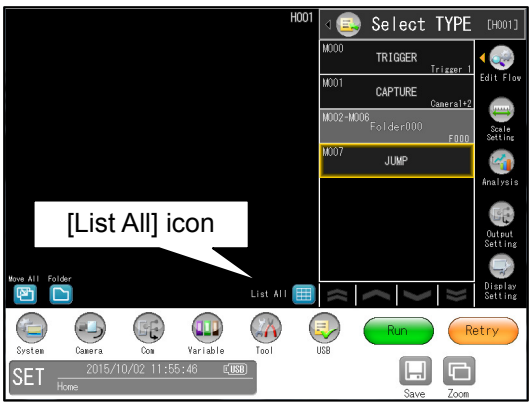


[Selectable options]
"Disable"
"Hardware error"
"Module judgment result"
"Running"
"OFF"
"Folder judgment result"

[4] List All icon

All the module flow (maximum 21 modules/folder) can be displayed for easy check.

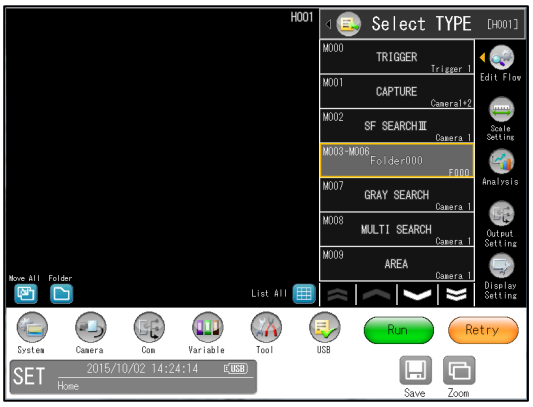
① Touch the [List All] icon on (Home) SET screen.



② All the modules are listed.
Maximum 21 modules/folder can be displayed on the screen.
Use  keys to list other modules.

③ When all the modules are listed and  icon is touched, the modules in a folder are combined in the folder.

④ Touch “Back” icon to display maximum 7 modules/folder normal display.



⑤ Module display of a folder
Touch the Folder name button to display the modules in the folder.
Touch the Folder name button again to close the display of the modules in the folder.

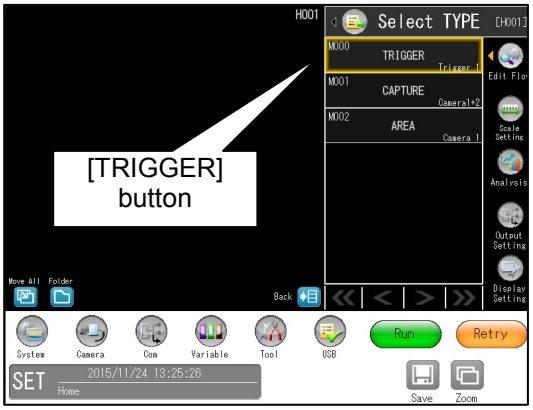
4-4-2 Trigger module

When the device received a trigger, it starts capturing an image from the camera and then transfers the image.
Select the trigger signal source in this trigger module.
The following two triggers are available as the trigger source.

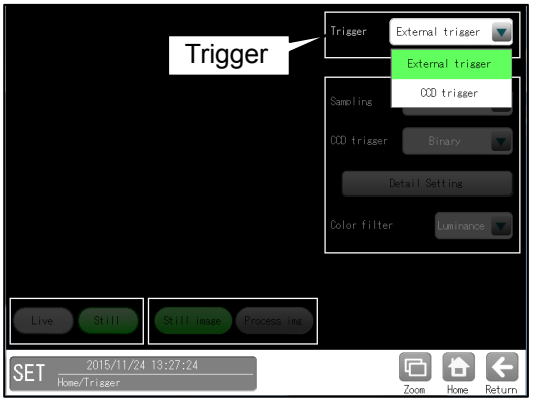
External trigger:
The device starts capturing an image when it received a trigger signal from external equipment.

CCD trigger:
(Only when 1 Trigger mode is selected)
The device checks a part of the image captured with the CCD camera (the trigger window) at high speed, and starts the inspection when there is a change in the captured image. Therefore, the device can start an inspection when the object moved, without needing any external trigger such as a photo sensor.

① On the (Home) SET screen, touch the [Trigger] button.



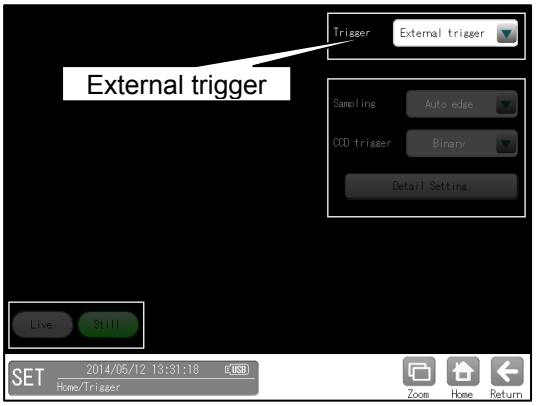
② The Trigger SET screen will appear.
Select the trigger type from the drop down list.



・External trigger => [1]
・CCD trigger => [2]

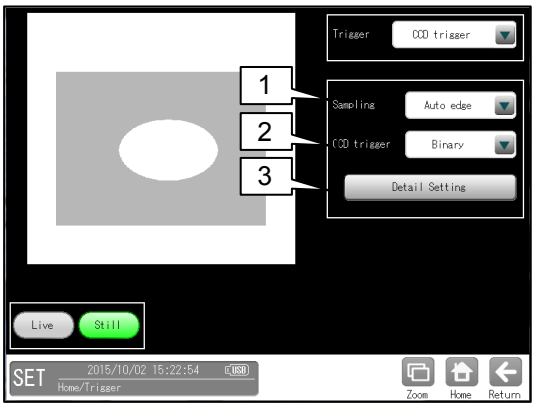
Note: When 2 Trigger mode is selected, CCD trigger cannot be selected.

[1] External trigger
[When a monochrome camera is used]

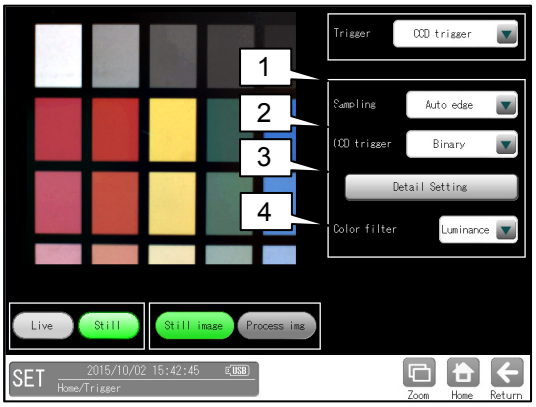


[When a color camera is used] (1 Trigger mode)

[2] CCD trigger (Only for 1 Trigger mode)
[When a monochrome camera is used]



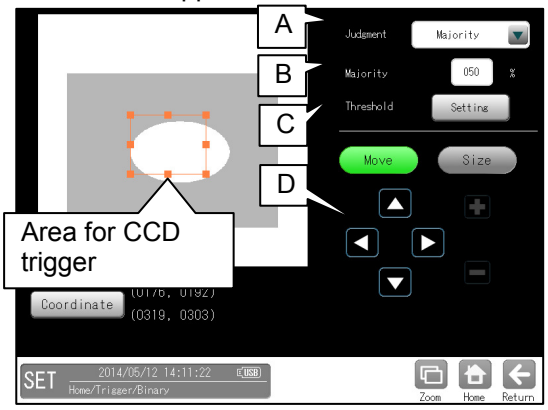
[When a color camera is used]



1. **[Sampling] drop down list**
   Select one from "Auto edge", "Auto level", "Parallel" and “CC-Link”.
   - **Auto edge**
     Continues sampling during Run operation. Starts inspection when the condition changes from out-of-judgment-criteria to within-the-criteria.
   - **Auto level**
     Continues sampling during Run operation. Starts and continues inspection as far as the judgment criteria is met.
   - **Parallel**
     Start sampling at the positive edge of the trigger signal (TRG1/TRG2). Starts inspection when the judgment criteria is met and stop inspection. To restart inspection, the trigger signal must be once turned off and then on.
   - **CC-Link**
     The operation is the same as the above Parallel except that the trigger signals are TRG1/TRG2 of CC-Link.

2. **[CCD trigger] drop down list**
   This is set to "Binary".

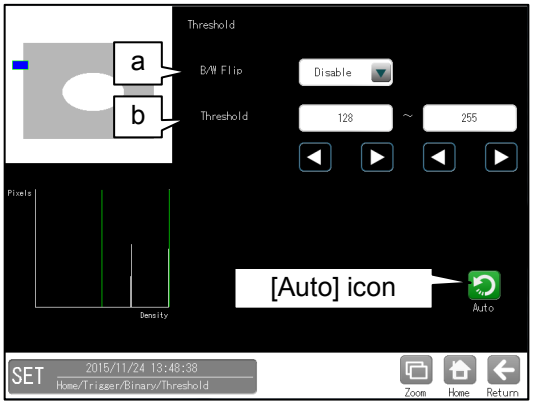
3. **[Detail setting] button**
   Touch the button and the condition SET screen will appear.



A. [Judgment] drop down list
Select one from "Majority", "AND" and "OR".
- **Majority**
  Judge that the criteria is met when the percentage of white pixel area after binarization is higher than the set value.
- **AND**
  Judge that the criteria is met when all pixels in the area are judged white after binarization,
- **OR**
  Judge that the criteria is met when one or more pixels in the area are judged white after binarization,

B. [Majority] data input box
Enter the percentage of Majority within 0 and 100% with the number keypad.

C. [Threshold] button
Touch the [Setting] button and the Threshold value SET screen will appear.



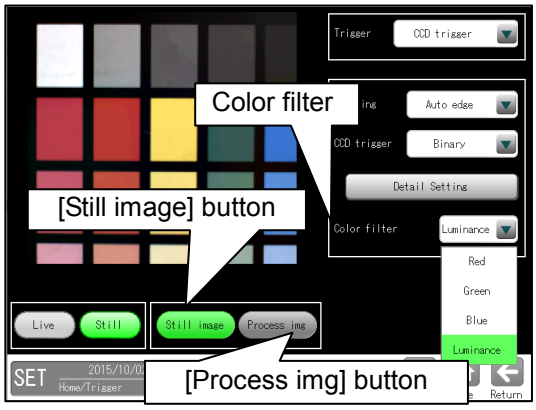
a. [B/W flip] drop down list
Select "Disable" or "Enable"
Enable:
The device will invert the black and white binary converted images.

b. [Threshold] data input boxes
Set the upper and lower limits for the threshold values.
(Setting range: 0 to 255)

D. Set the area for the CCD trigger.
See page 3-6 for the area setting procedure of this area.

4. **[Color filter] drop down list (When a color camera is used)**

When a color camera (IV-S300C3/C8, IV-C250C3/C8) is used, select one from "Red", "Green", "Blue" and "Light".



See page 4-68 for the setting details.

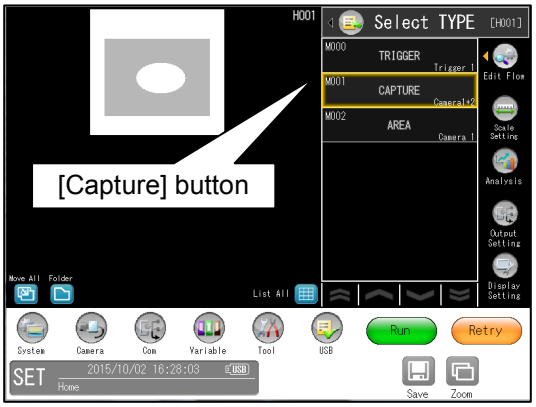
* Touch the [Process img] button, and the image processed by each setting will be displayed.

  Touch the [Still image] button to return to the camera image display.

4-4-3 Capture module

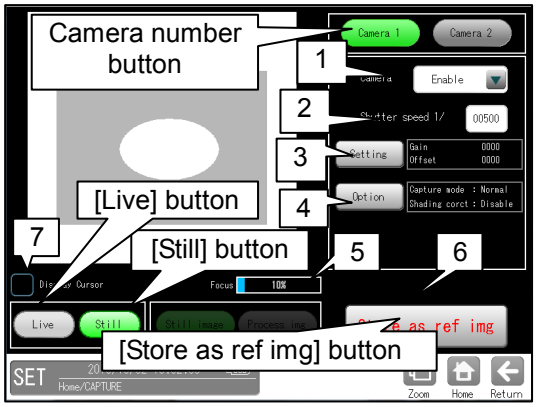
Set the following items (conditions for capturing image by a trigger signal) for this module:

① On the (Home) SET screen, touch the [CAPTURE] button.

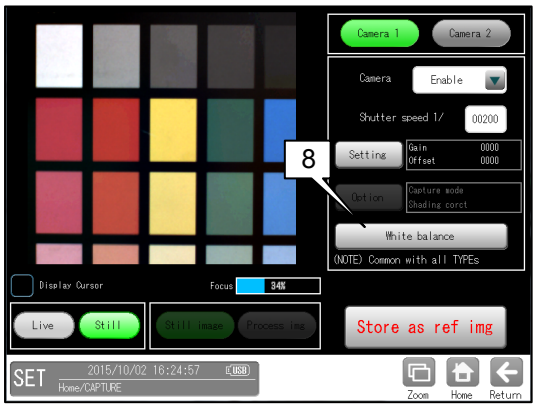


② The Capture setting screen will appear.

[When a monochrome camera is used]



[When a color camera is used]
(1 Trigger mode)



Touch a [Camera number] button and set the following:
Camera number:
(IV-S300J/IV-S300M: 1- 2, IV-S310M: 1- 4)
Note: In 2 trigger mode, the camera number is determined by the object type.

1. **[Execute] drop down list**
Select "Enable" or "Disable" for the capture module processing from the [Execute] drop down list.

2. **[Shutter speed] data input box**
Shutter speed. => [1]

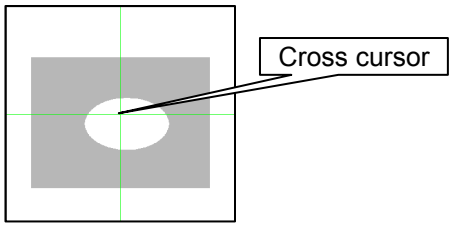
3. **[Setting] button**
Touch the [Setting] button and a screen to set the gain and other items will appear.
=> [2]

4. **[Option] button**
When a monochrome camera is used
(IV-S300C2/C5/C6/C7/CA/CD, IV-S200C6/S210C2)
Touch the [Option] button, and a screen will appear for setting the capture mode (Normal/Average/HDR) etc. => [3]

5. **[Focus] bar graph**
Displays the focus in %.
The higher value indicates better focus.
The focus is just for reference information.
Store the image by checking the actual image displayed on the screen.

6. **[Store as reference image] button**
Touch this button to store the image displayed as a reference image:
When an image is displayed on the screen, touch the [Live] button and then the [Still] button. Then, touch the [Store as ref img] button to store the image as a reference image.

7. **[Display Cursor] check box**
Check this box to display a cross cursor on the center of the screen that helps in positioning an image on the screen.



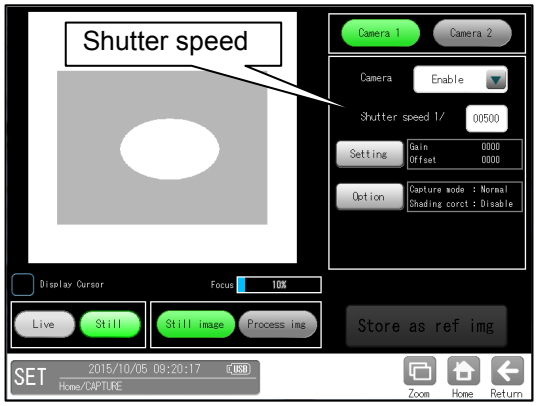
8. **[White balance] button**
when a color camera is used
(IV-S300C3/C8, IV-C250C3/C8)
Touch the [White balance] button and a screen will appear for setting the white balance.
=> [4]

[1] [Shutter speed] data input box

Enter the speed for each camera (1 and 2) within the following range:

IV-S200C6: 1/1-- 1/20000 (sec)
IV-S210C2: 1/2 - 1/14000 (sec)
IV-C250C3: 1/2 - 1/14000 (sec)
IV-C250C8: 1/1 - 1/20000 (sec)
IV-S300C2: 1/70 - 1/50000 (sec)
IV-S300C3: 1/70 - 1/50000 (sec)
IV-S300C5: 1/5 -1/100000 (sec)
IV-S300C6: 1/120 -1/10000 (sec)
IV-S300C7: 1/500 - 1/50000 (sec)
IV-S300C8: 1/500 - 1/50000 (sec)
IV-S300CA: 1/250 - 1/10000 (sec)
IV-S300CD: 1/80 - 1/10000 (sec)

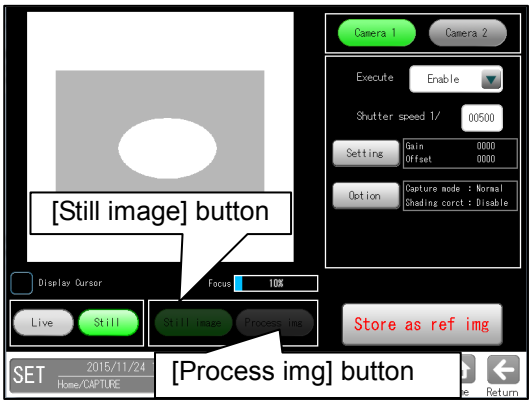
(The screen shown below is an example when a monochrome camera is used)



- **Shutter speed**
  A shutter on a camera is a mechanism to open and close like a human's eye lid and adjusts the image exposure time to a CCD. The time that the shutter remains open is referred to as shutter speed.
  In general, in case the shutter speed is slow, image is exposed on the CCD for longer time, therefore if an object moves, the image will be blurred. On the contrary, if the shutter speed is fast, image is exposed on the CCD for shorter time; therefore the captured image may become darker. In this case, brighter lighting is required on the object. The image brightness is also influenced by lens iris.

・ Touch the [Process img] button and the image processed by the settings will be displayed. Touch the [Still image] button to return to the camera image display.

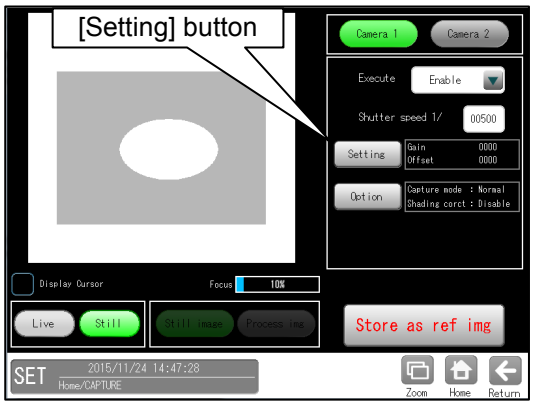
(The screen shown below is an example when a monochrome camera is used)

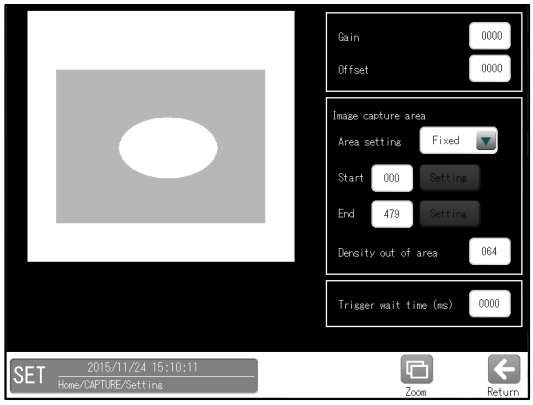


[2] Setting gain and offset, etc.

Touch the [Setting] button on the capture setting screen and a screen will appear to let you set the gain, offset, etc.

(The screen shown below is an example when a monochrome camera, IV-S200C6, is used)

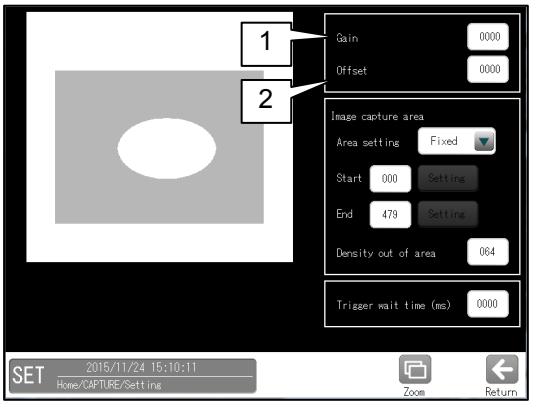




- Gain => (1)
- Image capture area => (2)
- Intensity out of area => (3)
- Trigger wait time (ms) => (4)

(1) [Gain] data input boxes

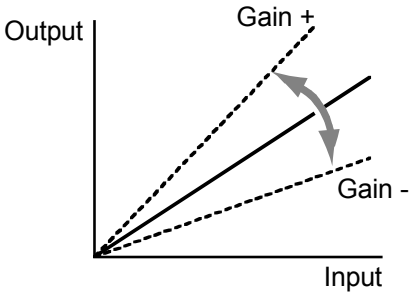
When the whole image is darker or brighter than you want, you can adjust the image quality by changing the gain value.



Touch the "Gain" data input box and enter the desired value.

1. Gain

The device will modify the image input level by using the gain setting to achieve a specific magnification rate.



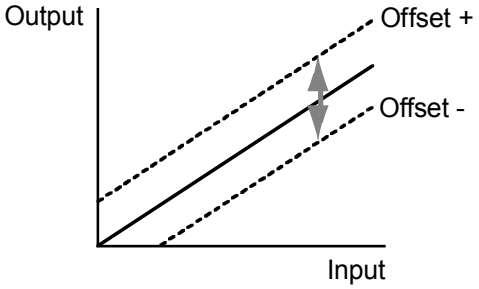
If you enter a larger value for the gain, the gradation differences in the image will be larger and the image will become more vivid. If you enter a smaller value for the gain, the gradation differences in the image will be reduced and the image will become less intense.

[Gain setting range]

IV-S200C6:	-192 to 831
IV-S210C2:	-494 to 529
IV-C250C3/C8:	-534 to 489
IV-S300C5:	0 to 125
IV-S300C2/C3/C7/C8 :	0～120
IV-S300C6 :	0～98
IV-S300CA/CD :	0～124

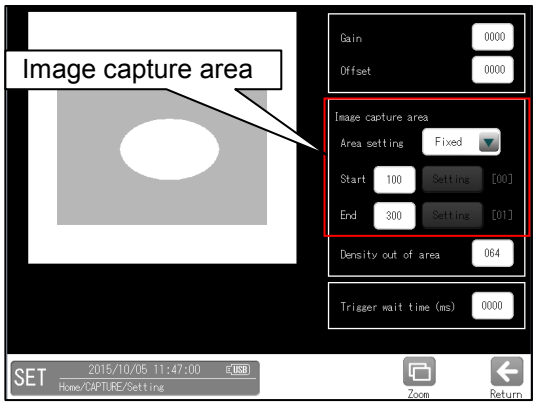
2. Offset

Note:
The offset cannot be set with IV-S300C2/C3/C6/C7/C8/CA/CD.
Touch the "Offset" data input box and enter the desired value.
By setting an offset value, the whole image input level is shifted higher or lower and the whole image will become brighter or darker.



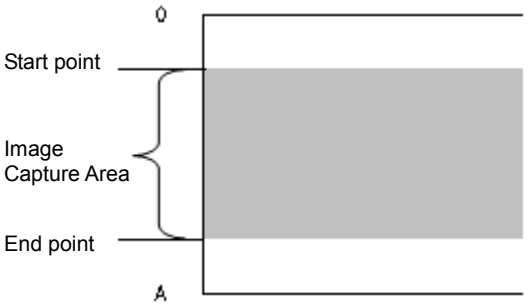
[Offset setting range]
IV-S200C6, IV-S210C2, IV-C250C3 and IV-C250C8: -32 to 991
IV-S300C5: 0 to 125

(2) [Image capture area] data input boxes



Set the image capture area (start and end points) for the camera.

This setting is used to avoid capturing unnecessary portions at the top (0 to start point) and bottom (end point to A) of an image and make the capturing time of the image faster.



Note:
The image capture area cannot be set with IV-S300C6/CA/CD.

・ Setting of Image capture area:
Select “Fixed” or “Variable” from the Area setting drop down list.

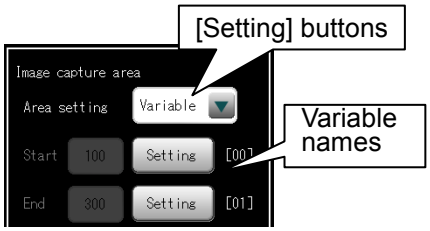
Fixed: Set the area with “Start” and “End” data input box.

Camera	A
IV-S200C6	479
IV-S210C2	1199
IV-C250C3	1199
IV-C250C8	479
IV-S300C2	1079
IV-S300C3	1079
IV-S300C5	2559
IV-S300C7	479
IV-S300C8	479

※

※ The image capture area can be narrowed by making the shutter speed faster with IV-S300C7/C8.

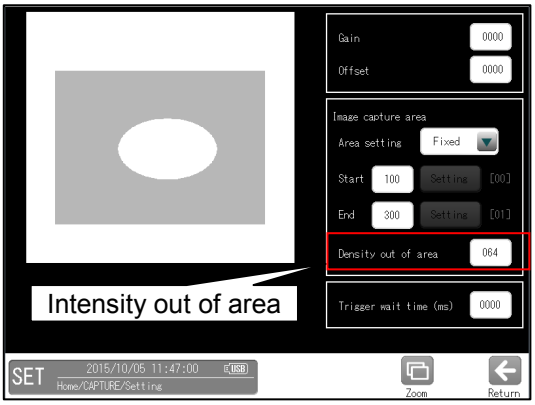
Variable: Select variables from the list.
([00]SV00 to [31]SV31)
The start and end values are set by the variables.
See page 4-260 for the details of the variable.



Touch the Setting button of each “Start” and “End” and a window of variable list appears.
Select a variable and touch “Enter” icon.
The selected variables are shown on the right of Setting buttons as shown above.

Note:
When the variable has a number to the right of the decimal point, it is rounded.

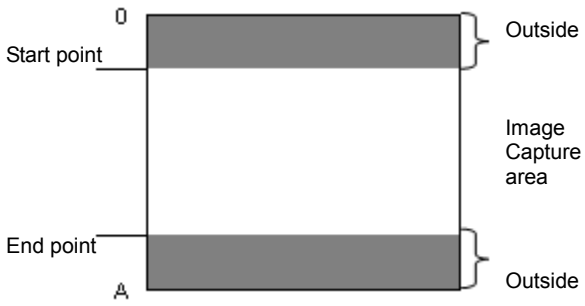
(3) [Intensity out of area] data input box



This function will convert the area outside the image capture area to the image intensity set here, white or black.

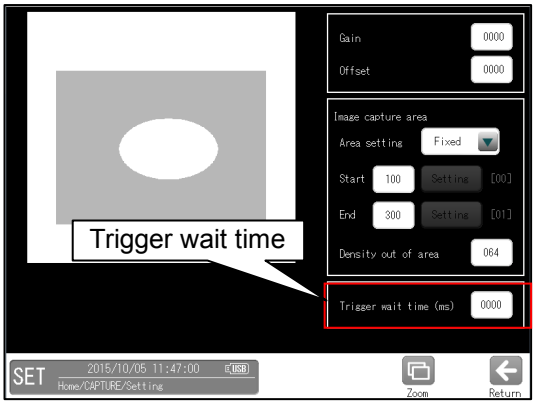
This setting is helpful in identifying the captured image area and outside of the image capture area easily.

See (2) "Image capture area" on the previous page for the image capture area.
(Setting range: 0 to 255)

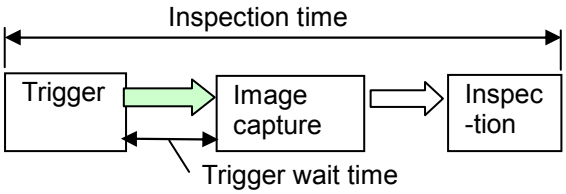


Note:
The intensity out of area cannot be set with IV-S300C6/CA/CD.

(4) [Trigger wait time] data input box



A trigger wait time, from receiving a trigger input to actually capturing image, can be set.
(Setting range: 0 to 9999ms)

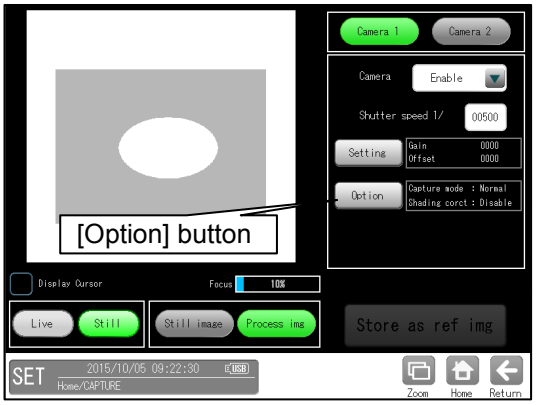


- RDY (ready) signal is off from the trigger input to the inspection finish.
- The trigger wait time can be set independently for each camera.
  Set the wait time for each camera 1 and camera 2, as necessary.
- Trigger wait time cannot be set when 2 Trigger mode is selected

[3] High function capture (Only when a monochrome camera is used)

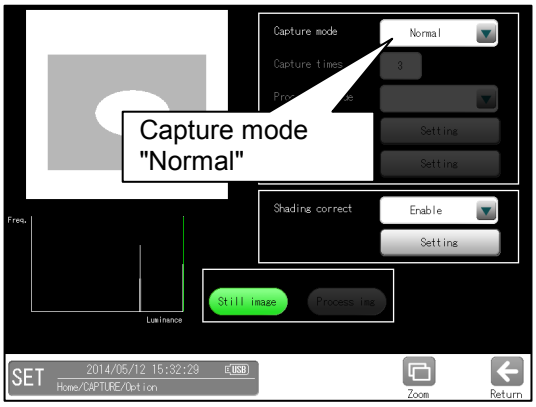
When a monochrome camera, (IV-S300C2/C5/C6/C7/CA/CD, IV-S200C6/S210C2) is used, a few high functions can be set.

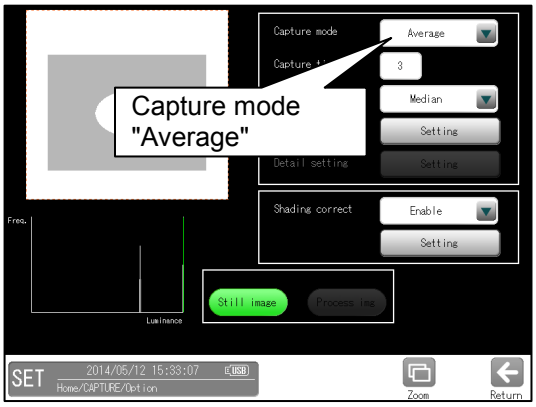
Touch the [Option] button on the Capture setting screen.

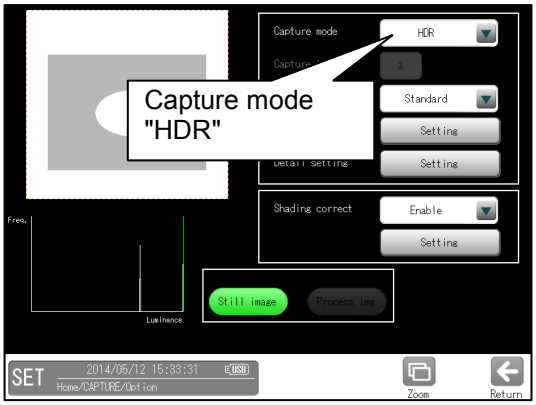


One of the screens shown below will appear:
Select one from "Normal", "Average" and "HDR" options for the "Capture mode".

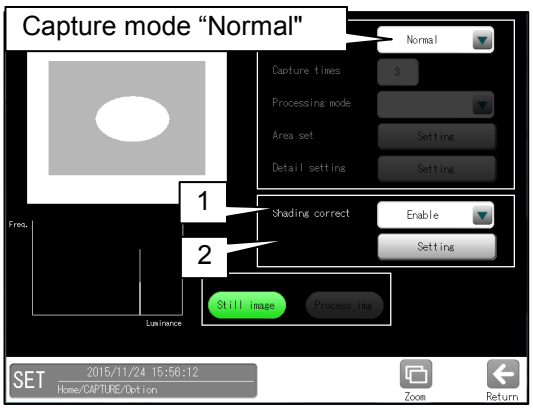
(The screen shown below is an example when a monochrome camera is used)







(1) When "Normal" is selected



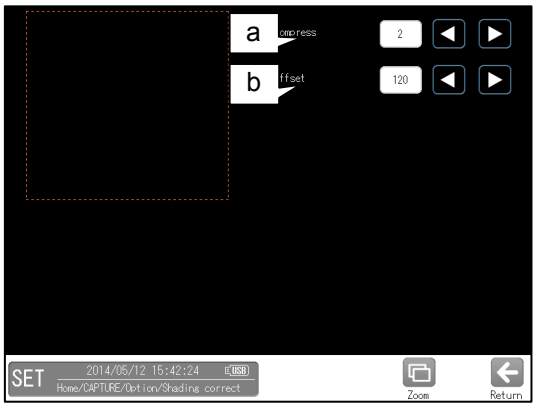
1. [Shading correct] drop down list

Select "Disable" or "Enable" for shading correction.

When “Enabled” is selected the Setting button will be enabled.

2. [Setting] button

Touch the button and the shading correction setting screen will appear.



a. [Compress] data input box

Enter the compression level (0 to 3).

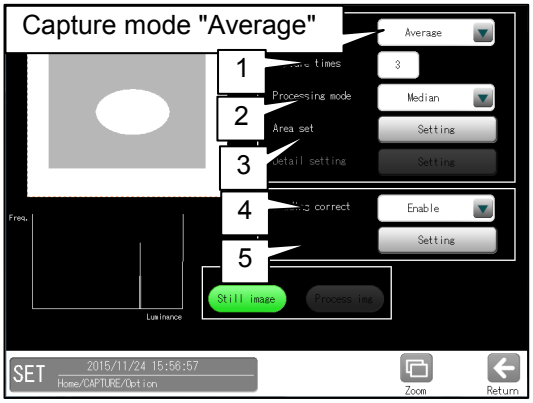
The higher the level, the higher the shading correction process is.

b. [Offset] input data button

Enter the Offset level (0 to 255).

The higher the level, the higher the brightness of the shading corrected image.

(2) When "Average" is selected



1. [Capture times] data input box

Specify the number of capturing (2 to 5).

2. [Processing mode] drop down list

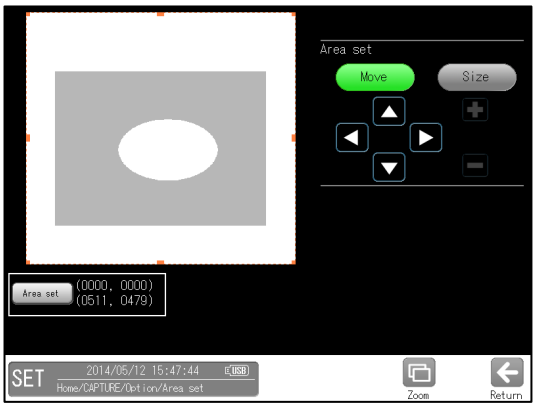
Select the image processing mode for the pixels at the same position in multiple captured images.

"Median" or "Average"

- **Median:**
  Uses the intermediate intensity value.
- **Average:**
  Uses the average intensity value.

3. Process area

Touch the [Area set] setting button and the Process area setting screen will appear.

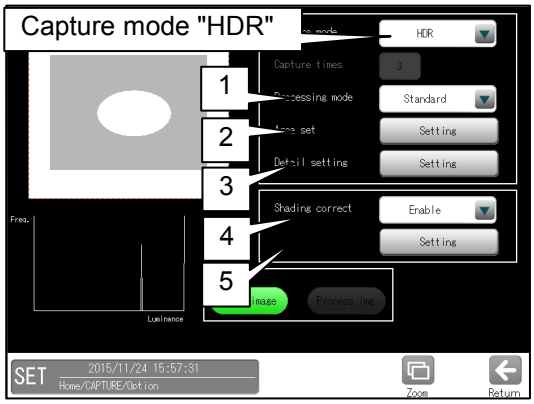


See page 3-6 for setting the process area.

4. [Shading correct] drop down list and
5. [Setting] button

See 1. and 2. under (1) When "Normal" is selected on the left of this page.

(3) When "HDR" is selected



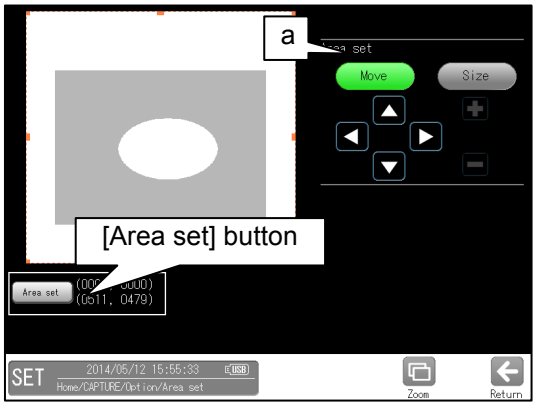
1. [Processing mode] drop down list

Select the processing mode for multiple captured images.
"Standard", "Remove black" or "Remove white"

- **Standard:** Emphasizes both the brighter and darker areas of the image.
- **Remove black:** Emphasizes the darker areas of the image.
- **Remove white:** Emphasizes the brighter areas of the image.

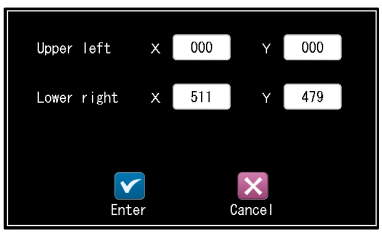
2. [Area set] button

Touch the [Setting] button and the Process area setting screen will appear.



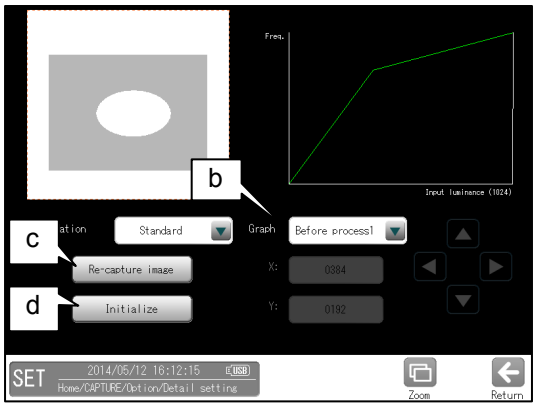
a. Process area buttons

Set the areas for applying the HDR (High Dynamic Range) process.
See page 3-6 for setting the process area.
Touch the [Area set] button and the window shown below will appear.
Enter upper left and lower right coordinates (X, Y) for the rectangle.



3. Detail setting

Touch the [Detail setting] setting button and the Detail setting screen will appear.

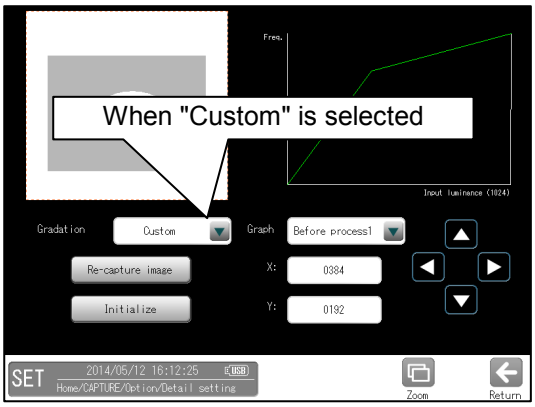


a. [Gradation] drop down list

This function is relating to converting HDR image (merged image of multiple captured images) with 1024 gradations into 256 gradations.
The gradation conversion rate of a toning curve can be changed with this setting.

Select one from "Standard" and "Custom".

- **Standard:** The default setting will be used for the toning.
- **Custom:** Specifies the gradation conversion rate change point on the toning curve.
  The horizontal axis is the input image with 1024 gradations and the vertical axis is the processed image with 256 gradations.
  When "Before process1" or "Before process2" is selected for the b. "Graph", the toning curve will be displayed as a green line in the graph.
  Enter the "conversion rate change point" with the X and Y data input boxes and number keypad or [Direction] buttons.



b. [Graph] drop down list
Select one from "Before process1", "Before process2" and "After process", and the following graph will be displayed.

- **Before process1:**
  Gradation histogram.
  X: Input brightness (1024 gradations)
  Y: Number of pixels at each gradation level of the image before HDR processing.
- **Before process2:**
  Cumulative frequency curve
  X: Input brightness (1024 gradations)
  Y: Cumulative frequency of at each gradation level of the image before HDR processing.
- **After process:**
  HDR processed image
  X: Input brightness (1024 gradations)
  Y: Output brightness (256 gradations) of the HDR processed image

c. [Re-capture image] button
Touch this button to re-capture the image.

d. [Initialize] button
Touch this button to initialize X and Y coordinates..

4. [Uneven Corct (Unevenness correction)] drop down list and

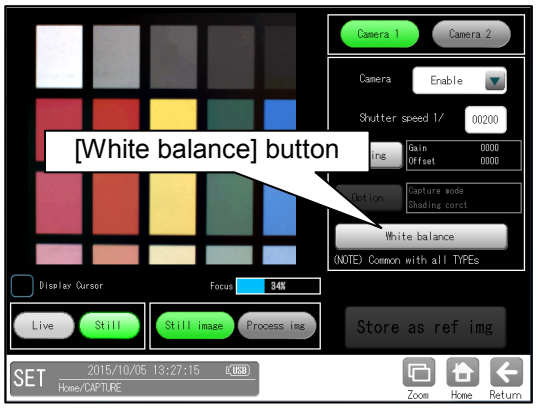
5. [Setting] button
See 1. and 2. under (1) “When "Normal" is selected” on page 4-47.

[4] White balance
(When a color camera is used)

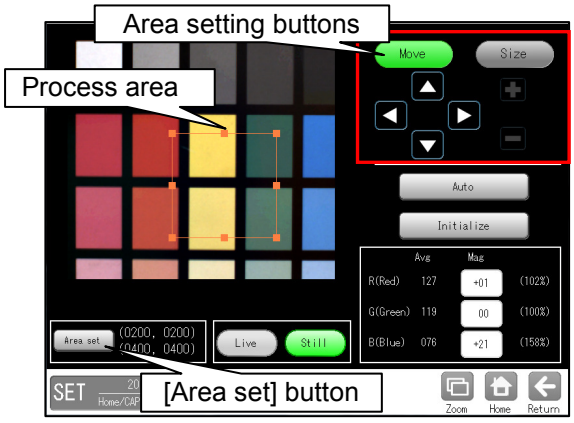
When a color camera, IV-S300C3/C8、IV-C250C3/C8, is used, set the white balance on the capture module.
The white balance is a function to make white color as white regardless of different light source conditions. When you use a color camera for the first time, or you changed camera or lighting, set the white balance.

① Put a white workpiece that is the reference for the white balance adjustment in front of the color camera and adjust the focus and iris to obtain good image.

② Touch the [White balance] button.



③ The White balance setting screen will appear.

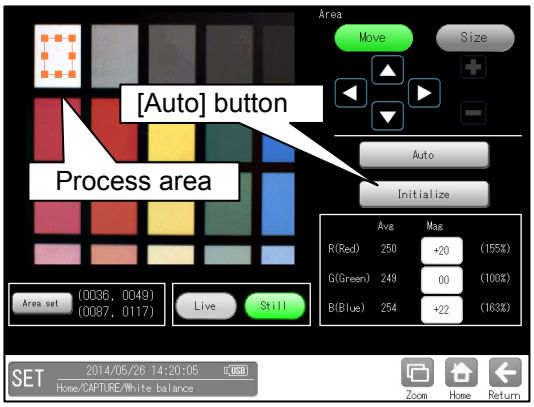


Move the Process area (orange square) on the white square at top left of the color table (as shown in the picture under ④) with the [Move], [Size], [Direction], [+] and [-] buttons. See page 3-6 for moving the Process area.

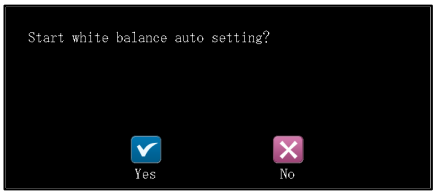
[Note]
The Process area cannot be set when a live image is displayed.

■ To set white balance automatically

④ Touch the [Auto] button.



⑤ The White balance auto setting confirmation window will appear.
Touch the ☑ [Yes] icon and the device starts the white balance auto setting.

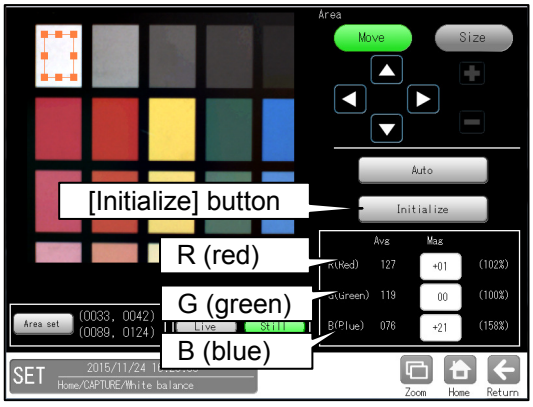


[Important]
White balance setting change affects on the already set parameters relating to color camera.
When you have already set the parameters, be sure to check and set the parameters after white balance adjustment.

■ To set white balance manually

Manual setting of white balance is done by setting magnification level of each red (R), green (G), and blue (B).

⑥ Enter the magnification levels with the data input boxes and number keypad of R (red), G (green), and B (blue).



Note:
G (green) cannot be set for IV-S300C3/C8.

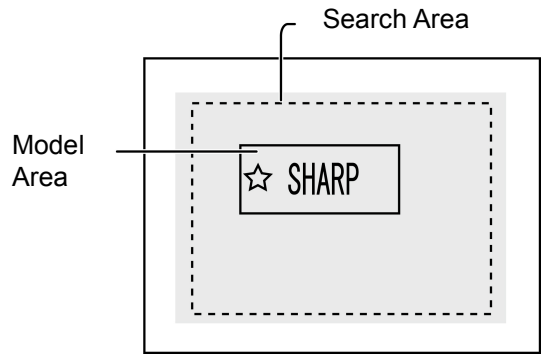
■ To initialize to the factory default

Touch the [Initialize] button.

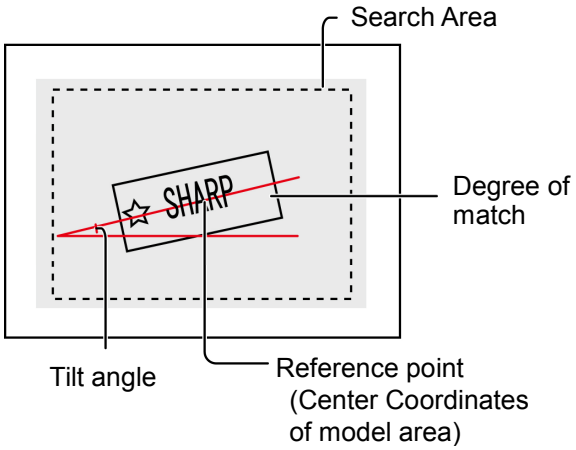
4-4-4 SF (Smart Frame) Search III module

The SF search module is an image processing module and searches an image in the search area that is close to the pre-registered model image.

- **When registering a model image**



- **When executing SF search**

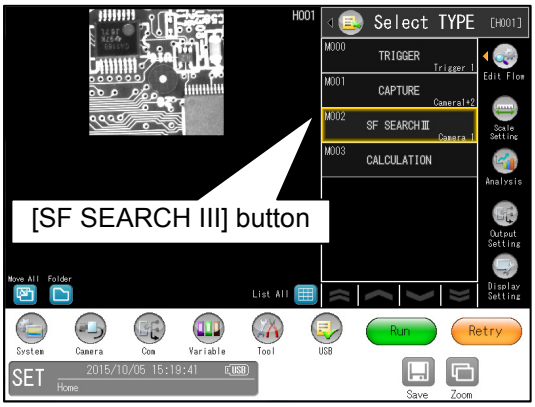


■ **Output details**

The following inspection results are output.

- **Number of detection**
  The number of searched images close to the model image.
- **Coordinates XY**
  The center coordinates of the searched image.
- **Angle Θ**
  The tilt angle of the searched image against the model image.
  (Expressed by + degree for CCW rotation or - degrees for CW rotation)
- **Matching**
  The matching degree between the searched image and the model image.
  (Expressed by a number: 0 to +10000).
- **Deviation**
  The deviation in the coordinates between the searched image and the model image.
- **OK/NG judgment**
  The upper and lower limits of each of the above output are set and used as the criteria for "OK" and "NG" judgment.
  OK: All outputs are within the criteria
  NG: One or more are out of the criteria.

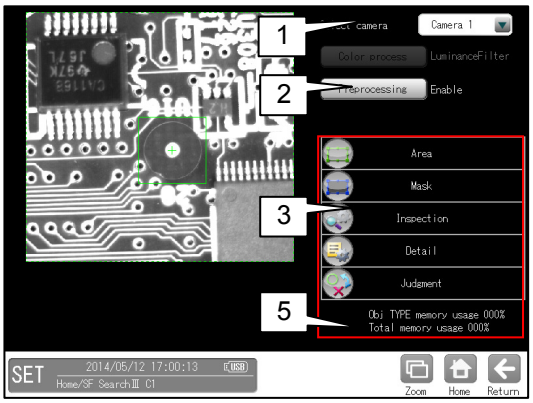
① Touch the [SF SEARCH] button on the (Home) SET screen.



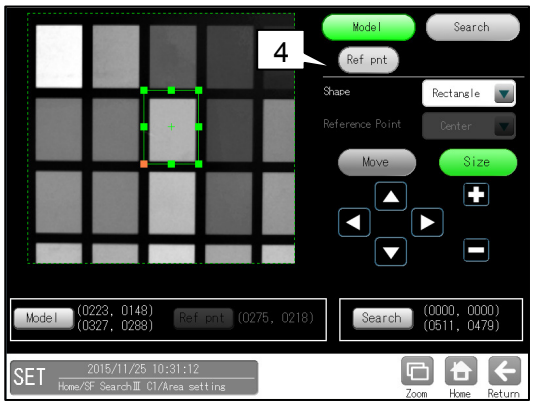
・See page 4-31 for editing the module flow.

② The SF search module setting screen will appear.

[When a monochrome camera is used]



[When a color camera is used]



1. **[Select Camera] drop down list**
   Select a "Camera number to use" when enabled this module:
   "Camera 1" or "Camera 2".
   In 2 Trigger mode, select a camera depending on the Object type number. See page 4-6.
2. **[Preprocessing] button**
   Preprocessing will make the captured image easy for inspection.
   See page 4-56 for the functions and setting procedures.

3. [Setting] icons

- Area => [1]
- Mask => [2]
- Inspection => [3]
- Detail => [4]
- Judgment => [5]

4. [Color process] button

(When a color camera is used)

When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8) See page 4-68 for the function and setting procedures.

5. Search Memory Usage

Object TYPE memory usage and Total memory usage are displayed in %.

[Note]

The memory is used by SF search III, Gray search and Multiple Search modules commonly. The number of model images that can be registered depends on the model size and detection accuracy and is as listed below, (Max. 4000).

- Number of models for the memory

Model Size (pixels)	Maximum Number	
	Standard	Precise
50×50	2786	2786
100×100	1768	1137
200×200	1237	1146
500×500	758	673
800×800	646	583
1000×1000	438	431

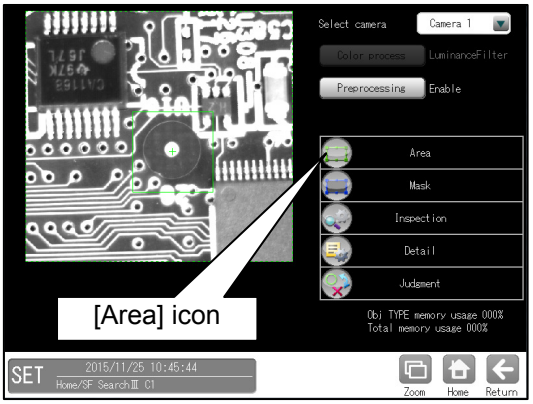
- Number of models for an object type

Model Size (pixels)	Maximum Number	
	Standard	Precise
50×50	126	126
100×100	126	126
200×200	126	126
500×500	126	126
800×800	126	126
1000×1000	126	126

[1] [Area] icon

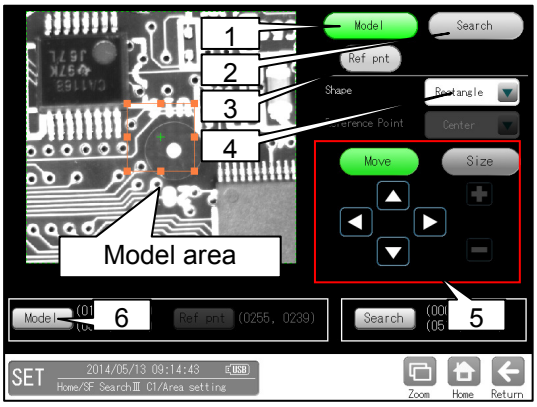
Set each item for the model area and search area.

① Touch the [Area] icon on the SF Search module setting screen.



② The Area setting screen will appear.

[When the Model button is selected]



1. [Model] button

Enables setting of model area.

2. [Search] button

Enables setting of search area.

3. [Ref pnt (Reference point)] button

Enables setting of Reference point.

4. [Shape] drop down list

Select the shape for the model area: "Rectangle", "Circle", "Ellipse", "Polygon" or “Rotate rectangle"

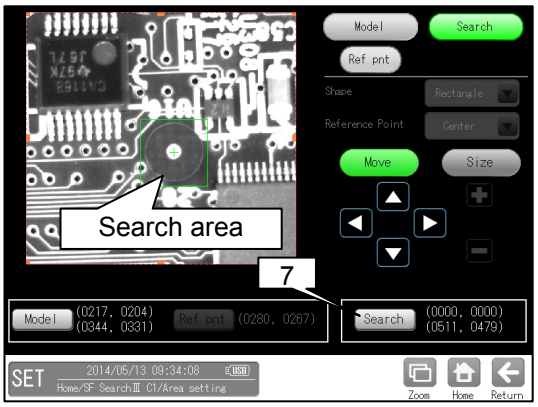
5. Area setting buttons

Set the model and search areas with the [Move], [Size], [Directions] and [+], [-] buttons. See page 3-6 for setting the Model area and the Search area.

6. [Model] coordinate setting button

Enables setting of Model area by coordinates.

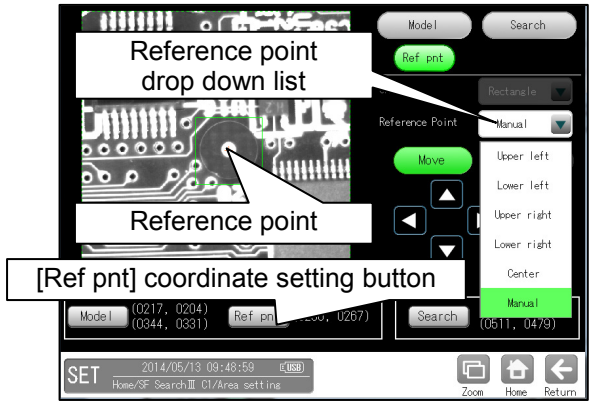
[When the Search button is selected]



7. [Search] coordinate setting button

Enables setting of Search area by coordinates.

[When the Ref pnt button is selected]

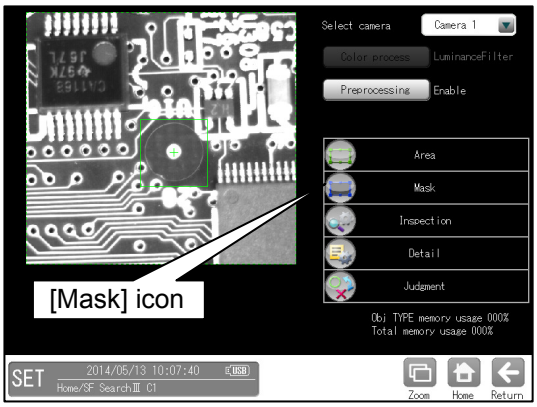


Enables setting of Reference point position. When “Manual” is selected from the Reference point drop down list, set the position by the [Directions] buttons or [Ref pnt] coordinate setting button.

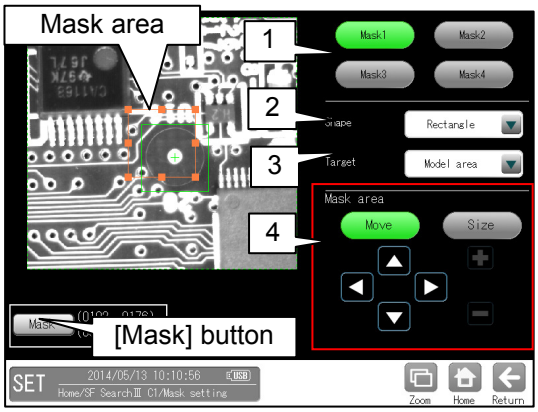
[2] [Mask] icon

When you want to avoid inspecting one or more areas within the search and model areas, you can create up to four mask areas.

① Touch the [Mask] icon on the SF Search III module setting screen.



② The Mask setting screen will appear.

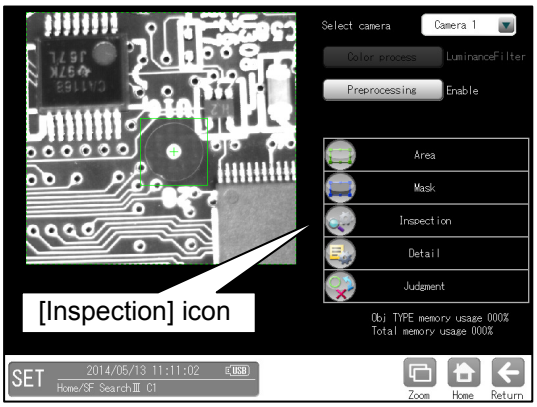


1. **[Mask 1] to [Mask 4] buttons**
   Touch one of the mask buttons: [Mask 1] to [Mask 4].
2. **[Shape] drop down list**
   Select a shape for the mask area: "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon"
3. **[Target] drop down list**
   Select a target to mask: "Model area" or "Inspection area".
4. **[Mask area] buttons**
   Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.
   ・See page 3-6 for setting the Mask areas.

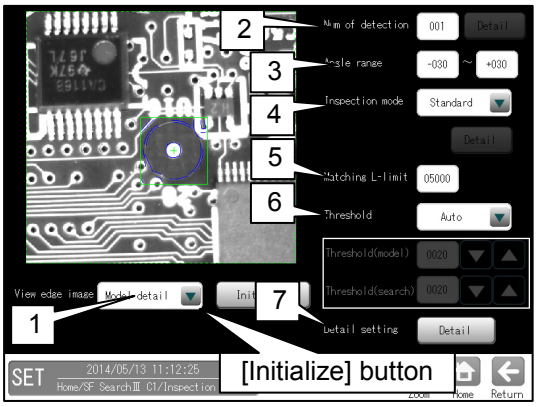
[3] [Inspection] icon

Set the "Number of detection", "Angle range", "Inspection mode", etc.

① Touch the [Inspection] icon on the SF Search module setting screen.

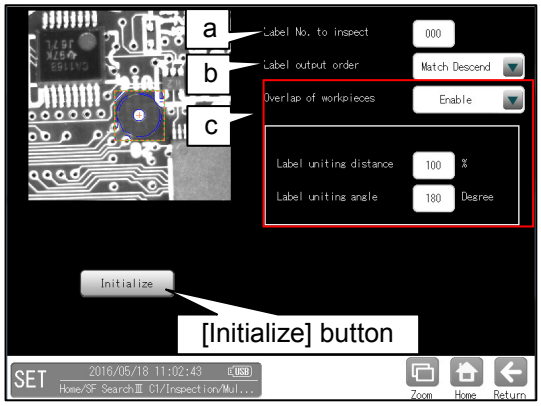


② The Inspection setting screen will appear.



1. **[View edge image] drop down list**
   When the "Processing image" is selected for "Image mode" on the Run screen, select the processing image for the SF Search: "Model", "Search", "Disable", "Coarse model", or "Coarse search"
2. **[Number of detection] data input box**
   Enter the number of images to search in the search area (target: 1 to 128).
   When a number 2 or higher is entered here, touch the [Detail] button on the right side.

The setting screen will appear.



a. [Labels No. to inspect] data input box
Enter the number of label for deviation inspection. The device outputs the deviation between the positions of reference and captured images with the entered label number.

b. [Labeling order] drop down list
Select the labeling order for the searched images.
Order:
"Y ->X", "X ->Y", "Match Ascend (Degree of match in ascending order)", "Match Descend (Degree of match in descending order)", "X Ascend", "X Descend", "Y Ascend", "Y Descend", "Angle Ascend", or "Angle Descend".

c. [Overlap of workpieces] drop down list
Select the overlap condition between workpieces: "Enable" or "Disable".
Enable: The device will output more than one search results for overlapped searched images. In order to produce only one search result, specify the distance and angle to consolidate the multiple search results into one.

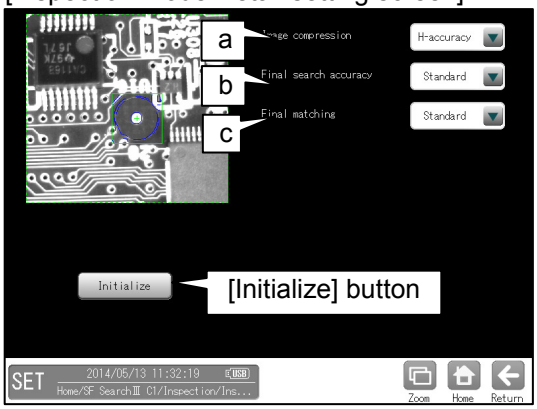
- **[Label uniting distance] (Distance for consolidating labels) data input box**
  Enter the distance (0 to 200%).
- **[Label uniting angle] (Angle for consolidating labels) data input box**
  Enter the angle (10 to 180˚).

3. [Angle range] data input box
By making the tilt angle of the pre-registered model image as 0˚, specify the angle range (-180 to +180˚) to use when searching a model image.
(CCW angles are positive numbers)
[Note]
Do not set the angle range wider than required. The narrower the angle range, the faster the detection speed will be.

4. [Inspection mode] drop down list
Select the accuracy to use for searching.
The accuracy is specified as a speed.
"SH (Super high) speed", "H (High) speed", "Standard", "H (High) accuracy", or "Detail set*".

* When the "Detail set" is selected, touch the [Detail] button below the drop down list and set each item on the Detail setting screen.

[Inspection mode Detail setting screen]



Select each item from the drop down lists.

a. [Image compression] drop down list
Select one of the following to set the searching speed of the SF Search.
"SH (Super high) speed", "H (High) speed", "Standard", or "H (High) accuracy".
Searching capability is affected by the set speed because searching a position is made on compressed image.

- **Super high speed**: The searching speed becomes faster, however, the searching capability becomes lower.
- **High accuracy**: The searching capability becomes higher, however, the searching speed becomes slower.

b. [Final search accuracy] drop down list
(Narrowing down candidates in the final search)
Set this when the device cannot detect a workpiece in the final search.
Select one of the following for narrowing priority: "High speed", "Standard", or "High accuracy".

- **High speed**: Fewer candidates are searched in the final search and the processing speed becomes faster, however, the search capability becomes lower.
- **High accuracy**: More candidates are searched in the final search and the search capability becomes higher, however, the processing speed becomes slower.

c. [Final matching] drop down list
Select the final position inspection method.
"Speed up", "Standard", "Accuracy" or "Disable".

- **Speed up**: The processing speed becomes faster, however, the position inspection accuracy becomes slower.
- **Accuracy**: The position inspection accuracy becomes higher, however, the processing speed becomes slower.

5. [Matching L-limit] data input box

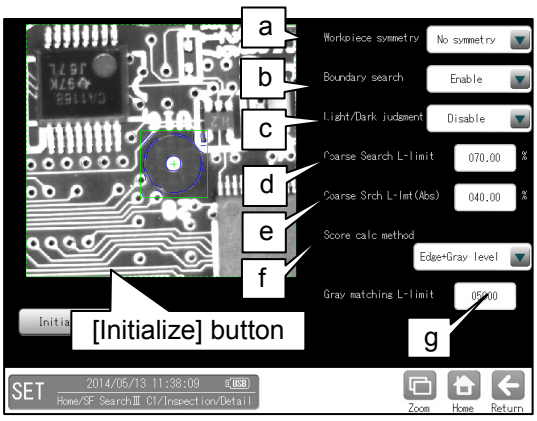
Enter the lower limit for inspecting the degree of matching (0 to 10000).

6. [Threshold] drop down list

Select either "Manual" or "Auto".
When the "Manual" is selected, enter the "Model threshold value" and "Search threshold value" from their data input boxes (0 to 100).

7. [Detail setting] button

Touch the [Detail] button and the Search detail setting screen will appear.



a. [Workpiece symmetry] drop down list

When the workpieces to inspect have symmetry at a unit of 180°or 90°, select one:
"No symmetry", "180 deg symmetry" or "90 deg symmetry".
When 180°or 90° symmetry is set, the processing speed becomes higher.
(Example: A plus sign (+) has 90° symmetry)

b. [Boundary search] drop down list

Select whether or not to look for a workpiece outside the search area.

- **Enable:** Search a workpiece that is at partially or outside of the search area boundary.
- **Disable:** Do not search workpieces that are on or outside of the search area boundary.

c. [Light/Dark judgment] drop down list

Select either “Disable” or “Enable” the judgment.

d. [Coarse search L-limit] data input box

When the device cannot detect a workpiece, or cannot detect a workpiece after changing the Coarse search L-limit (absolute value), enter the lower limit value for the coarse search setting: 0 to 100%.

e. [Coarse search L-limit (absolute)] data input box

Enter the lower limit (absolute value) for the coarse search: 0 to 100%. When the device cannot detect a workpiece by the coarse search, lower this value below the matching degree by coarse search displayed on the screen.

f. [Score calculation method] drop down list

Select either
"Number of edges" or "Edge+Gray level".

- When the device mistakenly identifies an object with a different color as a workpiece, due to a similar shape, select "Edge+Gray level".

g. [Gray matching L-limit] data input box

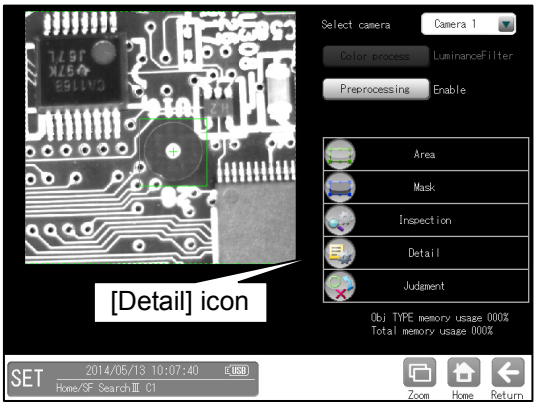
When "Edge + Gray level" is selected in the above, set the lower limit for gray processing between 0 and 10000.

- When the device mistakenly identifies an object with a different color but with a similar shape as a workpiece, increase this value.
- When the device does not detect a workpiece due to low gray level matching, decrease this value.

[4] [Detail] icon

Set the coordinate output of SF Search.

① Touch the [Detail] icon on the SF Search module setting screen.



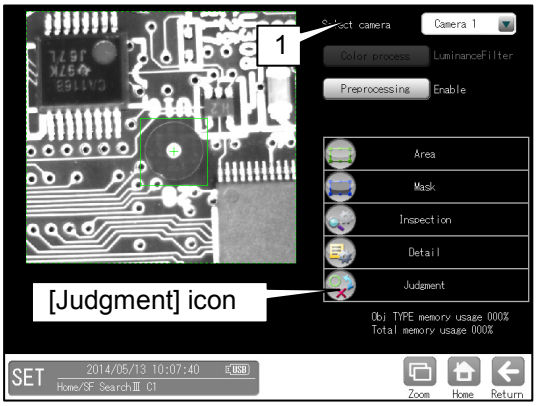
Select either “Original” or “Tilt corrected”.

- **Original:** Outputs coordinates of the camera captured image
- **Tilt Corrected:** Outputs coordinates of the camera captured image after tilt correction.

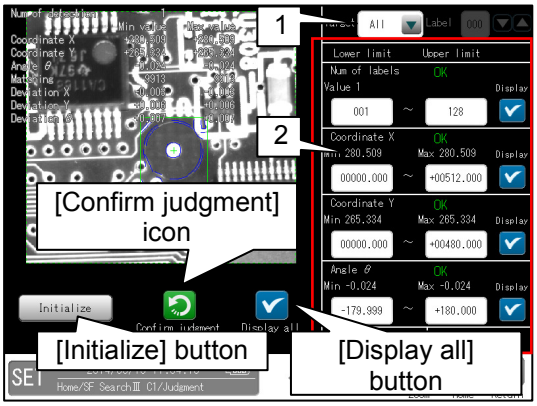
[5] [Judgment] icon

Set the upper and lower limits for OK/NG judgments based on the results of SF Search.

① Touch the [Judgment] icon on the screen.



② The Judgment setting screen will appear.



1. [Label to judge] drop down list

Select either "All" or "Specify".
When "Specify" is selected, enter the label number to use (0 to 127) with the [Label number] data input box and number keypad.

2. Inspection items, lower and upper limits, and judgment data input boxes

Enter the judgment criteria (upper and lower limits) for each inspection item.

[Inspection items]

"Number of labels (0 to 127) ", "Coordinate X", "Coordinate Y", "Angle θ", "Matching", "Deviation X", "Deviation Y", and "Deviation θ".

- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting. It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

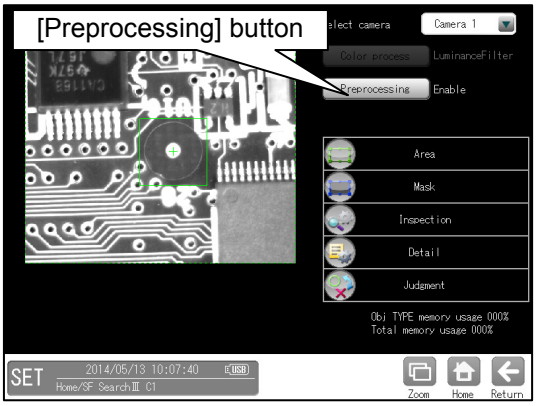
[6] [Preprocessing] button

On the device, the following two preprocessing are available:

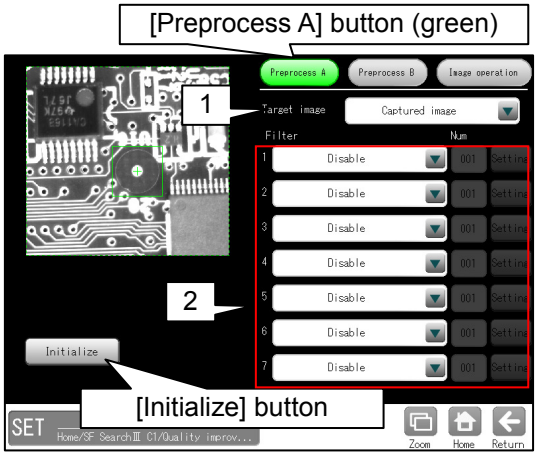
- **Simple preprocessing**
  A simple preprocessing uses the Captured image, Reference image or output Image (1 to 4) that has been set by the Filter module in upstream of the flow. => (1)
- **Image operation**
  Image operation uses two out of the following four images in the image operation (such as subtraction or calculate the difference of absolute values, etc.):
  "Captured image (without preprocessed)", "Reference image (without preprocessed)", "Preprocess A image", "Preprocess B image", or output Image (1 to 4) that has been set by the Filter module in upstream of the flow. => (2)

(1) Setting procedures for simple preprocessing

① Touch the [Preprocessing] button on the screen.

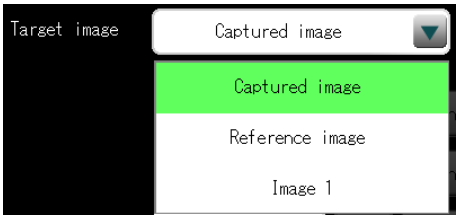


② The preprocess setting screen will appear.
Touch the [Preprocess A] button.



Select and enter each item from the drop down lists, data input boxes and number keypad.

1. **[Target image] drop down list**
Select an image to do preprocess.
"Captured image", "Reference image" or output Image (1 to 4).



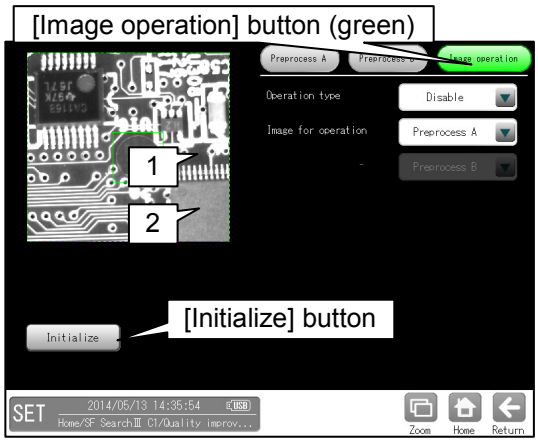
- Output Image (1 to 4) are not displayed if they have not been set by the Filter module in upstream of the flow.
- In 2 Trigger mode, the output images (1 to 4) have restrictions as follows depending on the Object TYPE:
  Object TYPE 0 to 99 (1 Trigger): 1/2 image
  Object TYPE 100 to 199 (2 Trigger): 3/4 image

2. **[Filter 1] to [Filter 7] drop down lists**
Select a filter from the list.

[Filter types]
"Disable", "Contrast enhance",
"Gamma correction +", "Gamma correction -",
"Change linearity", "Mid-gray emphasis",
"Intensity average", “Shading correction”,
"B/W Flip", “Binarization”, “Block Binarize”,
"Smoothing (average) ", "Smoothing (median)",
"Maximum intensity", "Minimum intensity",
"Edge emphasis", "Horizontal edge extract",
"Vertical edge extract", "Edge extract S",
"Edge extract L", "Edge extract P",
"Edge extract R",
"Defect extract", "Defect extract 2",
"Bottom Hat", “Top Hat”, “Blur”,
“Mirroring (H)” and “Mirroring (V)”.

・For the details of each filter, see page 4-60.

③ Touch the [Image operation] button.

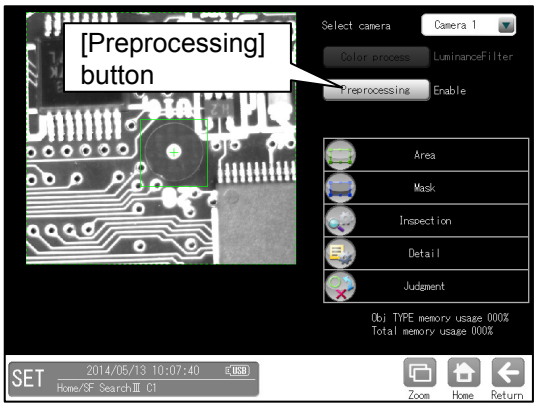


1. **[Operation type] drop down list**
Select "Disable".
2. **[Image for operation] drop down list**
Select "Preprocess A".

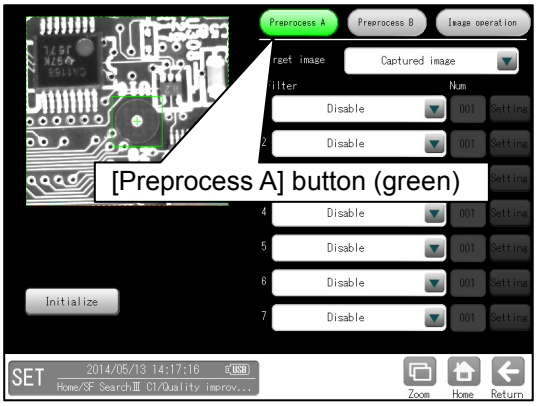
The device will perform preprocessing A on the selected image by the settings done above.
"Captured image (without preprocessed)",
"Reference image (without preprocessed)",
"Preprocess A image", "Preprocess B image",
or output Image (1 to 4) that has been set by the Filter module in upstream of the flow.

(2) Setting procedures for image operation

① Touch the [Preprocessing] button on the screen.

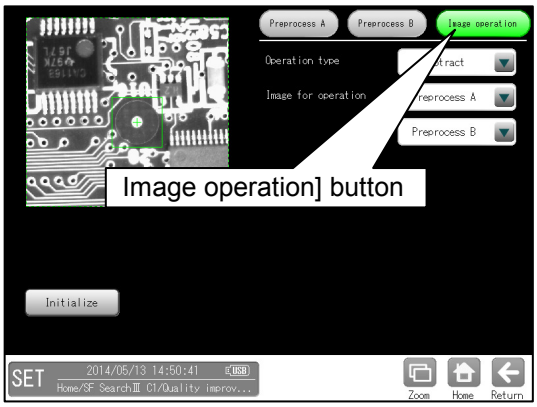


② The preprocess setting screen will appear.

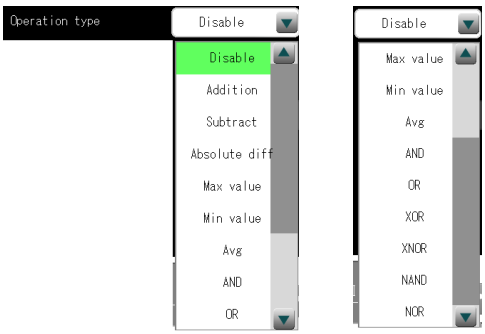


- When using a preprocessed image for the operation, touch the [Preprocess A] button and select the target image for preprocess A and its filter.
- When doing an image operation between the images after a different preprocess, touch the [Preprocess B] button and select the target image for preprocess B and its filter.
  The procedures for setting the "Preprocessing" are the same as those for "Simple preprocessing" in page 4-56.

③ Touch the [Image operation] button.



1. [Operation type] drop down list
Select an operation type (12 types).



[Operation types]
"Disable", "Addition, Subtract", "Absolute difference", "Max value", "Min value", "Avg", "AND", "OR", "XOR", "XNOR", "NAND" or "NOR"

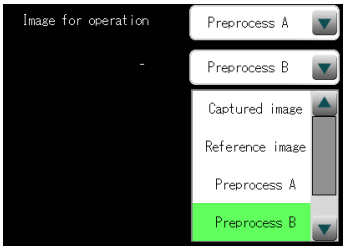
- **Disable**: The device does not do operation between images.
- **Addition**: Adds the intensity at the same coordinates of the selected images. (When the result exceeds 255, the result is rounded off to 255)
- **Subtraction**: Subtracts the intensity at the same coordinates of the selected images. (When the result is less than 0, the result is rounded up to 0)
- **Absolute difference**: Obtains the absolute difference value of the intensity at the same coordinates of the selected images.
- **Max value**: Chooses the higher intensity at the same coordinates of the selected images.
- **Min value**: Chooses the lower intensity at the same coordinates of the selected images.
- **Avg**: Calculates the average intensity at the same coordinates of the selected images.

By using logical operations such as ANDing two images and by making one of the selected image into a binary image (0 or 255), the device can mask an image, for instance.

Note: 8-bit binarized data (0 to 255) of each pixel intensity at the same coordinates of the selected images are used in the following logical operations.

- **AND**: Set AND value of the selected images.
- **OR**: Set OR value of the selected images.
- **XOR**: Set XOR value of the selected images.
- **XNOR**: Set XNOR value of the selected images.
- **NAND**: Set NAND value of the selected images.
- **NOR**: Set NOR value of the selected images
- **XNOR**: Set XNOR value of the selected images

2. [Image for operation] drop down list
Select two images to process from the drop down list.



[Process image type]
"Captured image", “Reference image”, "Preprocess A", "Preprocess B" or output Image (1 to 4) that has been set by the Filter module in upstream of the flow.

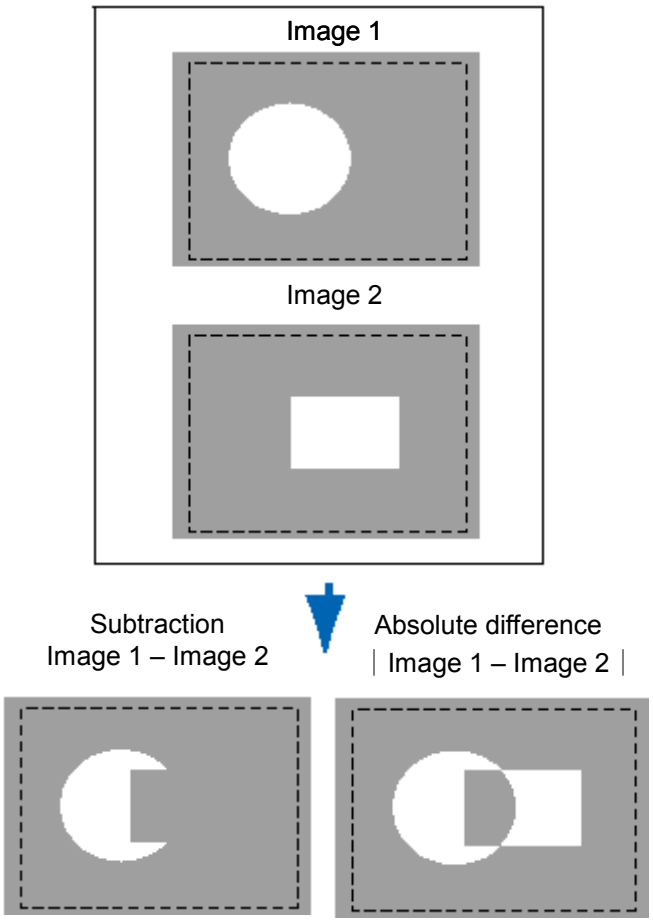
- Output Image (1 to 4) are not displayed if they have not set by the Filter module in upstream of the flow.
- In 2 Trigger mode, the output images (1 to 4) have restrictions as follows depending on the Object TYPE:
  Object TYPE 0 to 99 (1 Trigger): 1/2 image
  Object TYPE 100 to 199 (2 Trigger): 3/4 image

  The device will perform image preprocessing and operations on the selected images by using the settings done above.

● **Principles of image operation**

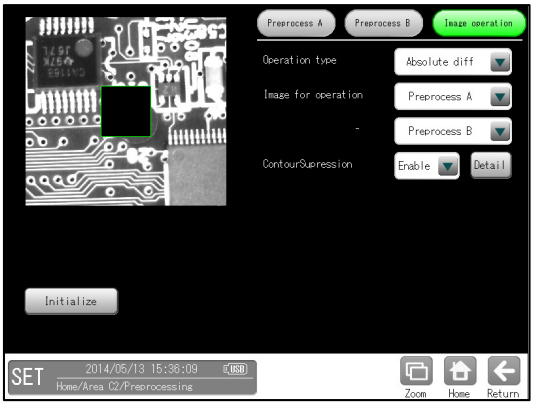
The device does image operation by using each pixel intensity data at the same coordinates of the selected two images and uses the result as the inspection image.
The paragraph below describes a processing example of "Subtraction" and "Absolute difference".

- "**Subtraction**" subtracts corresponding pixel intensity data of the selected two images and use the resulted value as the inspection image. When the calculation result is a negative value, the device forcibly makes all the calculation result to 0.
- "**Absolute difference**" subtracts corresponding pixel intensity data of the selected two images and uses the resulted absolute value as the inspection image.



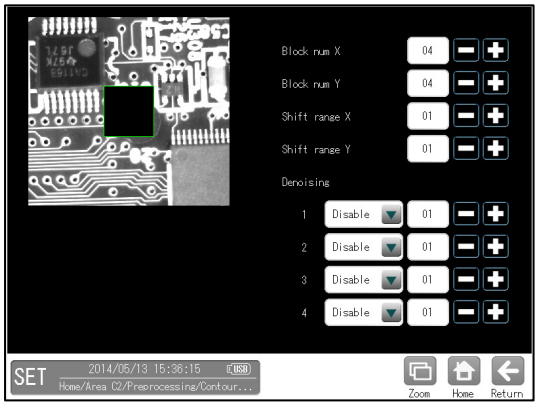
3. Contour Suppression

When the type of image operation is “Subtract” or “Absolute diff”, select either “Disable” or “Enable” for Contour Suppression.



When “Enabled” is selected:

The following screen will appear when the “Detail” button is touched.



Set the “Block number (X)/(Y)”, “Shift range (X)/(Y)”” and “Denoising” by the data input boxes, [Denoising] drop down list and +/- buttons.

(3) Filter processing details

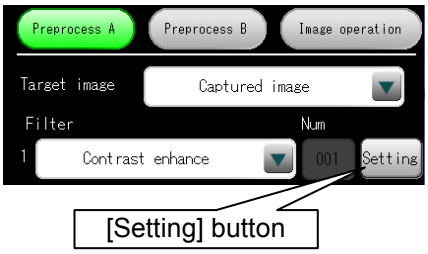
The image processing details for the filters are described below.
=> See page 4-57 for the filter types.

Select one of the following filters from the drop down list.

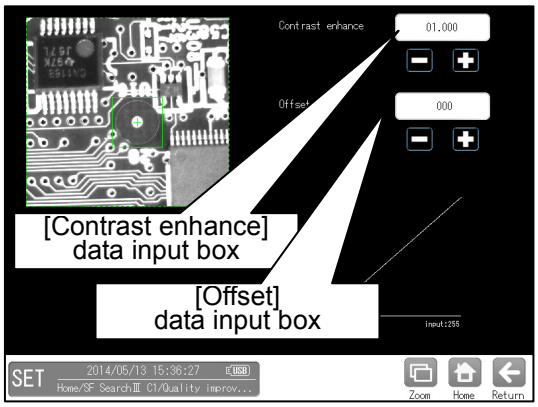
① Disable
Do not filter the images.

② Contrast enhance
Used for images that do not have enough difference between bright and dark areas (the background and the workpiece), such as black letters under poor lighting. Then the contrast between bright and dark portions of the image is increased for easy detection.
(For example, you can make the background lighter while keeping the brightness of the black letters unchanged).

Touch the [Setting] button.

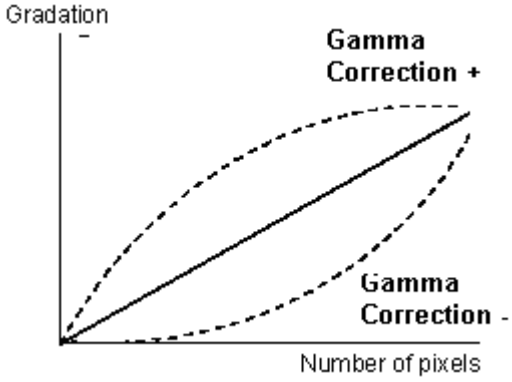


The setting screen will appear.



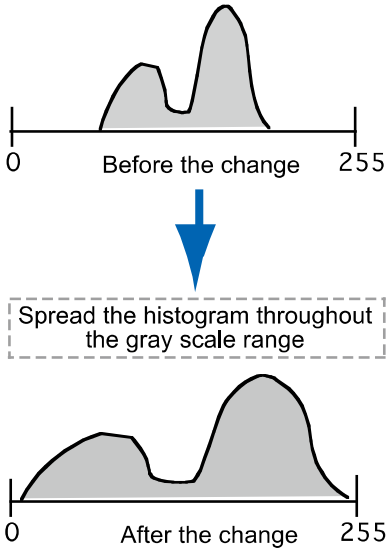
- Enter the contrast enhancement level between 00.000 and 99.999.
- Enter the offset level between -255 and 255.

③ Gamma correction +, Gamma correction -
Leaves the shadows (dark areas) and highlights (bright areas) in the image unchanged and make only the intermediate tones brighter (white emphasis) or darker (black emphasis).

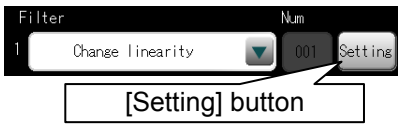


④ Change linearity

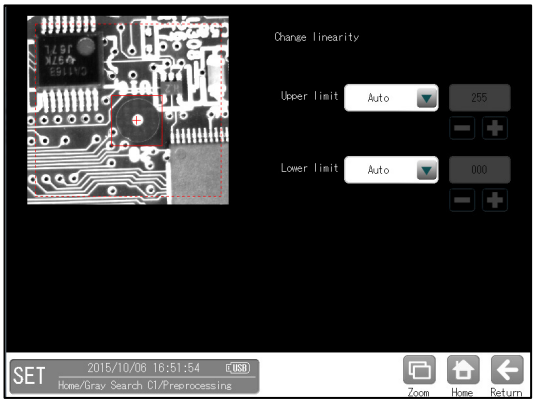
For an image that has intensity variations within a limited band of the gray scale range, (bad contrast), this function spreads out the histogram as shown in the figures below.



Touch the [Setting] button.



The setting screen will appear.

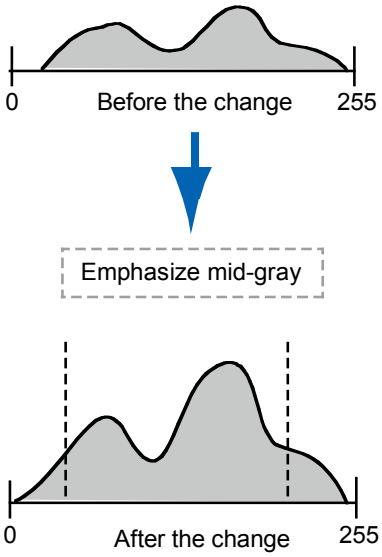


Select either "Manual" or "Auto" from the “Upper limit” and “Lower limit” drop down lists. When the "Manual" is selected, enter a value between 0 and 255.

⑤ Mid-gray emphasis

Leaves the shadows (dark areas) and highlights (bright areas) in the image unchanged and increases the contrast in the intermediate tones. This function is used to improve the contrast while leaving the background of the image unchanged.
Converts the gray-level of each pixel by using the equation below.

- Gray-level range (G): 0 to 127
  $(G \div 127)^2 \times 127$
- Gray-level range (G): 128 to 255
  $(\sqrt{(G-128) \div 127}) \times 127 + 127$

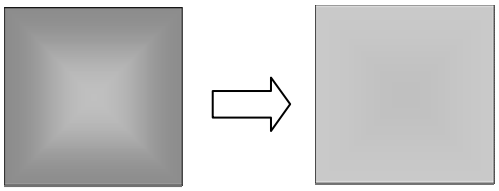


⑥ Intensity average

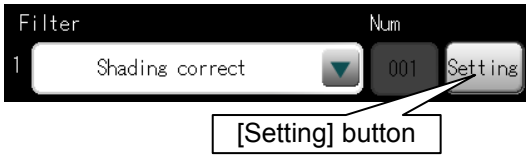
Correct the intensity of an image using the average intensity of the model area as the reference.

⑦ Shading correction

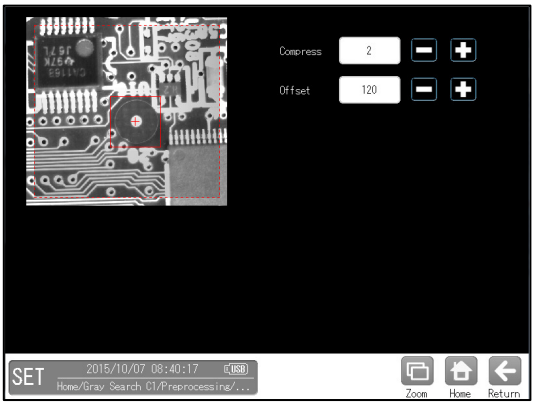
Improves uneven intensity and light reflection due to workpiece's surface shape and quality differences for instance.



Touch the [Setting] button.



The setting screen will appear.



Enter values in the input data boxes:

- Compression: Set a value between 0 and 3.
- Offset: Set a value 0 and 255.

⑧ B/W Flip

Reverse the black and white in the image.

⑨ Binarization

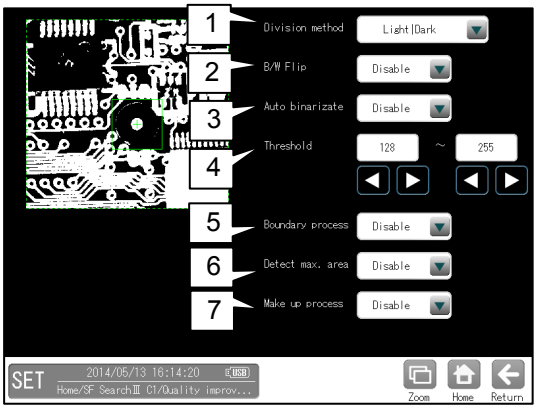
Coverts the image into binary.

Touch the [Setting] button.

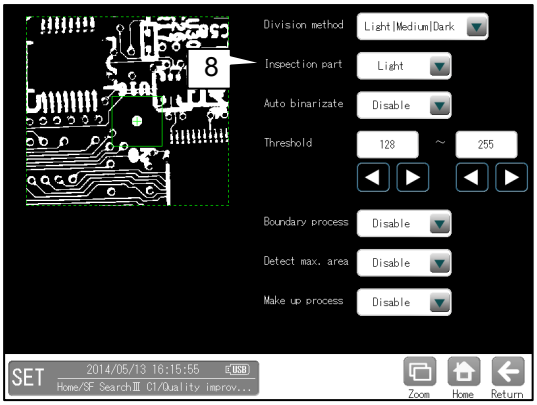
[Setting] button

The setting screen will appear.

When the "Light｜Dark" is selected from the [Division method] drop down list:



When the "Light｜Medium｜Dark" is selected from the [Division method] drop down list:



Select the following items 1 to 3 and 5 to 8.

1. [Division method] drop down list

Select the method for converting an image into binarized data.

- **Light｜Dark:** The device will convert the image into white and black areas.
- **Light｜Medium｜Dark:** The device will convert the image into white, gray and black areas.

2. [B/W flip] drop down list
(In case the Division method is "Light｜Dark")

Select either "Disable" or "Enable".
Enable: The device will flip the white and black binary converted image:
white into black and vise versa.

3. [Auto binarization] drop down list

Select either "Disable" or "Enable".
Enable: The device automatically sets the threshold values for binarization for each image captured.

4. [Threshold] data input boxes

In case "Auto binarization" is "Disabled", threshold values can be set manually.
To adjust the threshold value manually, enter the upper and lower threshold values between 0 and 255 using the data input boxes and number keypad or [Direction] buttons.

5. [Boundary process] drop down list

Select either "Disable" or "Enable".
Enable: The white areas after binarization that are contacting the border of the inspection area will remain white.
Disable: The white areas after binarization that are contacting the border of the inspection area will be made black.

6. [Detect max. area] drop down list

Select either "Disable" or "Enable".
Enable: The device extracts only the searched image with the largest size after binarizing the images within the target area for preprocessing.
In case multiple searched images with the same size exist, the image scanned first will be used.

7. [Make up process] drop down list

Select either "Disable" or "Enable".
Enable: In case there is small black area inside large white area after binarization, the device will convert the black area into white.
(In case B/W Flip is enabled, the device will convert small white area inside large black area into black).

8. [Inspection part] drop down list
(In case "Light｜Medium｜Dark" is selected for the "Division method")

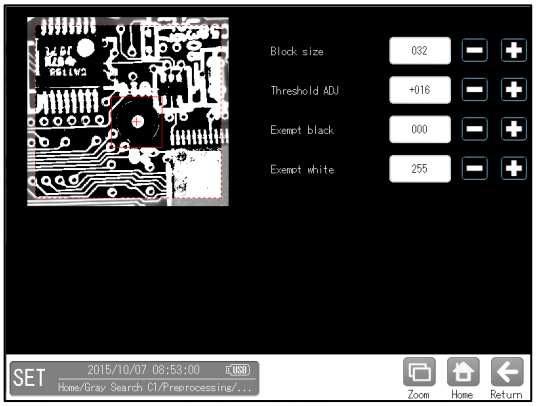
Select one from "Light", "Medium", "Dark", "Light + Medium", "Medium + Dark" or "Light + Dark".

⑩ Block Binarize

Divides inspection area into smaller blocks and does binarize them.
Effective in the binarization of an image with uneven intensity background.

Touch the [Setting] button.

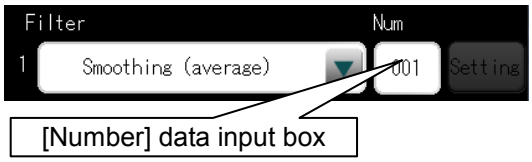
The setting screen will appear.



1. **Block size**
   Set a value between 1 and 256.
2. **Threshold Adjustment**
   Set a value between -128 and 127.
3. **Exempt black intensity**
   Set a value between 0 and 255.
4. **Exempt white intensity**
   Set a value between 0 and 255.

⑪ Smoothing (average)

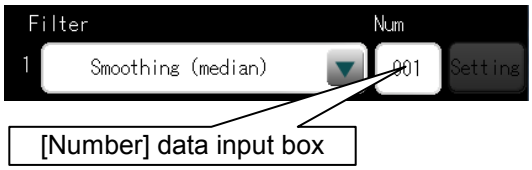
By replacing the pixel intensity with the average image intensity of the neighboring pixels in a 3 x 3 area centering on the pixel, the image can be made smoother.



Enter the number of doing the process between 1 and 16.

⑫ Smoothing (median)

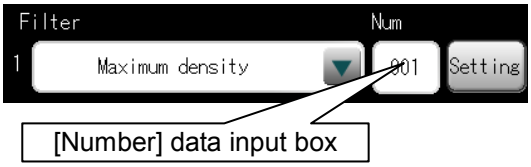
By replacing the pixel intensity with the median image intensity of the neighboring pixels in a 3 x 3 area centering on the pixel, the image can be made smoother.
Noise elements are reduced compared with the smoothing (average) function. However, smoothing (median) takes longer time to process than the smoothing (average).



Enter the number of doing the process between 1 and 16.

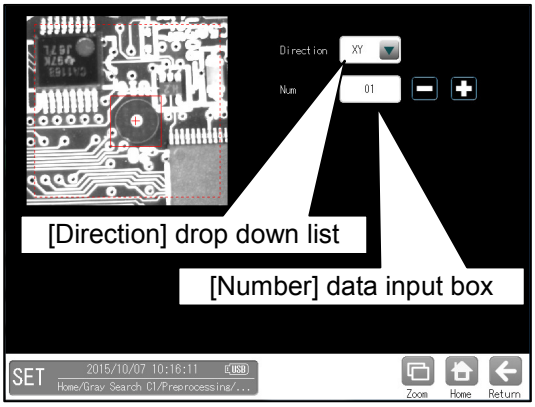
⑬ Maximum intensity

Replace the pixel intensity with the maximum intensity of the neighboring pixels in a 3 x 3 area centering on the pixel.



Enter the number of doing the process between 1 and 16.

Touch the [Setting] button.
The setting screen will appear.

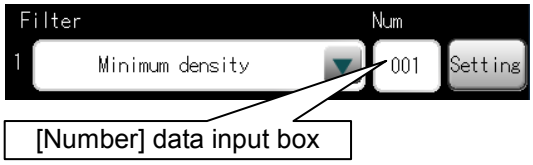


1. **[Direction] drop down list**
   Select the direction:
   “Disable”, "X", "Y", "XY"

2. **[Number] data input box**
   Enter the number of doing the process between 1 and 16.

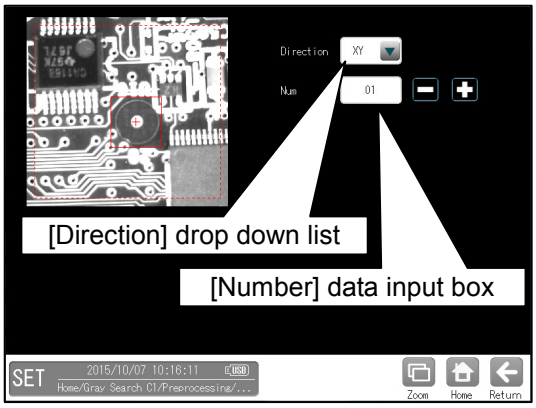
⑭ Minimum intensity

Replace the pixel intensity with the minimum intensity of the neighboring pixels in a 3 x 3 area centering on the pixel.



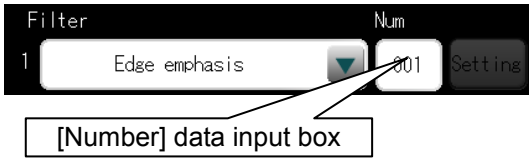
Enter the number of doing the process between 1 and 16.

Touch the [Setting] button.
The setting screen will appear.



⑮ Edge emphasis

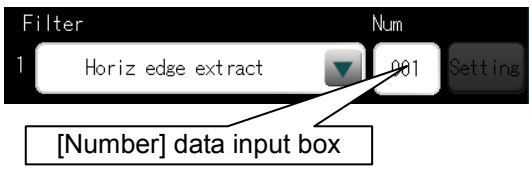
By emphasizing the edges of dark and bright areas in an image, the outlines of shapes become clear.



Enter the number of doing the process between 1 and 16.

⑯ Horizontal edge extract

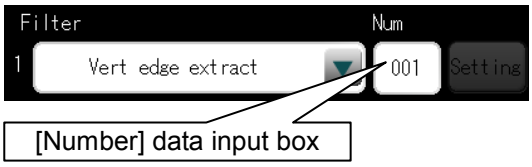
Coverts the image into the one that contains only the extracted horizontal edges.



Enter the number of doing the process between 1 and 16.

⑰ Vertical edge extract

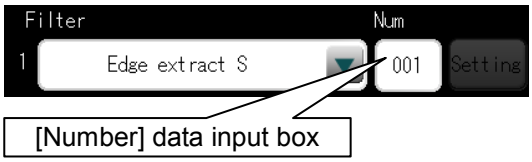
Covert the image into the one that contains only the extracted vertical edges.



Enter the number of doing the process between 1 and 16.

⑱ Edge extract S

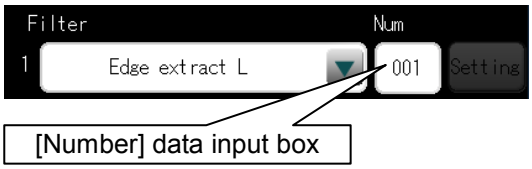
Sobel Edge Detection



Enter the number of doing the process between 1 and 16.

⑲ Edge extract L

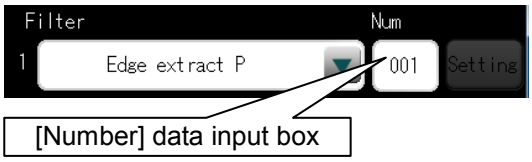
Laplacian edge extraction



Enter the number of doing the process between 1 and 16.

⑳ Edge extract P

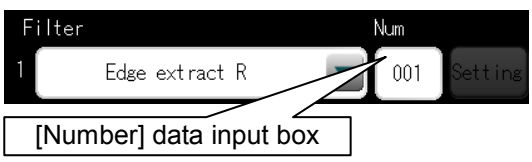
Prewitt edge detection



Enter the number of doing the process between 1 and 16.

㉑ Edge extract “R"

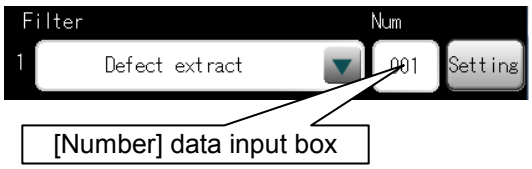
Roberts edge extraction



Enter the number of doing the process between 1 and 16.

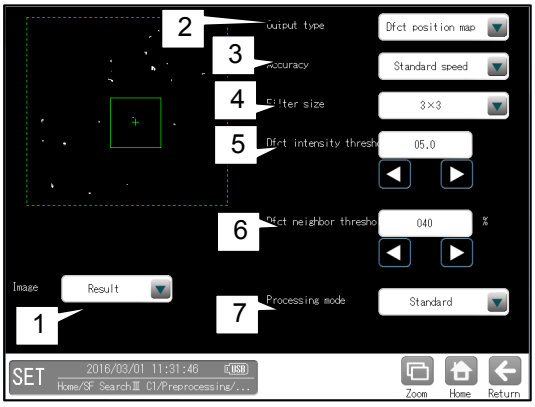
㉒ Defect extract

Extracts the areas that are different from the background image pattern (including periodically repeated patterns or gradations). The area to extract must be 128 pixels or more in both height and width.



Enter the number of doing the process between 1 and 16.

Touch the [Setting] button.
The setting screen will appear.



1. [Image] drop down list
Select the image(s) to filter:
"Original" or "Result".

2. [Output type] drop down list
Select "Defect intensity map" or "Defect position map".

3. [Accuracy] drop down list
Select "High accuracy" or "Standard speed".

4. [Filter size] drop down list
When "Standard speed" is selected for "Accuracy", select either "3×3" or "5×5".

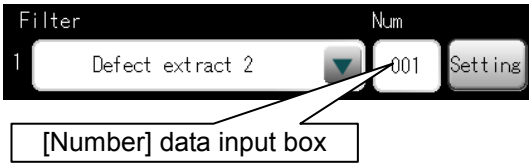
5. [Defect intensity threshold] data input box
When "Defect position map" is selected for "Output type", enter a value between 00.0 and 10.0.

6. [Defect Neighbor threshold] data input box
When "Defect position map" is selected for "Output type", enter a value between 1 and 100.

7. [Processing mode] drop down lists
Select one from "Standard" or "Vertical/Horizontal line enhance".
Defect extract 2

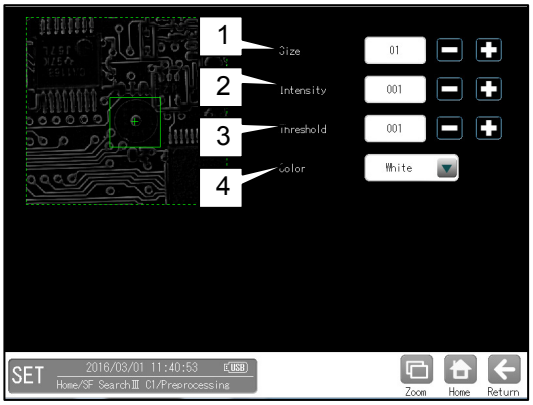
㉓ Defect extract 2

Extracts steep contrast change (shading) by subtracting processed image from the input image.



Enter the number of doing the process between 1 and 16.

Touch the [Setting] button.
The setting screen will appear.



1. [Size] data input box
Enter a value between 1 and 16.

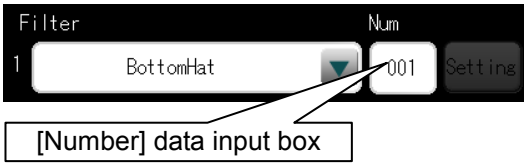
2. [Intensity] data input box
Enter a value between 1 and 255.

3. [Threshold] data input box
Enter a value between 1 and 255.

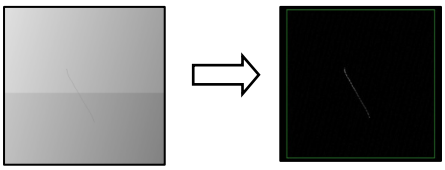
4. [Color] drop down list
Select either “White” or “Black”.

㉔ Bottom Hat

Subtracts the intensity values at the same coordinates of the image and its processed image to eliminate the background information and extracts darker area.

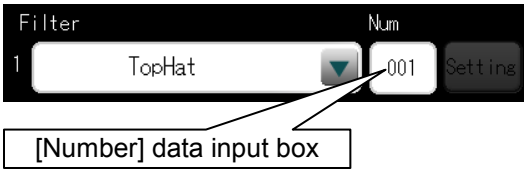


Enter the number of doing the process between 1 and 16.
Example:



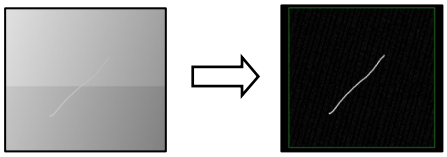
㉕ Top Hat

Does different operation between the intensity values at the same coordinates of the image and its processed image to eliminate the background information and extracts lighter area.



Enter the number of doing the process between 1 and 16.

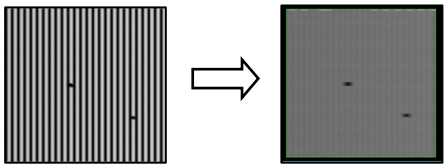
Example:

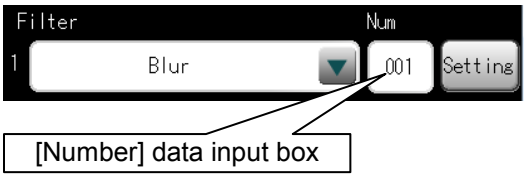


㉖ Blur

It is possible to blur X and Y independently.
By blurring the image, fine background and noises can be eliminated.

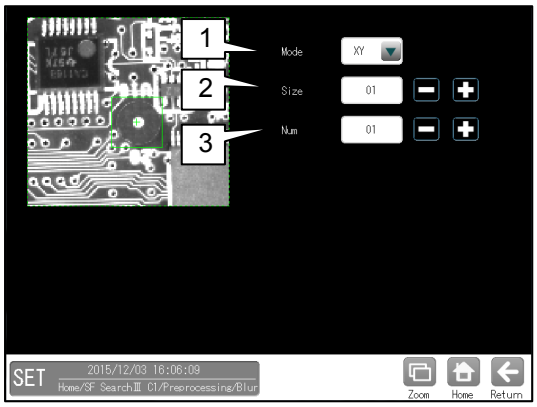
Example:





Enter the number of doing the process between 1 and 16.

Touch the [Setting] button.
The setting screen will appear.



1. [Mode] drop down list
Select the axis to blur:
"X", “Y” or "XY".

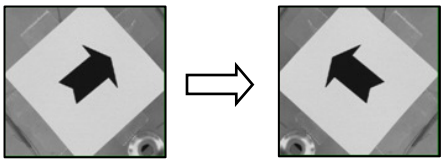
2. [Size] data input box
Enter a value between 1 and 99 for the pixel size.

3. [Number] data input box
Enter a value between 1 and 99 for doing the blur process.
The function is the same as [Number] data input box.

㉗ Mirroring (H)

Flips the image in X direction.

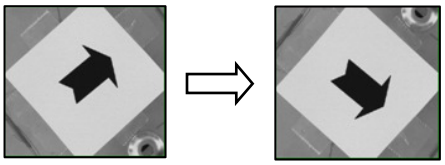
Example:



㉘ Mirroring (H)

Flips the image in Y direction.

Example:

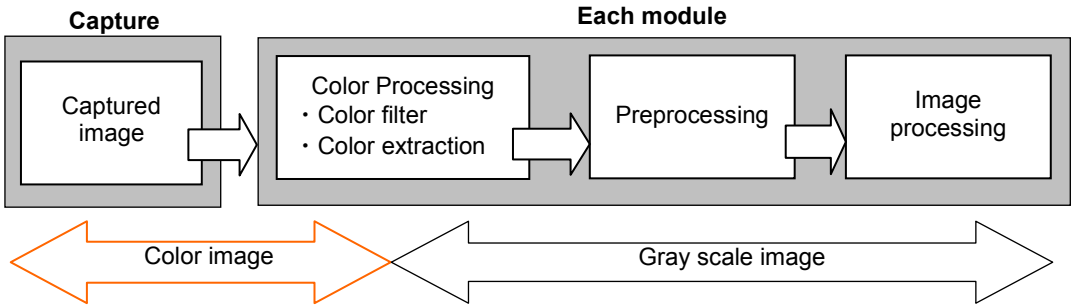


[7] Color processing (When a color camera is used)

When a color camera (IV-S300C3/C8, IV-C250C3/C8) is used, setting of color processing is required. The processing corrects the captured images before an image processing so that they can be inspected easily.

All of the image processing modules have setting items for the processing.
There are two types of pre-processing:

Preprocessing: Effective only for gray scale images
Color processing: Effective only for color images
Color processing converts the captured color images into gray scale images that are suitable for inspection.



・The Color processing settings are only effective when a color camera is connected.
・For information about Preprocessing, see page 4-56.

The Color processing consists of "Color fitter" and "Color extraction."

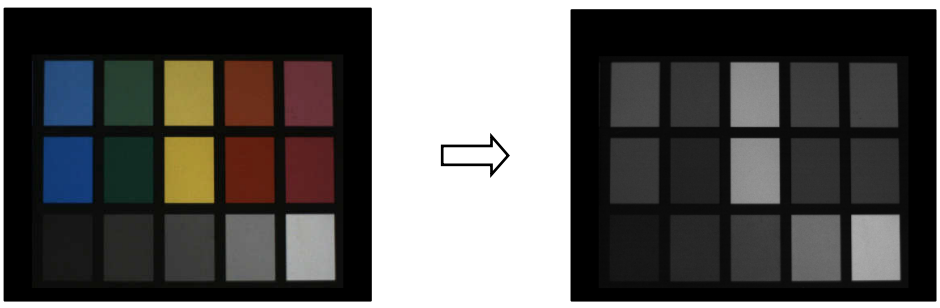
● **Color filter**

Color filtering is a preliminary process for converting captured images into gray scale. The device applies red, blue, green, or luminance filters to the captured images and brightens the areas that are close to the filter color, while the areas least like the filter color are made darker.

Color filter	Detail
Red	Converts a color image by making the areas with a red component brighter and areas that do not contain any red darker.
Green	Converts a color image by making the areas with a green component brighter and areas that do not contain any green darker.
Blue	Converts a color image by making the areas with a blue component brighter and areas that do not contain any blue darker.
Luminance	Converts a color image by making the areas with higher luminance brighter while making the areas with lower luminance darker.

・**How to set the color filter => See page 70.**

[An example of converting an image by using the color filter]



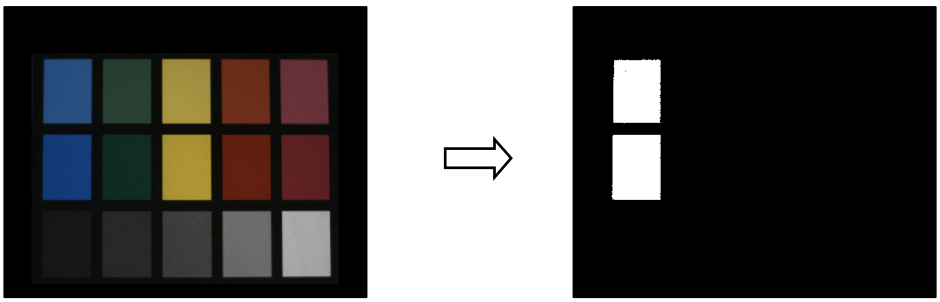
By using one of the four filters (red, blue, green or luminance), convert the original color image into gray scale image.
After the conversion, the image becomes gray scale image that is easier for identifying slight color difference such as flaws or dirt in the image you want to inspect.

● Color extraction

This preprocess binarizes the captured image into "with the specified color" and "without the specified color" areas.
To specify a specific color, set an area in the reference image which has the color you want to extract. Then set the upper and lower limits for the hue, saturation and luminance of that color to define the color to extract.

・How to set the color extraction process => See page 4-70.

[An example of image conversion by using color extraction]

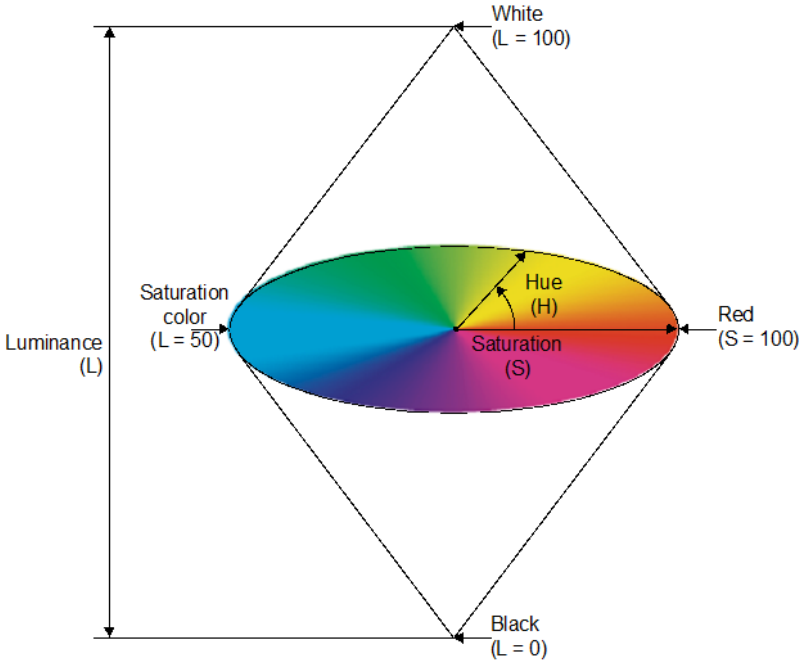


(Original color image) (Image after color extraction)

The color extraction allows judgments that result in OK/NG by extracting the areas with the specified color from the original color image and binarizing them. Also, the device can extract the areas according to their luminance by adding hue and saturation, so that it can extract specific areas in unsaturated images that cannot be processed by the color filter.

■ Hue, Saturation and Luminance

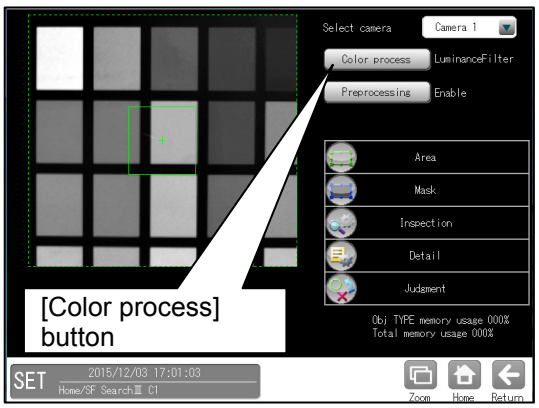
The device develops image information (RGB information) obtained from a CCD on a color expressing morel that is called HSL color space. The HSL color space expresses a color by using color 3 elements: hue, saturation and luminance. It can be expressed with the following image.



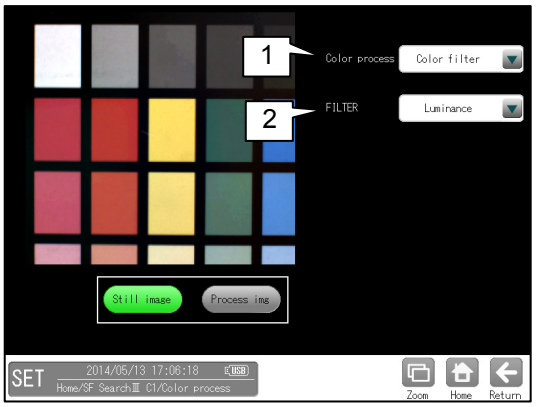
Element	Detail
Hue (H)	Express hue within the range of 0 and 359˚.
Saturation (S)	Express vividness of colors. As approaching to the center, the saturation decreases (no saturation). As approaching to the peripheral, the saturation increases (vivid).
Luminance (L)	Express color brightness. As approaching to the upper side, luminance increases. As approaching to the lower side, luminance decreases. Luminance 0% is black and 100% is white. The intermediate (50%) is a saturated color.

[7]-1 Color filter setting

① When a color camera is used, touch the [Color process] button on the setting screen of each inspection module.

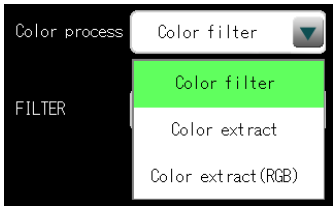


② The Color process setting screen will appear.



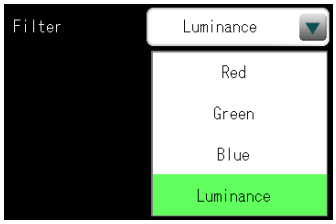
1. [Color process] drop down list

Select "Color filter".



2. [Filter] drop down list

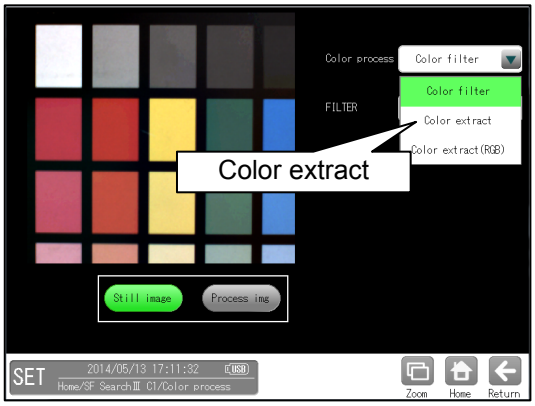
Select "Red", "Green", "Blue" or "Luminance".



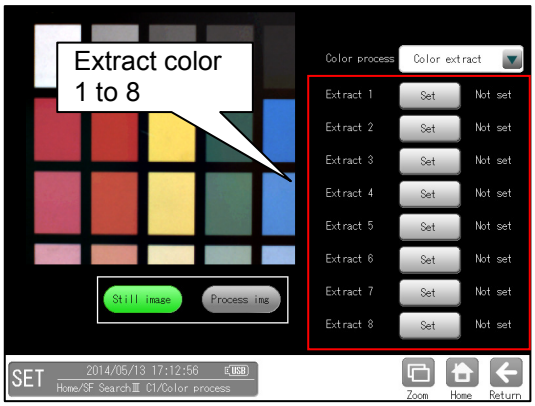
[7]-2 Color extraction setting

① When a color camera is used, touch the [Color process] button on the setting screen of each inspection module.
The Color process setting screen will appear.

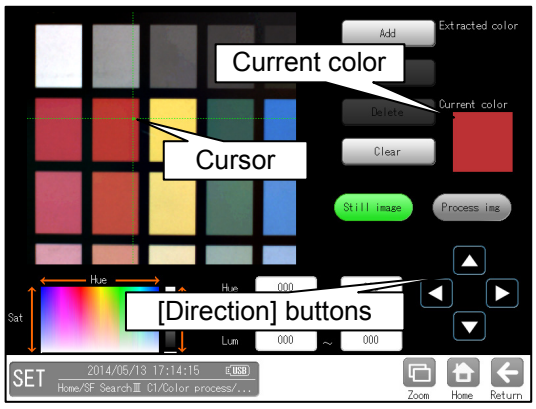
② Select "Color extract" from the [Color process] drop down list.



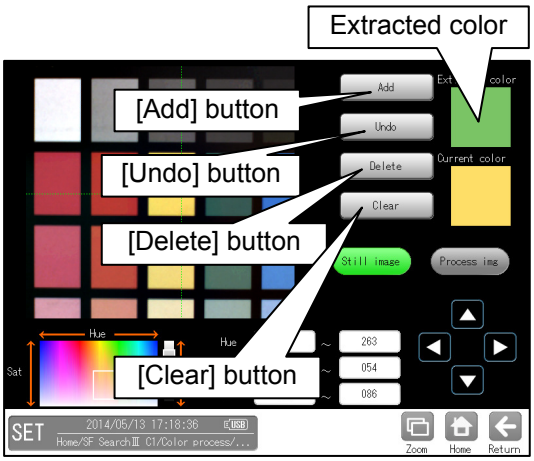
③ The color extraction setting screen will appear. Touch a [Set] button to extract a color.



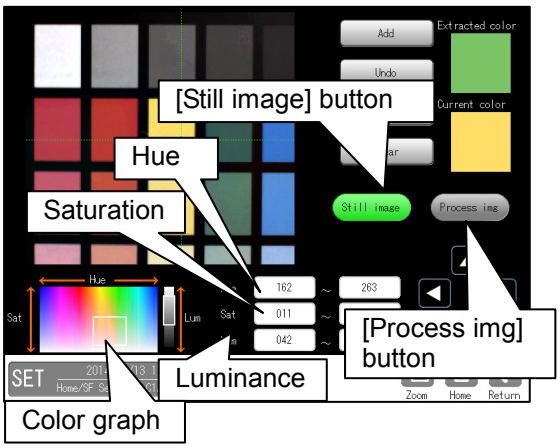
④ The Color extract (1 to 8) setting screen will appear. Set a color to extract according to the following procedures.



・Touch the position of the extract color on the screen or move the cursor (intersection of two lines) with the [Direction] buttons and move the cursor to a position to extract color. The color at the cursor (intersection) is displayed on the "Current color" box.



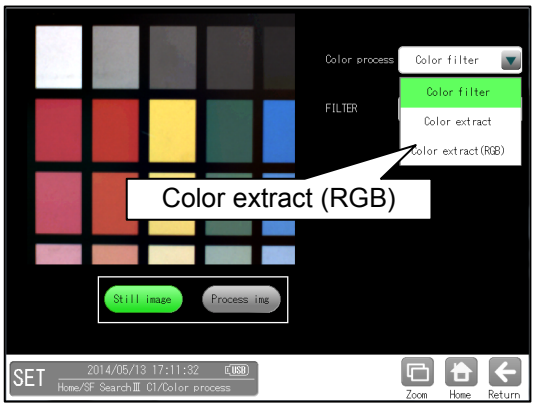
- To add the color selected by the cursor as "extract color", touch the [Add] button.
  To delete the color selected by the cursor from the "extract color", touch the [Delete] button.
  The resulted color of the addition or deletion is displayed on the [Extracted color] box.
- Touch the [Undo] button to return to the previous setting condition.
- Touch the [Clear] button to clear all the color extract settings.



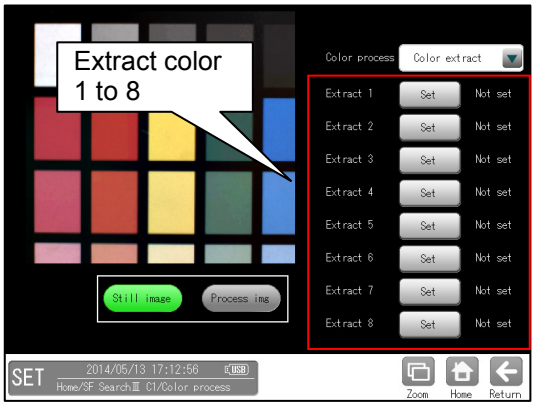
- Touch the [Process img] button to check the extracted image.
- Touch the [Still image] button to display camera image on the screen.
- Touch one of the following data input boxes and enter a number to specify the criteria for hue, saturation and luminance (see page 4-69) with the number keypad.
  [Hue] data input box
  Enter hue (color tone) upper and lower limits within 0 and 359.
  [Saturation] data input box
  Enter saturation (vividness) upper and lower limits within 0 and 255.
  [Luminance] data input box
  Enter luminance upper and lower limits within 0 and 255.
  Color Graph
  Displays Hue, Saturation and Luminance areas set by the data input boxes.

[7]-3 Color extraction (RGB) settings

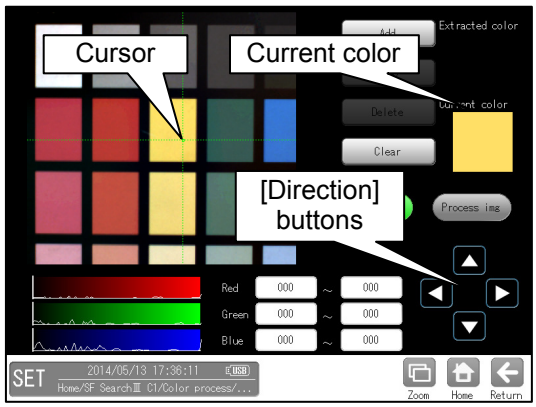
① Select "Color extract (RGB)" from the [Color process] drop down list.



② The color extraction (RGB) setting screen will appear. Touch a [Set] button to extract a color.



③ Touch a “Set” button of “Extract n” (n =1 to 8). The Color extract (RGB) (1 to 8) setting screen will appear. Set a color to extract according to the following procedures.

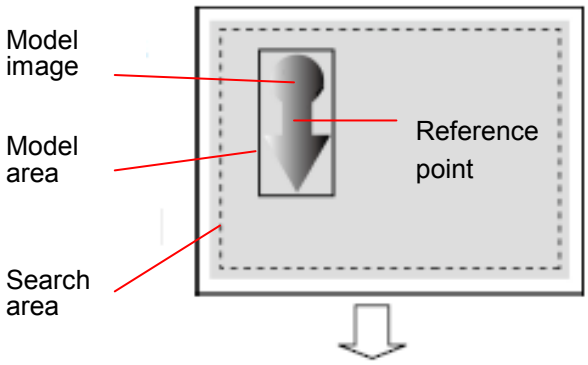


- Touch the position of the extract color on the screen or move the cursor (intersection of two lines) with the [Direction] buttons and move the cursor to a position to extract color.
  The color at the cursor (intersection) is displayed on the "Current color" box.
  Color (Red, Green, Blue) data input boxes
  Enter color upper and lower limits within 0 and 255.

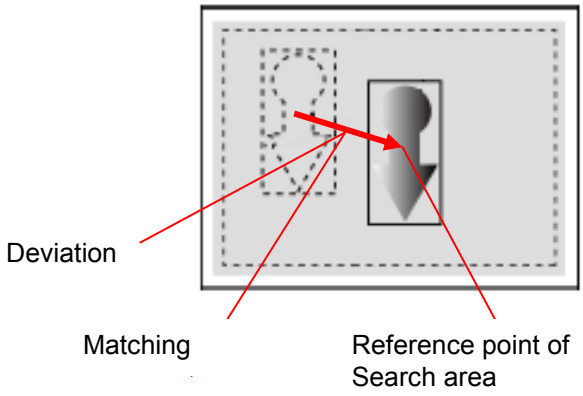
4-4-5 Gray Search module

The Gray Search module is an image processing module and searches an image in the search area that is close to the pre-registered model image in shape and color intensity distribution.

- **When registering a model image**



- **When executing Gray search**

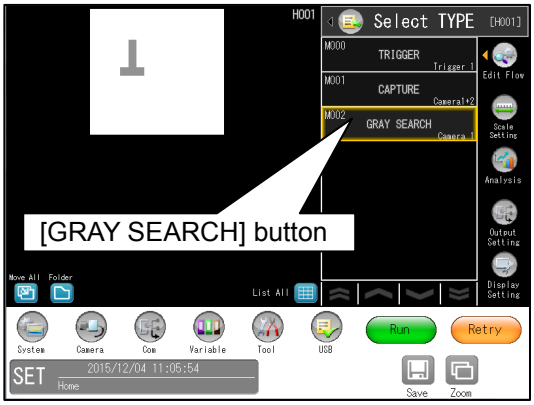


■ Output details

The following inspection results are output.

- **Number of detection**
  The number of searched images close to the model image.
- **Coordinates XY**
  The coordinates of the searched image.
- **Angle Θ**
  Tilt angle of the searched image against the model image.
  (+: Counter clockwise, -: Clockwise)
- **Matching**
  The matching degree between the searched image and the model image.
  (Expressed by a number: 0 to +10000).
- **Deviation**
  The deviation in the coordinates between the searched image and the model image.
- **OK/NG judgment**
  The upper and lower limits of each of the above outputs are set and used as the criteria for "OK" and "NG" judgment.
  OK: All outputs are within the criteria
  NG: One or more are out of the criteria

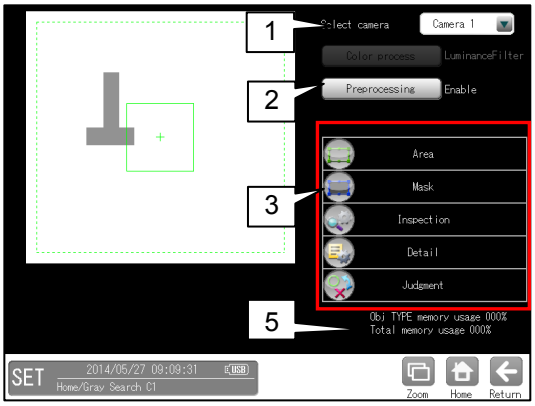
① Touch the [GRAY SEARCH] button on the (Home) SET screen.



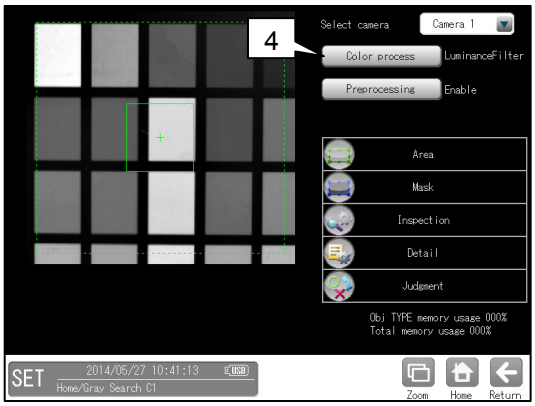
・See page 4-31for editing the module flow.

② The Gray Search module setting screen will appear.

[When a monochrome camera is used]



[When a color camera is used]



1. **[Select Camera] drop down list**
   Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".
   In 2 Trigger mode, select a camera depending on the Object type number. See page 4-6.

2. **[Preprocessing] button**
   Preprocessing will make the captured image easy for inspection.
   See page 4-56 for the functions and setting procedures.

3. **[Setting] icons**
   - Area => [1]
   - Mask => [2]
   - Inspection => [3]
   - Detail => [4]
   - Judgment => [5]

4. **[Color preprocess] button**
   (When a color camera is used)
   When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)
   See page 4-68 for the function and setting procedures.

5. **Search Memory Usage:**
   Object Type memory usage and Total memory usage are displayed in %.
   [NOTE]
   The memory is used by SF search III, Gray search and Multiple Search modules commonly.

   The number of model images that can be registered depends on the model size and detection accuracy and is as listed below, (Max. 4000).

   - Number of models for the memory

Model Size (pixels)	Max number of models	
	Standard	High resolution
50 x 50	4000	4000
100 x 100	1940	1940
200 x 200	788	709
500 x 500	390	291
800 x 800	195	140
1000 x 1000	186	148

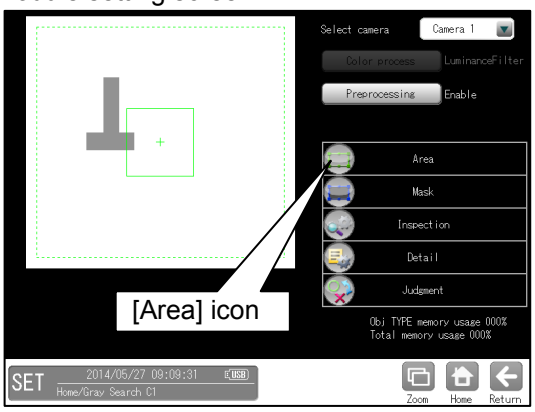
   - Number of models for a module

Model Size (pixels)	Max number of models	
	Standard	High resolution
50 x 50	126	126
100 x 100	126	126
200 x 200	126	126
500 x 500	126	97
800 x 800	65	46
1000 x 1000	62	49

[1] [Area] icon

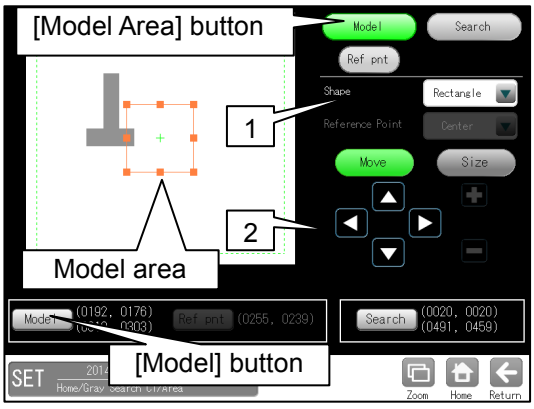
Set each item for the model area and search area.

① Touch the [Area] icon on the Gray Search module setting screen.



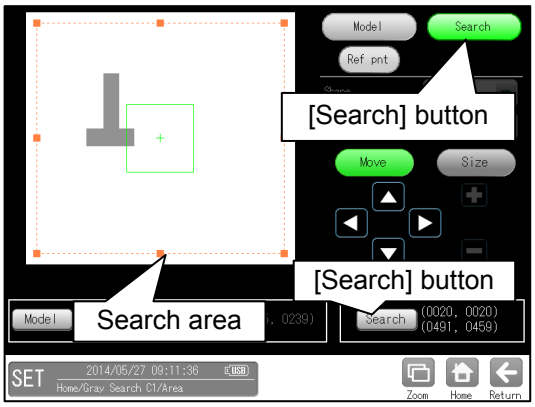
② The Area setting screen will appear.
See page 3-6 for setting the Model area.

・When [Model Area] button is touched



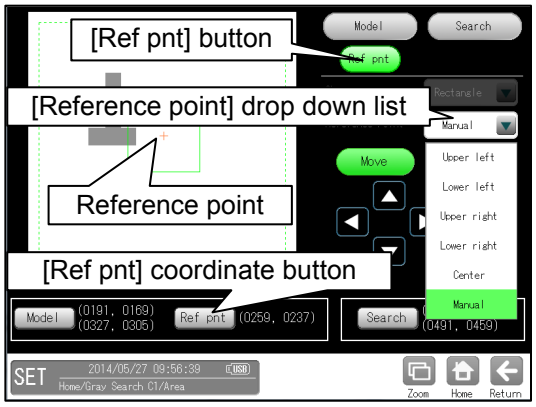
1. **[Shape] drop down list**
   Select the shape for the model area: "Rectangle", "Circle", "Ellipse", "Polygon" or “Rotate rectangle”.
2. **Area setting buttons**
   Set the model area with the [Move], [Size], [Directions] and [+], [-] buttons.
3. **[Model] coordinate setting button**
   Enables setting of Model area by coordinates.

・When [Search Area] button is touched



Set the area referring to the above steps for Model area.

・When [Ref pnt. (Reference point)] button is touched

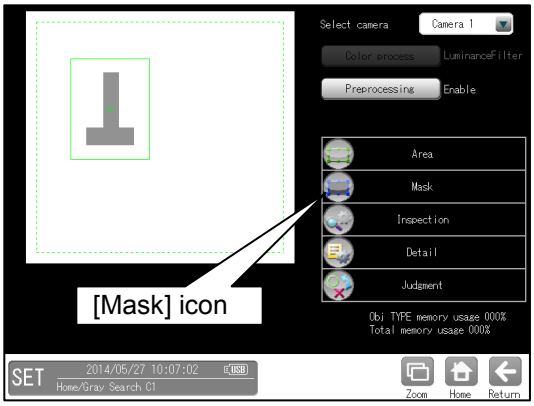


Reference point of the Model Area can be changed.
Select “Upper left”, “Lower left”, “Upper right”, “Lower right”, “Center” or “Manual” from the drop down list.
For “Manual”, move the reference point with the [Directions] buttons or [Ref pnt] coordinate button.

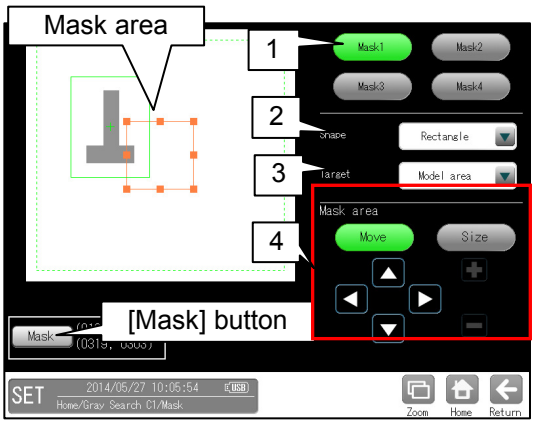
[2] [Mask] icon

When you want to avoid inspecting one or more areas within the Model and Search areas, you can create up to four mask areas.

① Touch the [Mask] icon on the Gray Search module setting screen.



② The Mask setting screen will appear.



1. **[Mask 1] to [Mask 4] buttons**
   Touch one of the mask buttons: [Mask 1] to [Mask 4].

2. **[Shape] drop down list**
   Select a shape for the mask area: "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon"

3. **[Target] drop down list**
   Select a target to mask: "Model area" or "Search area".

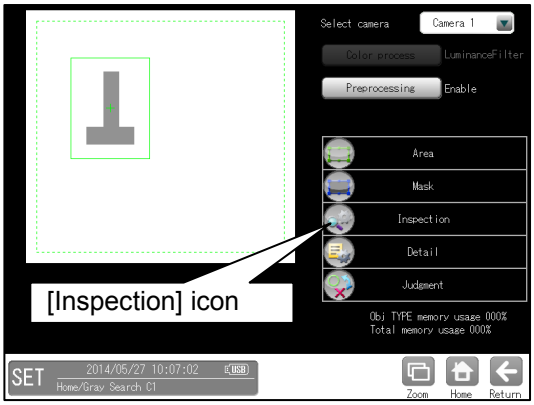
4. **[Mask area] buttons**
   Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.
   ・See page 3-6 for setting the Mask areas.

5. **[Mask] button**
   Enables setting of Mask area by coordinates.

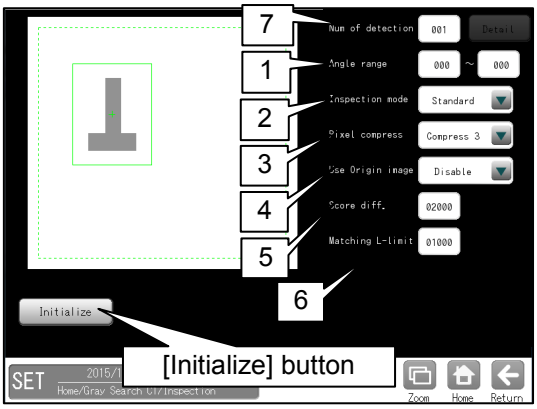
[3] [Inspection] icon

Set the "Number of detection", "Angle range", "Inspection mode", etc.

① Touch the [Inspection] icon on the Gray Search module setting screen.



② The Inspection setting screen will appear.



1. **[Angle range] data input boxes**
   By making the tilt angle of the pre-registered model image as 0˚, specify the angle range (-180 to +180˚) to use when searching a model image. (CCW angles are positive numbers)
   [Note]
   Do not set the angle range wider than required. The narrower the angle range, the faster the detection speed will be.

2. **[Inspection mode] drop down list**
   Select the accuracy to use for searching. The accuracy is specified as a speed.
   “SH-speed”, “H-speed”, "Standard", "H-accuracy", “SH-accuracy".

3. **[Pixel compress] drop down list**
   Select “Compress 2” or “Compress 3”.
   Stage search on compressed images is used in gray search. (See next page)
   Normally the search is started with Compress 3 (most compressed image) to process faster but there is a possibility of wrong search depending on the size and feature of a model.
   In such a case select Compress 2.

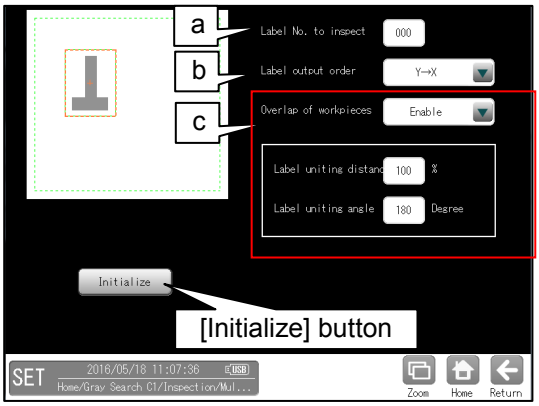
4. **[Use Origin image] drop down list**
   Select “Disable” or “Enable”.

5. **[Score diff] data input box**
   During the gray searching, process passes candidates to next stage compressed image. Set the difference from the highest matching score obtained in previous search to use in next search.
   The number of candidates increases and process time becomes longer as this setting becomes higher.

6. **[Matching L-Limit] data input box**
   Enter the lower limit for inspecting the degree of matching (0 to 10000).
   The area below the limit is not inspected.

7. **[Number of detection] data input box**
   Enter the number of images to search in the search area (target: 1 to 128).
   When a number 2 or higher is entered here, touch the [Detail] button on the right side.

The setting screen for multiple inspections will appear.

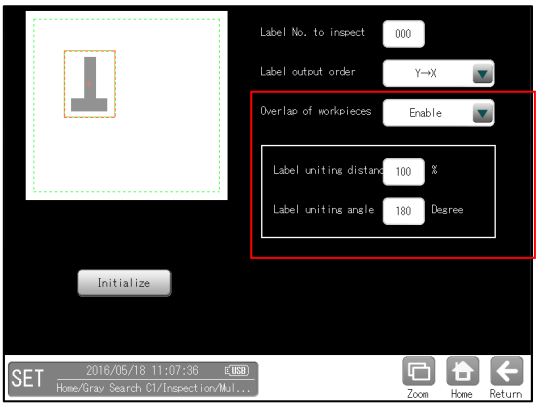


a. **[Labels No. to inspect] data input box**
   Enter the number of label for deviation inspection. The device outputs the deviation between the positions of reference and captured images with the entered label number.

b. **[Labeling output order] drop down list**
   Select the labeling order for the searched images.
   Order:
   "Y ->X", "X ->Y", "Match Ascend (Degree of match in ascending order)", "Match Descend (Degree of match in descending order)", "X Ascend", "X Descend", "Y Ascend", "Y Descend", "Angle Ascend", or "Angle Descend".

c. **[Overlap of workpieces] drop down list**
Select the overlap condition between workpieces: "Enable" or "Disable".
Enable: The device will output more than one search results for overlapped searched images.
In order to produce only one search result, specify the distance and angle to consolidate the multiple search results into one.

- **[Label uniting distance] (Distance for consolidating labels) data input box**
  Enter the distance (0 to 200%).
- **[Label uniting angle] (Angle for consolidating labels) data input box**
  Enter the angle (10 to 180˚).



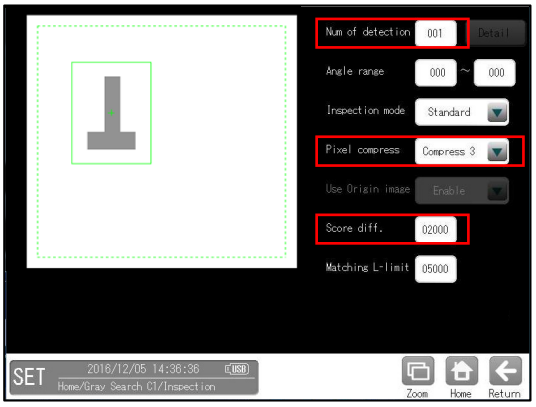
Stage Search

The gray search employs stage search to process faster.
Stage search means to find out candidates in a most compressed image first and then find out candidates precisely in next-most compressed image by using the candidate data.
Repeat this process for predetermined times and identifies candidate finally.

[Purpose of Stage Search]
When the setting of a model area is small and the image has a little contrast, there may be a case that the process identifies wrong image as the candidate at coarse search and finally results in wrong search.
By utilizing the Stage Search, elimination of wrong search and improved search accuracy can be expected but the process time becomes longer.

[Basic Stage Search Flow]

Example: Model Ares (X 63 pixels, Y: 13 pixels)



1. Stage Search Structure

   Compress 3 (1/8 reduction): Model image size = 9 x 3
   ↓
   Compress 2 (1/4 reduction): Model image size = 16 x 4
   ↓
   Compress 1 (1/2 reduction): Model image size = 32 x 6
   ↓
   Compress 0 (no reduction): Model image size = 63 x 13

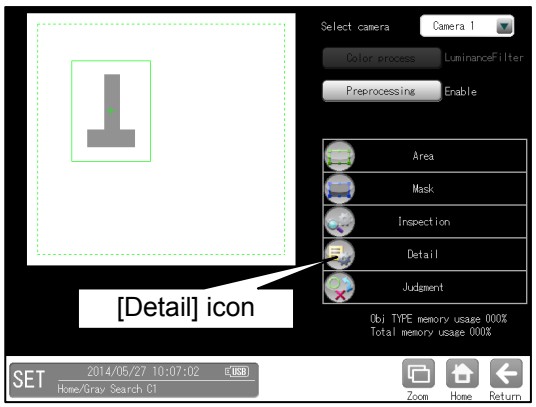
2. First Stage Search
   First stage search does coarse search and finds out certain number of candidates.
   In next stage search, process finds out candidates having matching score within the highest matching score in previous stage search (Max) and (Max – Difference set by Score diff).
   Normally the search is started with Compress 3 (most compressed image) to process faster but you may want to set it to Compress 2.

3. Intermediate Stage Search
   Process finds out candidates focusing on the matching score obtained in previous stage search.

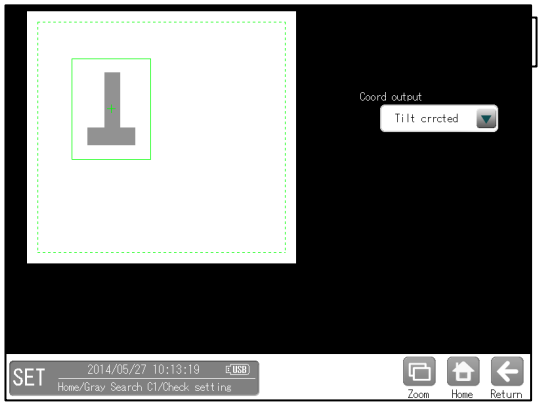
4. Final Stage Search
   Process finally identifies the candidates by the number set by Number of Detection.

[4] [Details] icon

① Touch the [Detail] icon on the Gray search module setting screen.



② The Detail setting screen will appear.



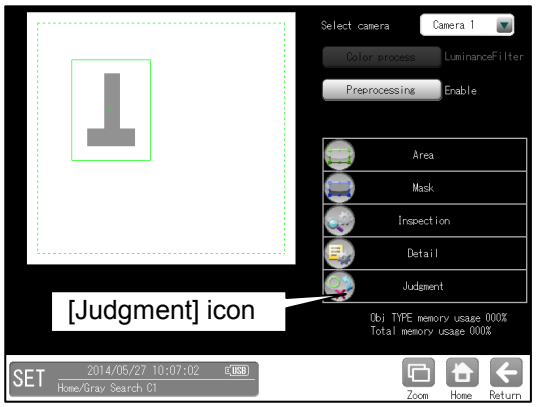
Select the coordinates output: "Original" or "Tilt corrected".
(Default setting: Tilt corrected)

- **Original:** Outputs the coordinates of the captured image without tilt correction.
- **Tilt corrected:** Outputs the coordinates of the captured image after the tilt correction.

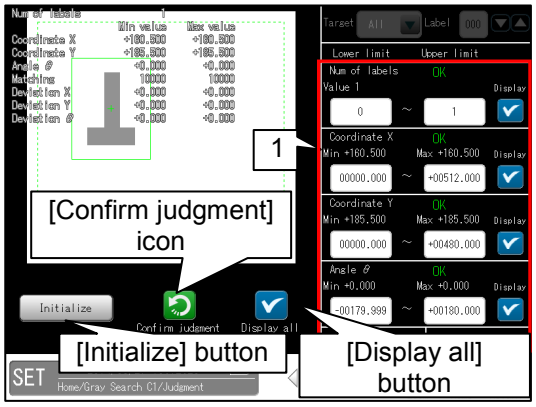
[5] [Judgment] icon

Set the upper and lower limits for OK/NG judgments based on the results of Gray Search. When the inspection result is within the range you set, the device will output "OK", or "NG" if otherwise.

① Touch the [Judgment] icon on the Gray Search module setting screen.



② The Judgment setting screen will appear.



1. **Inspection items/lower and upper limit data input boxes and judgment result**
   Enter the judgment criteria (upper and lower limits) for each inspection item.

   [Inspection items]
   "Number of labels (0 to 128) ", "Coordinate X", "Coordinate Y", "Angle θ", "Matching", "Deviation X", "Deviation Y", "Deviation θ" and “Degree of match”

- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting. It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

4-4-6 Multi Search Module

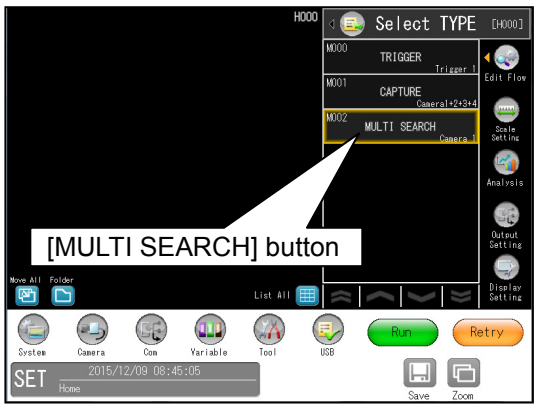
This module does gray search based on multiple model images.
By pre-registering multiple models, the system can handle changes in workpiece shape, size and color and can be used for screening and front/back identification check.

■ **Output details**

The following inspection results are output.

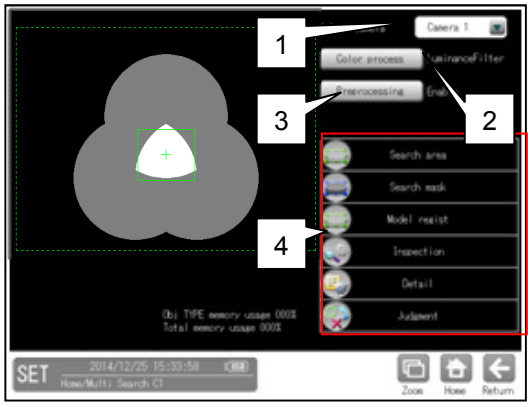
- **Number of detection**
  The number of searched images closer to the model images.
- **Group number**
  The group number of a registered image having highest matching score.
- **Element number**
  The element number of a registered image having highest matching score.
- **Coordinates XY**
  The coordinates of the searched image against the model image.
- **Angle Θ**
  The tilt angle of the searched image against the model image.
  (+: Counter clockwise, -: Clockwise)
- **Deviation X/Y/Θ**
  The deviation between the coordinates of the searched image and that of the model image.
- **Matching score**
  The matching degree between the searched image and the model image.
  (Expressed by a number: 0 to +10000).
- **OK/NG judgment**
  The upper and lower limits of each of the above output are set and used as the criteria for "OK" and "NG" judgment.
  OK: All outputs are within the criteria
  NG: One or more are out of the criteria

① Touch the [MULTI SEARCH] button on the (Home) SET screen.



・See page 4-31 for editing the module flow.

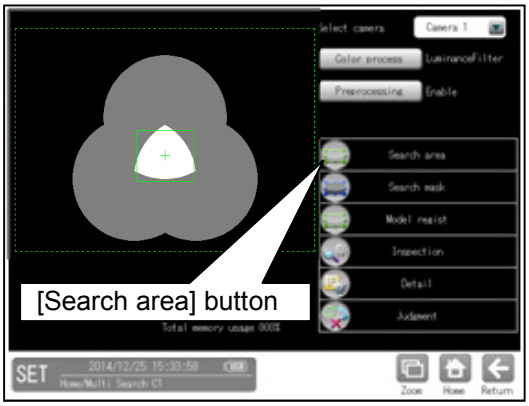
② The Multiple Search module setting screen will appear.



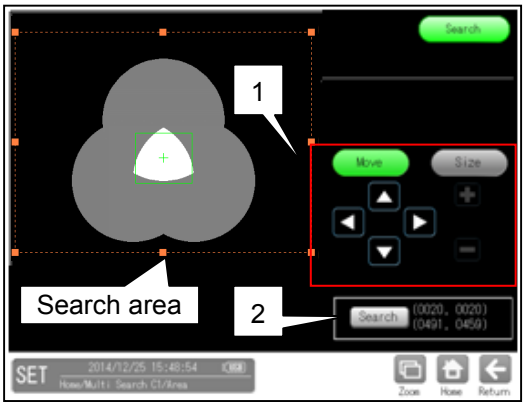
1. **[Select Camera] drop down list**
   Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".
   In 2 Trigger mode, select a camera depending on the Object type number.
   See page 4-6.
2. **[Color preprocess] button**
   When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)
   See page 4-68 for the function and setting procedures.
3. **[Preprocessing] button**
   The captured image can be preprocessed for easy inspection by setting the preprocess.
   See page 4-56 for the functions and setting procedures.
4. **[Setting] icons**
   ・ Search Area => [1] ・ Search Mask => [2]
   ・ Model registration => [3]
   ・ Inspection => [4] ・ Detail => [5]
   ・ Judgment => [6]

[1] [Search Area] icon

① Touch the [Search area] icon on the Multiple Search module setting screen.



② The Search area setting screen will appear.

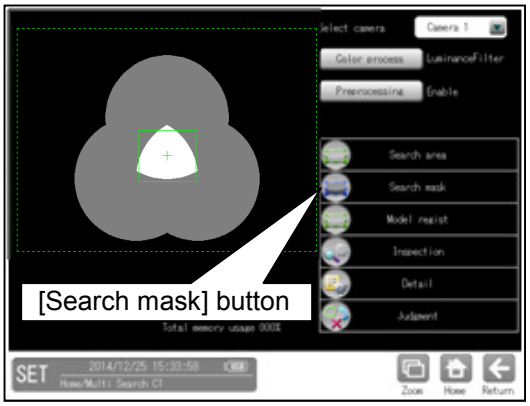


1. **Area setting buttons**
   Set the search area with the [Move], [Size], [Directions] and [+], [-] buttons.
   See page 3-6 for setting the Search area.
2. **[Search] coordinate setting button**
   Enables setting of Search area by coordinates.

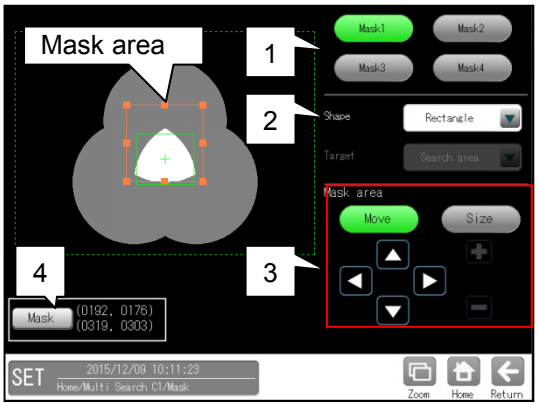
[2] [Search Mask] icon

When you want to avoid inspecting one or more areas within the search area, you can create up to four mask areas.

① Touch the [Search mask] icon on the Multiple Search module setting screen.



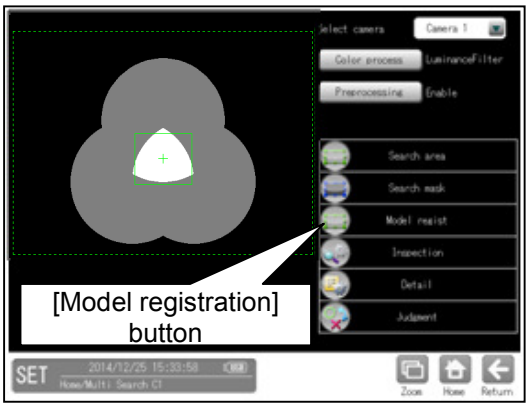
② The Search mask setting screen will appear.



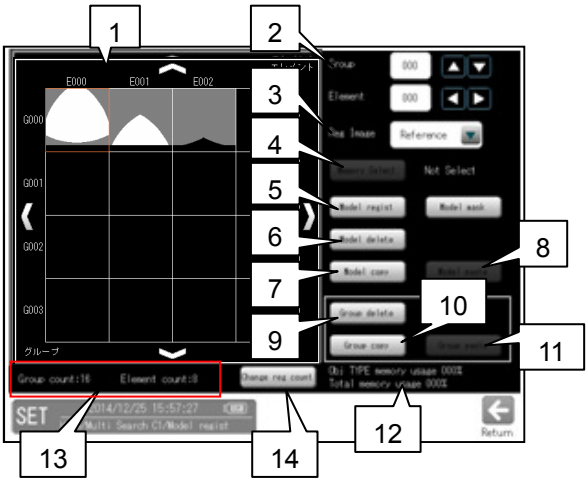
1. **[Mask 1] to [Mask 4] buttons**
   Touch one of the mask buttons: [Mask 1] to [Mask 4].
2. **[Shape] drop down list**
   Select a shape for the mask area: "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon"
3. **[Mask area] buttons**
   Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.
   ・See page 3-6 for setting the Mask areas.
4. **[Mask] coordinate setting button**
   Enables setting of Search area by coordinates.

[3] [Model registration] icon

① Touch the [Model registration] icon on the Multiple Search module setting screen.



② The Model registration setting screen will appear.



1. Model display

Displays the models registered.
Maximum number of models that can be displayed on the screen at a time is 16:
4 groups x 4 elements.
Use the arrow buttons to scroll other models.
Touch a model to display the enlarged view.

2. [Group/Element] data input boxes

Enter the number of group and element to select a model.

[Arrow] buttons

These can be used to select the number instead of the data input box.

3. [Register Image] drop down list

Select the type of the image to be registered as a model:

Reference: Use a reference image as a model.

Memory: Use an image in memory as a model.

4. [Memory Select] button

The button is enabled when “Memory” is set by the [Register Image] drop down list.

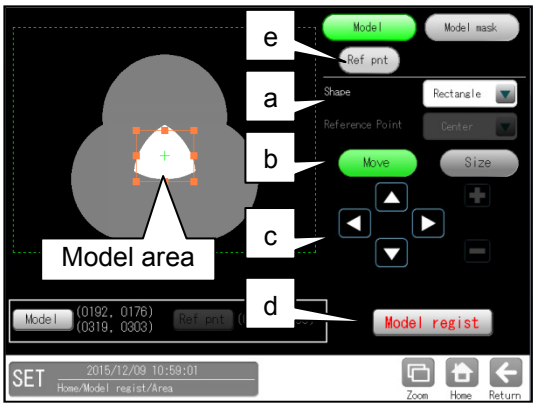
Touch the [Memory Select] button and the following screen will appear.

Touch and Select the image for a model.

5. [Model regist] button

This button is enabled when “Reference” is set by the [Register Image] drop down list.
Touch this button to access Model Area setting screen.

When [model] button is selected (green)



a. [Shape] drop down list

Select a shape for the model area:
"Rectangle", "Circle", "Ellipse" or "Polygon"

b. [Move/Size] buttons

Touch the button to Move or change Size of the cut area.

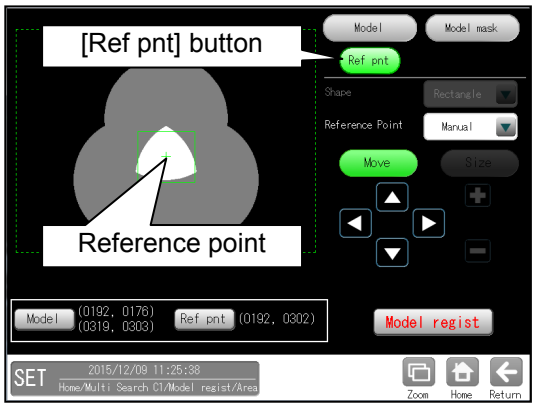
c. [Direction] keys

Use these direction keys to move or change size.

d. [Model regist] button

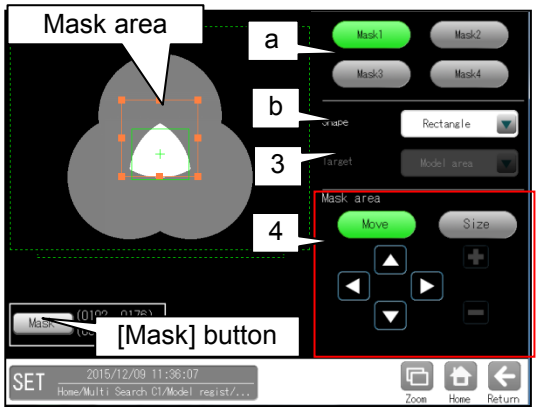
Touch to register the model.

e. **[Ref pnt] button**
Touch the button to change the position of the reference point of the Model area.



- **[Reference point] drop down list**
  Select the position:
  "Upper left", "Lower left", "Upper right", "Lower right", "Center" and "Manual"
  When "Manual" is selected, change the position with the "Move" and arrow buttons.

When [Model mask] button is selected (green)
When you want to avoid inspecting one or more areas within the Model area, you can create up to four mask areas.



a. **[Mask 1] to [Mask 4] buttons**
Touch one of the mask buttons: [Mask 1] to [Mask 4].

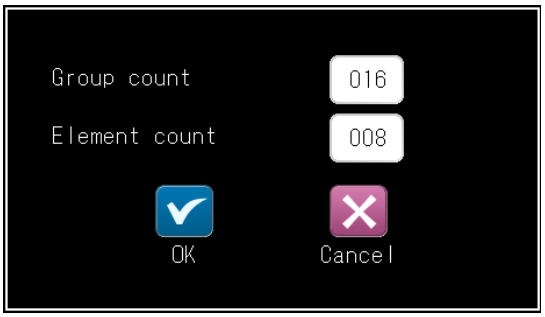
b. **[Shape] drop down list**
Select a shape for the mask area: "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon"

c. **[Mask area] buttons**
Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.
・ See page 3-6 for setting the Mask areas.

6. **[Model delete] button**
Touch this button to delete the selected model.
7. **[Model copy] button**
Touch this button to copy the selected model.
8. **[Model paste] button**
Touch this button to paste the copied model to the selected model.
9. **[Group delete] button**
Touch this button to delete all the models in the selected group.
10. **[Group copy] button**
Touch this button to copy all the models in the selected group.
11. **[Group paste] button**
Touch this button to paste all the copied models to the selected group.
12. **Memory Usage display**
Displays the following:

a. Object TYPE memory usage display
The memory usage of search memory for the present Object TYPE registration.
b. Total memory usage display
The memory usage of search memory for entire Object TYPE registration.

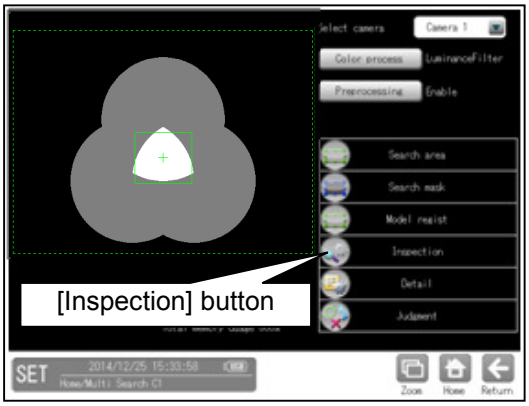
13. **Group count/Element count Display**
Displays the maximum group and element counts that can be registered.
14. **[Change reg count] button**
Touch this button to change the maximum counts of groups and elements to register.
Pop up window for the entry will appear.



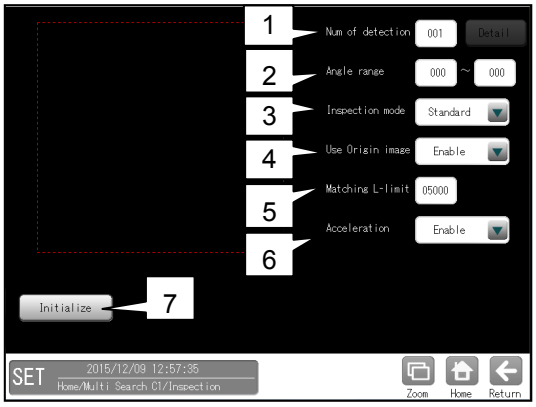
- When the counts are reduced, the models having group and element numbers higher than the set counts are deleted.
- The maximum counts must be set to meet such that counts of Group x Element ≦ 128.

[4] [Inspection] icon

① Touch the [Inspection] icon on the Multiple Search module setting screen.



② The inspection setting screen will appear.

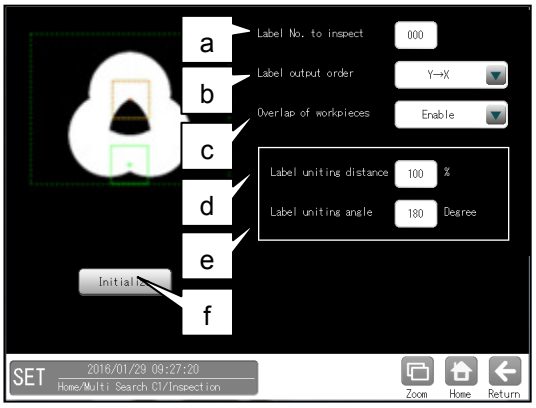


1. [Number of detection] data input box

Enter the number of images to search in the search area (1 to 128).

When a number 2 or higher is entered here, touch the [Detail] button on the right side.

The setting screen for multiple inspections will appear.



a. [Labels No. to inspect] data input box

Enter the number of label for deviation inspection. The device outputs the deviation between the positions of reference and captured images with the entered label number.

b. [Label output order] drop down list

Select the inspection result output order: “Y->X”, “X->Y”, “Match Ascend”, “Match Descend”, “X Ascend”, “X Descend”, “Y Ascend”, “Y Descend”, “Angle Ascend” and “Angle Descend”.

c. [Overlap of workpieces] drop down list

Select “Disable” or “Enable”:

When set to “Enable”, set the following Label uniting distance and angle to get one inspection result when multiple inspection results were obtained for one inspection object.

d. [Label uniting distance] data input box

Enter the distance (0 to 200%).

100% = Set model area

When multiple workpieces are within the label uniting distance, the workpiece with higher matching score is output.

e. [Label uniting angle] data input box

Enter the angle (0 to 180 degree).

When multiple workpieces with different angles are within the label uniting angle, the workpiece with higher matching score is output.

f. [Initialize] button

Touch the [Initialize] button to reset the detail setting to their initial values.

2. [Angle range] data input box

Enter the angle range (-180° to + 180°) to search a model by making the angle of registered model image as 0 °.

Note: + = counter clockwise

[Note]

Do not set the angle unnecessarily wider.

The narrower the angle, the higher the inspection speed will be.

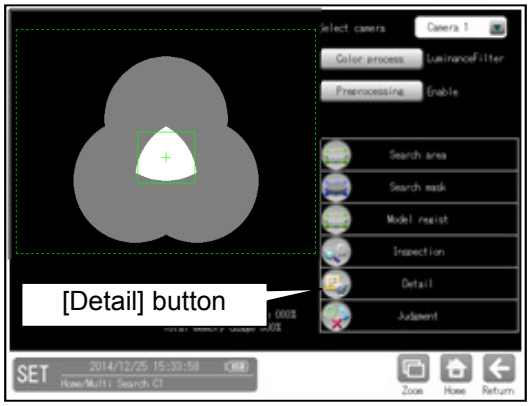
3. [Inspection mode] drop down list

Select the precision (speed) of the inspection: “SH-speed”, “H-speed”, “Standard”, “H-accuracy”, and “SH-accuracy”.

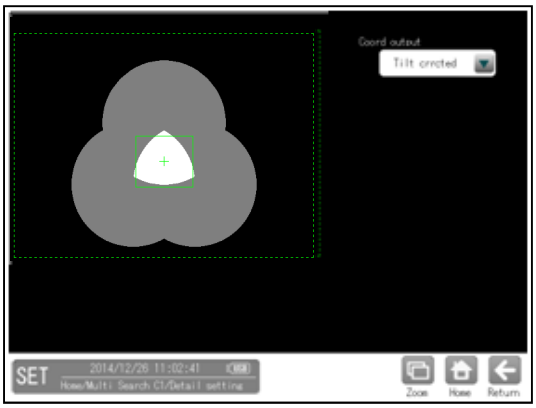
4. **[Use Origin image] drop down list**
   Select “Disable” or “Enable” for searching original image.
   When set to “Enable”, not-compressed image is used for final inspection that makes the inspection precise but takes longer time.
5. **[Matching L-limit] data input box**
   Enter the lower limit of matching score (0 to 10000).
   The area having matching score below the set limit is not inspected.
6. **[Acceleration] drop down list**
   Select “Disable” or “Enable”.
   When set to “Enable”, the determination of the last group/element determination is speeded up during the intermediate search stage.
7. **[Initialize] button**
   Touch the [Initialize] button to reset the inspection setting to their initial values.

[5] [Detail] icon

① Touch the [Detail] icon on the Multiple Search module setting screen.



② The detail setting screen will appear.



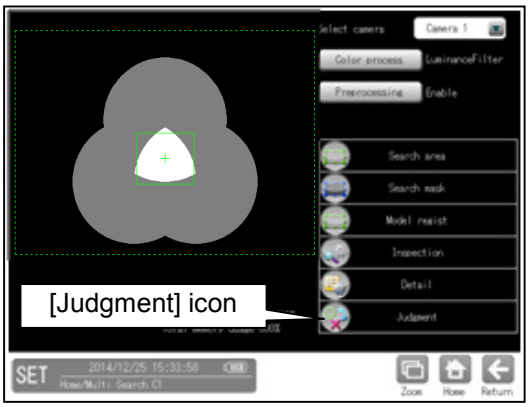
[Coordinate output] drop down list
Select either “Original” or “Tilt corrected” for coordinate output.

- **Original:** Outputs coordinates of the camera captured image.
- **Tilt Corrected:** Outputs coordinates of the camera captured image after tilt correction.

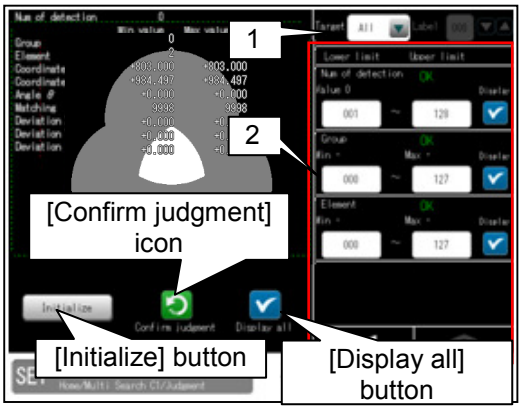
[6] [Judgment] icon

Set the upper and lower limits for OK/NG judgments based on the results of Multiple search.
When the inspection result is within the range you set, the device will output "OK", or "NG" if otherwise.

① Touch the [Judgment] icon on the Multiple Search module setting screen.



② The judgment setting screen will appear.



1. **[Target] drop down list**
   Select either "All" or "Specify".
   When "Specify" is selected, enter the label number to use (0 to 127) with the [Label number] data input box and number keypad.

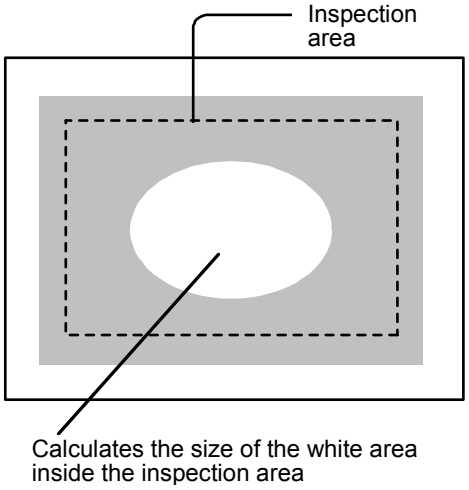
2. **Inspection items, lower and upper limits, and judgment data input boxes**
   Enter the judgment criteria (upper and lower limits) for each inspection item.

[Inspection items]
"Number of detections (0 to 127) ",
“Group Number“, “Element Number”
"Coordinate X", "Coordinate Y", "Angle θ",
"Matching", "Deviation X", "Deviation Y", and
"Deviation θ".

- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting.
  It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

4-4-7 Area module

The Area module binarizes the inspection area from a captured image and inspects the area size of the white or black area.



■ Output details

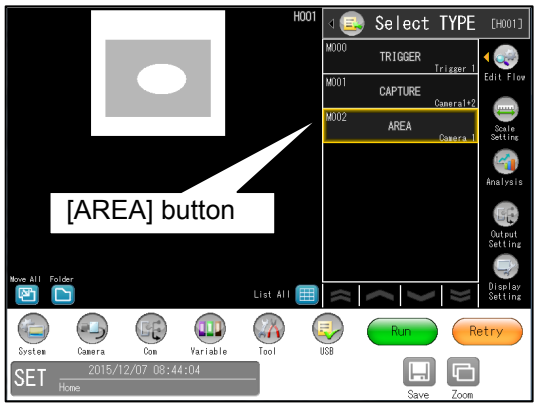
The following inspection results are output.

- **Area Size (number of pixels)**
  The number of pixels of the white area.
- **OK/NG judgment**
  The upper and lower limits of the area are set and used as the criteria for "OK" and "NG" judgment.
  OK: The size is within the criteria
  NG: The size is out of the criteria

■ Operation procedures

(The screens shown below are typical example)

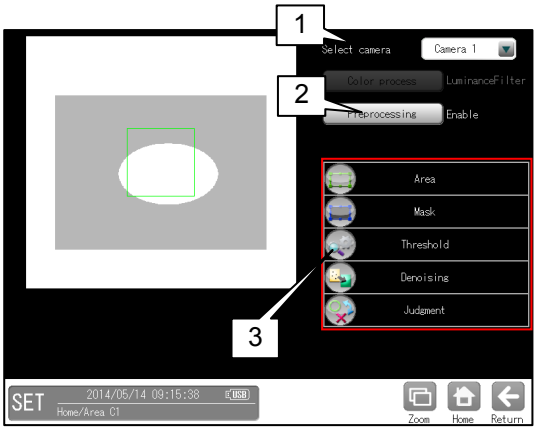
① Touch the [Area] button on the (Home) SET screen.



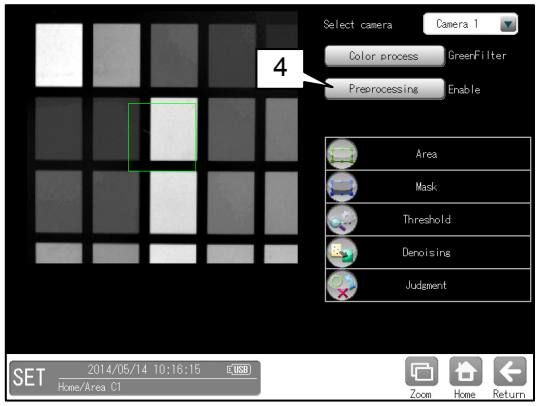
- See page 4-31 for how to edit the module flow.

② The Area module setting screen will appear.

[When a monochrome camera is used]



[When a color camera is used]



1. **[Select Camera] drop down list**
   Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".
   In 2 Trigger mode, select a camera depending on the Object type number. See page 4-6.

2. **[Preprocessing] button**
   Preprocessing will make the captured image easy for inspection.
   See page 4-56 for the functions and setting procedures.

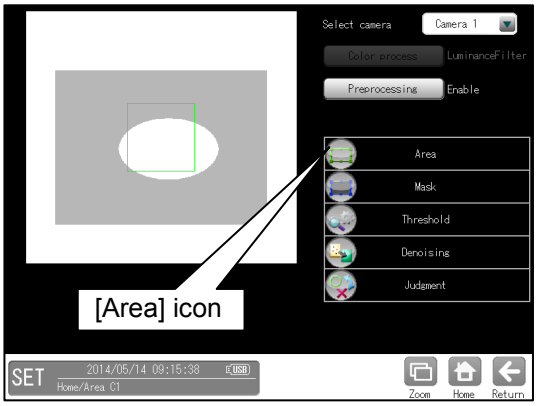
3. **[Setting] icons**
   - Area => [1]
   - Mask => [2]
   - Threshold => [3]
   - Denoising => [4]
   - Judgment => [5]

4. **[Color preprocess] button**
   (When a color camera is used)
   When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)
   See page 4-68 for the function and setting procedures.

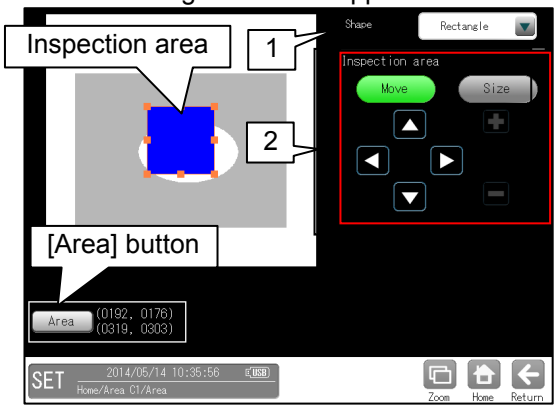
[1] [Area] icon

Set an inspection area.

① Touch the [Area] icon on the Area module setting screen.



② The Area setting screen will appear.



1. [Shape] drop down list

Select the shape for the inspection area: "Rectangle", "Circle", "Ellipse", "Polygon", "Rotate rectangle" or "Arc".

2. [Inspection area] buttons

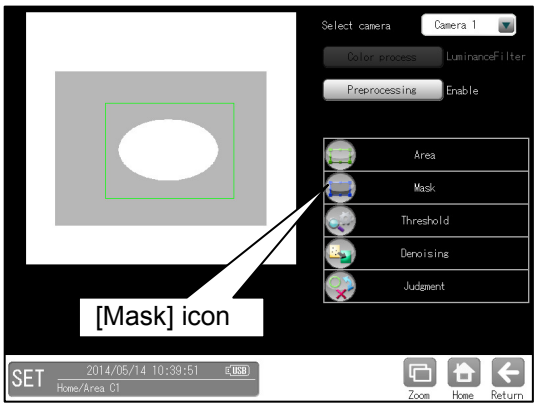
Define the inspection area with the [Area], [Move], [Size], [Direction] and [+] [-] buttons.

・See page 3-6 for setting the inspection area.

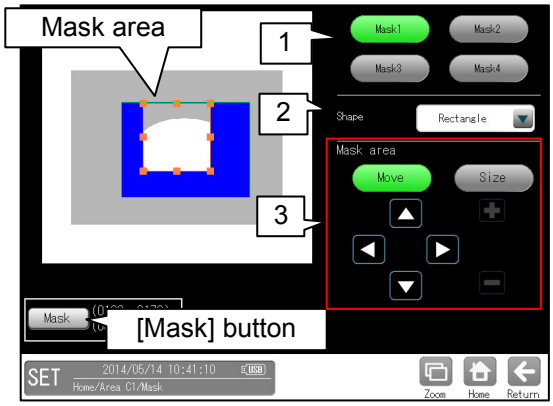
[2] [Mask] icon

When you want to avoid inspecting one or more areas within the inspection area, you can create up to four mask areas.

① Touch the [Mask] icon on the Area module setting screen.



② The Mask setting screen will appear.
The screens below are when “Rectangle” is selected for the Shape.



1. [Mask 1] to [Mask 4] buttons

Touch one of the mask buttons: [Mask 1] to [Mask 4].

2. [Shape] drop down list

Select a shape for the mask area: "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon".

3. [Mask area] buttons

Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.

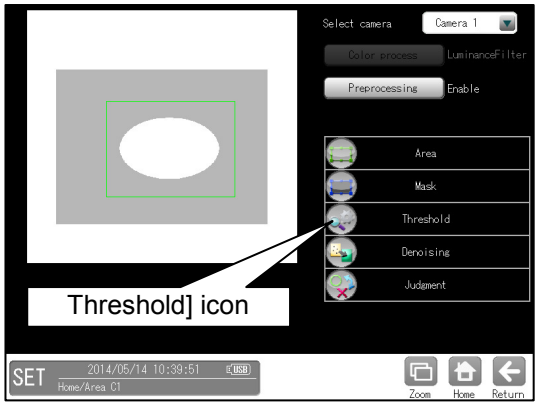
・See page 3-6 for setting the Mask areas.

[3] [Threshold] icon

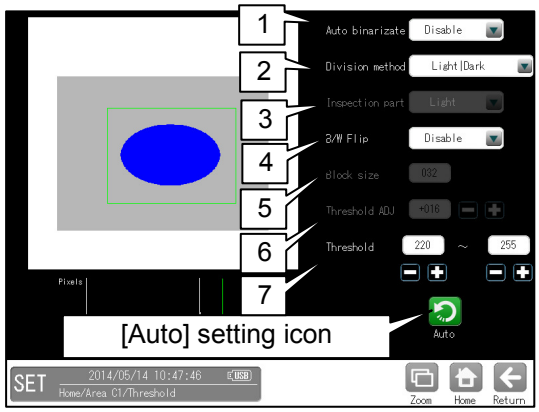
The "Threshold" refers to the criteria used to divide a grayscale image (the device captures images as 256 shades of gray) into white and black areas. When the gray value of a pixel is larger than this threshold value, it is converted into white or black if otherwise.

In addition, when you select "Light | Medium | Dark" as the "Division method", the device will convert the image into the three brightness areas. Further, you can use any two of the three areas to make a combined area ("Light + Medium", "Medium + Dark" and “Light + Dark) as the inspection object.

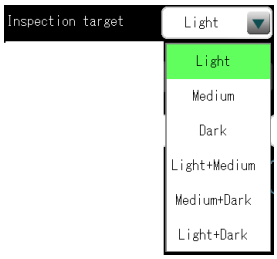
① Touch the [Threshold] icon on the Area module setting screen.

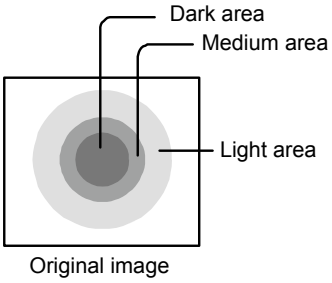


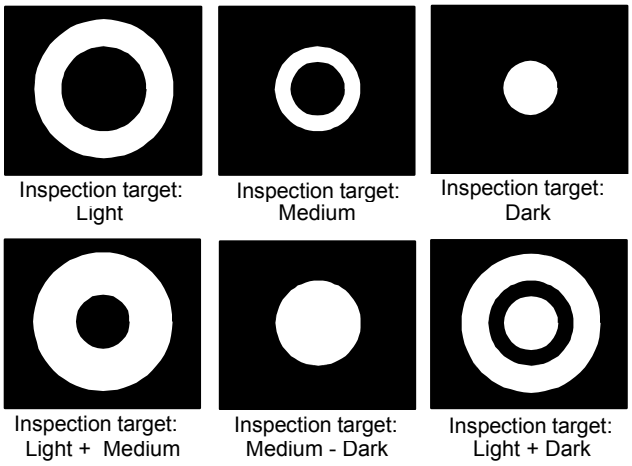
② The Threshold setting screen will appear.



1. **[Auto binarization] drop down list**
   Select "Disable", “Entire” or "Block".
   Entire: Sets the threshold automatically so that black and white areas of Inspection Area become half and half.
   Block: Sets the threshold automatically so that black and white areas of a block to be set by [Block Size] become half and half.
2. **[Division method] drop down list**
   Select "Light | Dark" or "Light | Medium | Dark" for conversion of a grayscale image.
   Light | Dark: Converts the image into two areas of white and black.
   Light | Medium | Dark: Converts the image into three areas of white, gray, and black.
3. **[Inspection Part] drop down list (When the Division method is "Light | Medium | Dark")**
   Select the inspection target from the six options: "Light", "Medium", "Dark", “Light+Medium”. ”Mediumi+Dark” or “Light+Dark”







· The white areas are inspection object areas

4. **[B/W Flip] drop down list (When the Division method is "Light | Dark")**
   Select "Enable" or "Disable".
   Enable: Converts the area identified as white into black, and the area identified as black into white.

5. **[Block Size] data input box (When the Auto binarization is "Block")**
   Set the block size within 1 and 256.

6. **[Threshold ADJ (adjust)] data input boxes (When the Auto binarization is "Block")**
   Set the Threshold within -128 and 127 with the data input boxes and number keypad or arrow keys when adjusting of the threshold is needed after auto binarization.

7-1. [Threshold] data input box

When "Disable" is selected for [Auto binarization] drop down list, set the upper and lower limits

Two methods are available for setting the upper and lower limits:

Manual setting while looking at the captured image, or Auto setting by using an optimum threshold value from the image currently displayed (reference image).

[To set manually]

Touch the [Threshold] data input box (lower or upper limits) and enter a value with the number keypad.

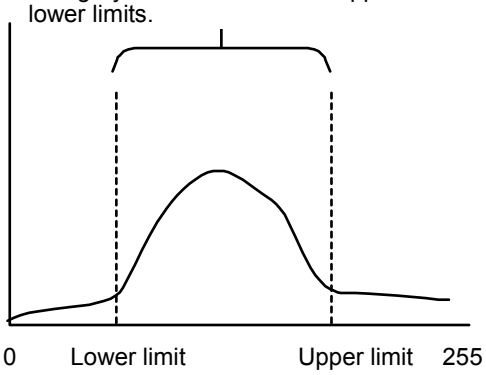
Only the lower limit is set normally.

When the upper limit is set, the device will detect only the areas with gray levels between the upper and lower limits.

The current inspection area is displayed in blue on the background reference image.

Adjust the upper and lower limits such that the inspection area becomes what you want.

If you set the upper and lower limits, the controller will inspect only the areas with gray levels between the upper and lower limits.



[To set automatically]

To set the upper and lower limits automatically, touch the [Auto] icon. The device enters an optimum threshold value automatically on the lower limit data input box.

You may fine tune the settings with the upper and lower limits data input boxes and number keypad after they have been set automatically.

7-2. [Exempt] data input box
(When the Auto binarization is "Block")

Set the threshold to judge as Black and White (0 to 255).

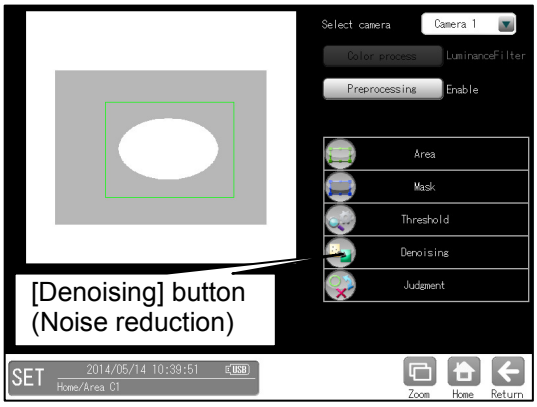
Note:

White must be set to a higher value than Black.

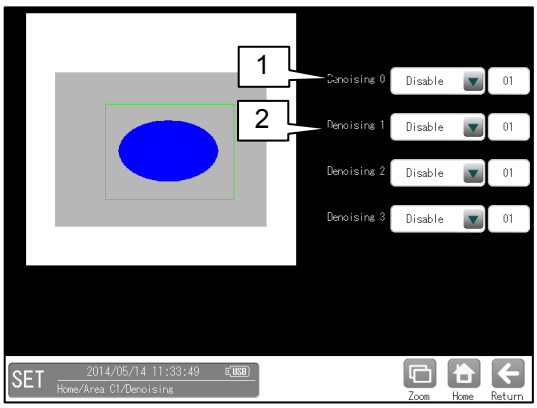
[4] Denoising (Noise reduction)

After a grayscale image is converted into a binary image, pixel noises may appear on the image. The noise reduction function lets the device remove the pixel noises by using "Dilate" or "Erode" processes.

① Touch the [Denoising] icon on the Area module setting screen.



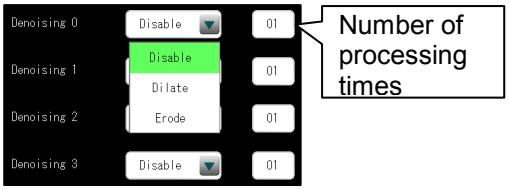
② The noise reduction setting screen will appear.



1. [Denoising 0] drop down list

Select "Disable", "Dilate" or "Erode" and then enter the number of times to process the image with the data input box (1 to 15) and number keypad.

(Default setting: Disable, 01)



- **Dilate:** When there is even one white pixel near the target area, all of that area will be converted into white.
- **Erode:** When there is even one black pixel near the target area, all of that area will be converted into black.

  Normally, you can remove pixel noises by repeating the "Dilate" or "Erode" processes a few times.

  The more times the image is processed, the clearer the resulting image will be.

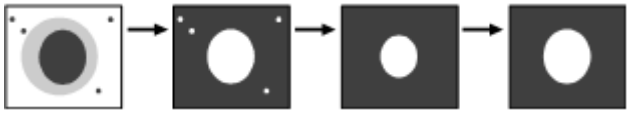
2. [Denoising] (1 to 3) drop down lists

From the [Denoisng 1] drop down list, select the reverse procedure of the process selected for [Denoising 0] (Dilate or Erode).
Set [Denoising 2] and [Denoising 3] as necessary.

・An example of Dilate -> Erode

Binarize Dilate Erode

・An example of Erode -> Dilate

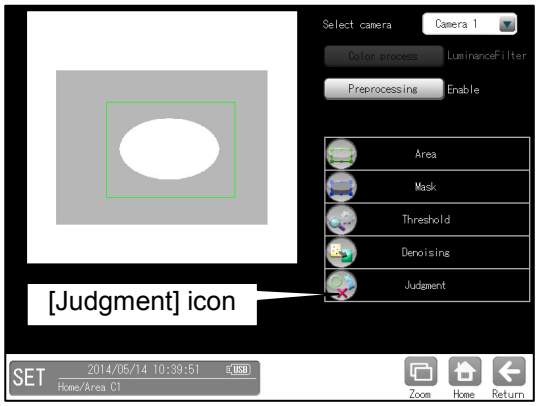


Binarize Erode Dilate

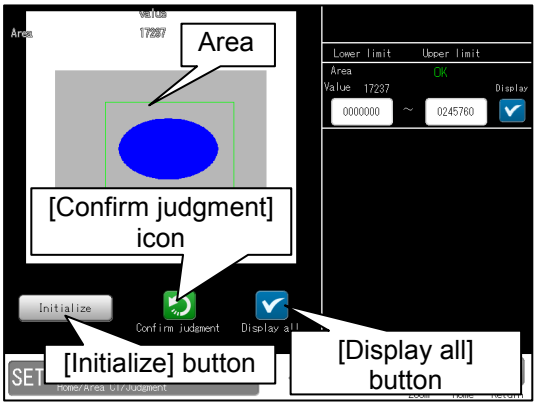
[5][Judgment] icon

Set the upper and lower limits for OK/NG judgment based on the results (area value) of processing the Area module.
When the inspection result is within the range you set, the device will output "OK", or "NG" if otherwise.

① Touch the [Judgment] icon on the Area module setting screen.



② The Judgment setting screen will appear.
The screens below are when “Light｜Medium｜Dark" is selected for “Division method”.



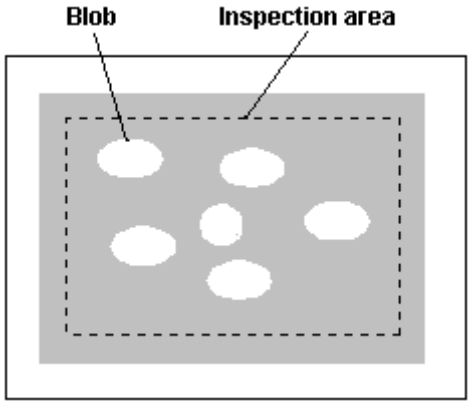
・Touch the [Area] data input boxes (for upper and lower limits) and enter the judgment criteria for the area with the number keypad.

[Inspection items]
"Area".

- Touch the [Display] or [Display all] button to display the judgment result.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting.
  It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

4-4-8 Blob module

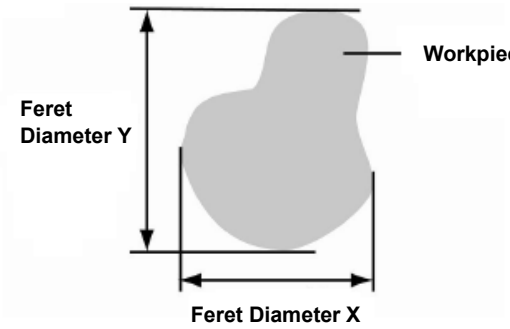
An area consisting of groups of connected white pixels (or black pixels when an image has been converted into black for white) is referred to as "blob" in a binary image.
The Blob module inspects the number of blobs, their area, perimeter, and gravity center coordinates, etc.



■ **Output details**

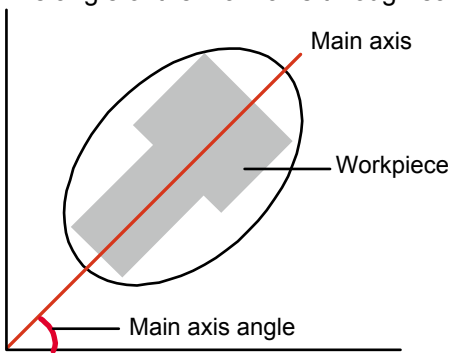
The following inspection results are output depending on the inspection item setting.

- **Number of labels**
  The number of blobs detected in the inspection area.
- **Total area size**
  The total area (number of pixels) of all the blobs.
- **Area size**
  The size (number of pixels) of each blob.
- **Perimeter**
  The perimeter of each blob.
- **Feret (diameter)**
  The X and Y Feret diameters of each blob.



・When a minimum rectangle that contains a workpiece is drawn, the length between the two vertical sides of the rectangle is referred to as Feret diameter X and the length between the two horizontal sides is referred to as Feret diameter Y.

- **Gravity center**
  The coordinates of the gravity center of each blob.
- **Center**
  The center coordinates of each blob.
- **Axis angle**
  The angle of the main axis through each blob.



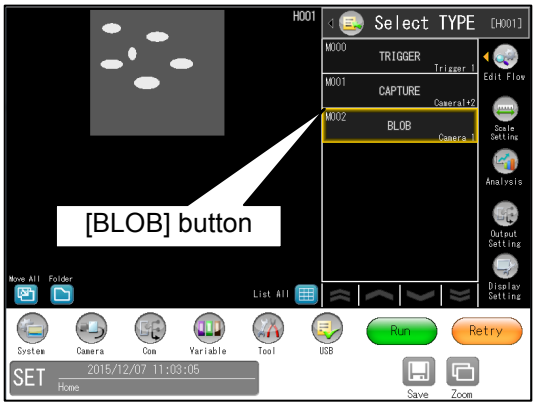
・When a minimum ellipse that contains a workpiece is drawn, a straight line passing through the center of the two ends of the ellipse is referred to as the main axis. The angle made relative to the X-axis (horizontal line) is referred to as the main axis angle.

- **Deviation**
  The coordinates difference between the positions of reference and captured images with the designated label number.
- **Intensity**
  The cumulative intensity of the pixels that forms a blob label.
- **Rotated circum rectangular (circumscribed Rotated rectangular)**
  Min and Max values of Center X/Y, Shape center X/Y, Shape angle and Shape Length (L/S) of the circumscribed rotated rectangular
- **Circum circle (circumscribed circle)**
  Min and Max values of Center X/Y, Shape center X/Y, Shape angle and Shape Length (L/S) of the circumscribed circle.
- **Circularity**
  The circularity of each blob.
- **OK/NG judgment**
  The upper and lower limits of each of the above inspection item are set and used as the criteria for "OK" and "NG" judgment.
  OK: All the inspection results are within the criteria
  NG: One or more of the inspection results are out of the criteria.

■ **Operation procedures**

(The screens shown below are typical example)

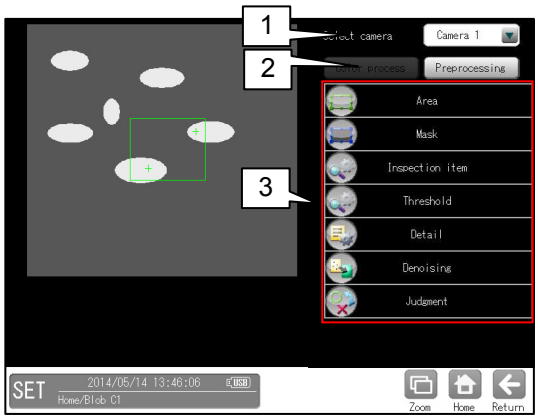
① Touch the [BLOB] button on the (Home) SET screen.



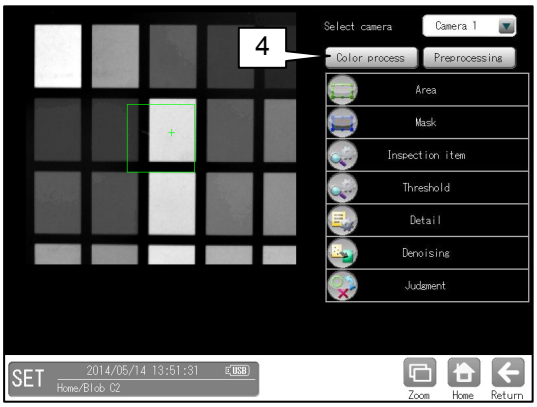
・See page 4-31 for how to edit the module flow.

② The Blob module setting screen will appear.

[When a monochrome camera is used]



[When a color camera is used]



1. [Select Camera] drop down list

Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".
In 2 Trigger mode, select a camera depending on the Object type number. See page 4-6.

2. [Preprocessing] button

Preprocessing will make the captured image easy for inspection.
See page 4-56 for the functions and setting procedures.

3. [Setting] icons

- Area => [1]
- Mask => [2]
- Inspection item => [3]
- Threshold => [4]
- Detail => [5]
- Judgment => [6]
- Denoising => [7]

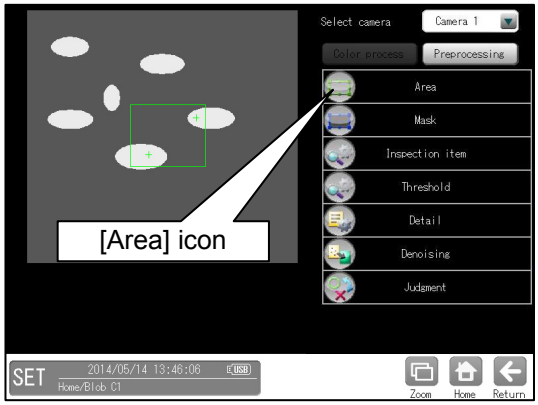
4. [Color preprocess] button
(When a color camera is used)

When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)
See page 4-68 for the function and setting procedures.

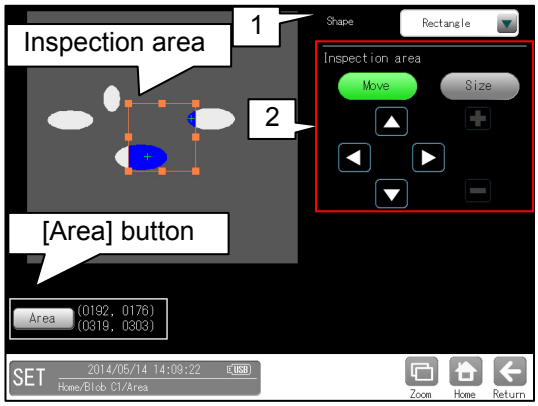
[1] [Area] icon

Set the inspection area.

① Touch the "Area" icon on the Blob module setting screen.



② The Area setting screen will appear.



1. [Shape] drop down list

Select the shape of the inspection area.
"Rectangle", "Circle", "Ellipse", "Polygon", "Rotate rectangle" or "Arc".

2. [Inspection area] buttons

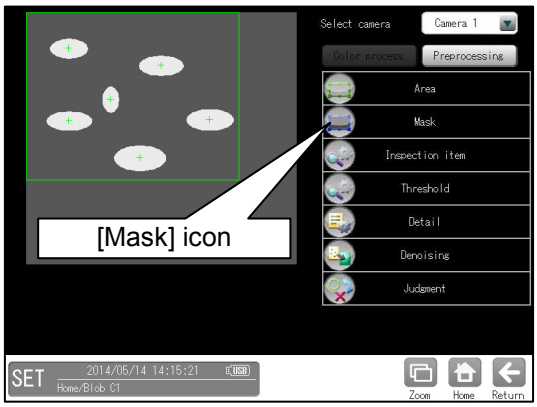
Define the inspection area with the [Area], [Move], [Size], [Direction] and [+] [-] buttons.

・See page 3-6 for setting the inspection area

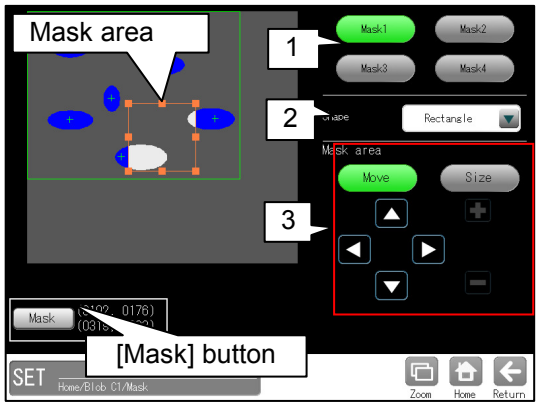
[2] [Mask] icon

When you want to avoid inspecting one or more areas within the inspection area, you can create up to four mask areas.

① Touch the [Mask] icon on the Blob module setting screen.



② The Mask setting screen will appear.
The screens below are when “Rectangle” is selected for “Shape”.



1. [Mask 1] to [Mask 4] buttons
Touch one of the mask buttons: [Mask 1] to [Mask 4].

2. [Shape] drop down list
Select a shape for the mask area: "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon".

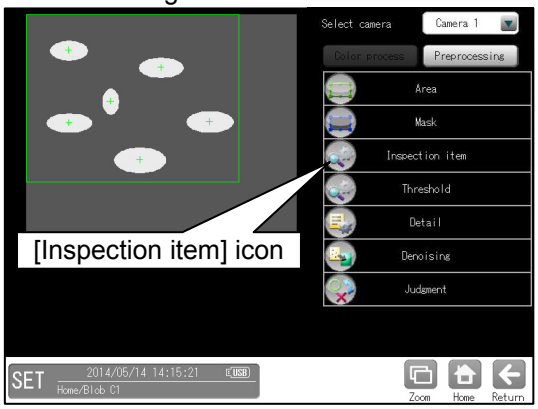
3. [Mask area] buttons
Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.

・See page 3-6 for setting the Mask areas.

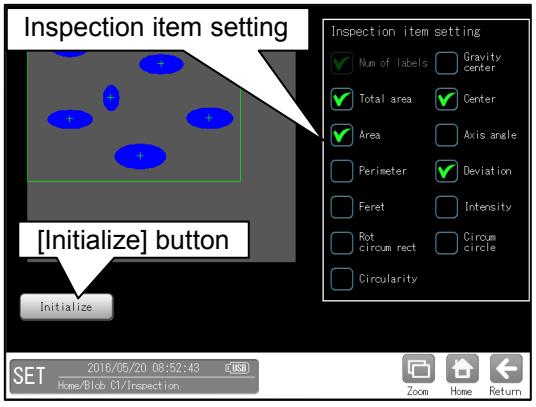
[3] [Inspection item] icon

With the Blob module, the device labels a unique number to each blob detected in the inspection area (labeling). You can inspect the number of blobs and the total area size of all the blobs, as well as any of the following desired items: "Area", "Perimeter", "Feret (diameter)", “Rot circum rect”, “Circularity”, "Gravity center", "Center", "Axis angle", "Deviation", “Intensity” and “Circum circle”. You can select more than one item to inspect.

① Touch the [Inspection item] icon on the Blob module setting screen.



② The Inspection item settings screen will appear. Touch the check box of the item you want to inspect to show ☑.

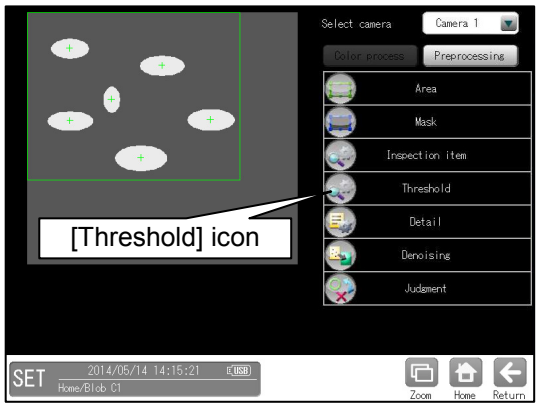


[Inspection items] check boxes
"Total area", "Area", "Perimeter", "Feret (diameter)", “Rot circum rect”, “Circularity”, "Gravity center", "Center", "Axis angle", "Deviation", “Intensity” and “Circum circle”.

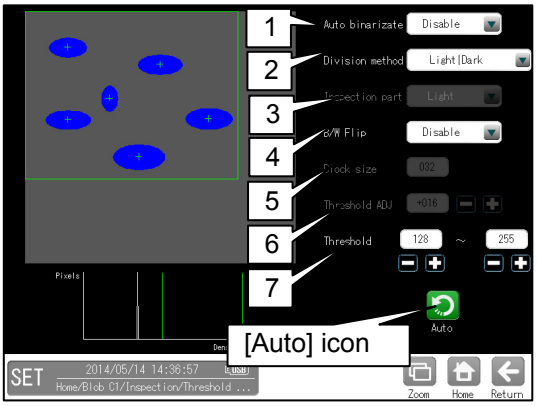
Note: Only one of “Rot circum rect” or “Circum circle” can be checked.

[4] [Threshold] icon

① Touch the [threshold] icon on the Blob module setting screen.



② The threshold setting screen will appear.

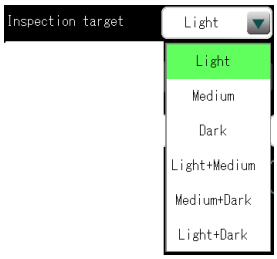


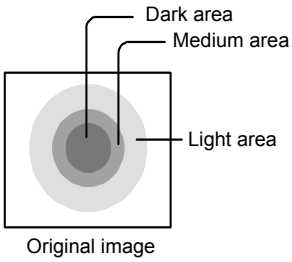
The "Threshold" refers to the criteria used to divide a grayscale image (the device captures images as 256 shades of gray) into white and black areas.
When the gray value of a pixel is larger than this threshold value, it is converted into white or black otherwise.
In addition, when you select "Light | Medium | Dark" as the "Division method", the device will convert the image into three brightness areas. Further, you can use any two of the three areas to make a combined area ("Light + Medium", "Medium + Dark" and “Light + Dark) as the inspection object.

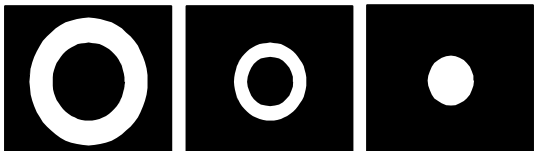
1. [Auto binarization] drop down list
Select "Disable", “Entire” or "Block".
Entire/Block: The device sets the threshold values automatically to the selected area for binarization of each image captured.

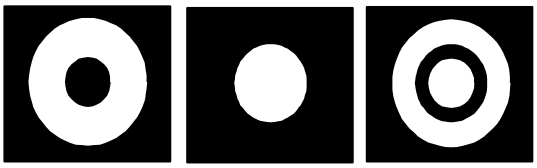
2. [Division method] drop down list
Select "Light | Dark" or "Light | Medium | Dark" for conversion of a grayscale image.
Light | Dark: The device will convert the image into white and black areas.
Light | Medium | Dark: The device will convert the image into white, gray and black areas.

3. [Inspection part] drop down list
Select the combination of two inspection objects from the six options:
"Light", "Medium", "Dark", “Light+Medium”. ”Mediumi+Dark” or “Light+Dark”









· The white areas are inspection object areas

4. [B/W Flip] drop down list
(When the Division method is "Light | Dark")
Select "Enable" or "Disable".
Enable: The device will convert the area identified as white into black, and the area identified as black into white.

5. [Block Size] data input box
(When the Auto binarization is "Block")
Set the block size within 1 and 256.

6. [Threshold ADJ (adjust)] data input boxes
(When the Auto binarization is "Block")
Set the Threshold within -128 and 127 with the data input boxes and number keypad or arrow keys.

7-1. [Threshold] data input box

When "Disable" is selected for [Auto binarization] drop down list, set the upper and lower limits

Two methods are available for setting the upper and lower limits:

Manual setting while looking at the captured image, or Auto setting by using an optimum threshold value from the image currently displayed (reference image).

[To set manually]

Touch the [Threshold] data input box (lower or upper limits) and enter a value with the number keypad.

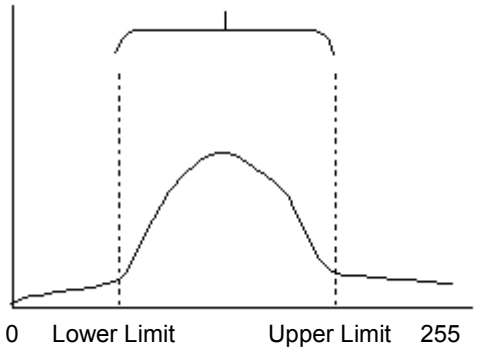
Only the lower limit is set normally.

When the upper limit is set, the device will detect only the areas with gray levels between the upper and lower limits.

The current inspection area is displayed in blue on the background reference image.

Adjust the upper and lower limits such that the inspection area becomes what you want.

If you set the upper and lower limits, the controller will inspect only the areas with gray levels between the upper and lower limits.



[To set automatically]

To set the upper and lower limits automatically, touch the [Auto] icon. The device enters an optimum threshold value automatically on the lower limit data input box.

You may fine tune the settings with the upper and lower limits data input boxes and number keypad after they have been set automatically.

7-2. [Exempt] data input box

(When the Auto binarization is "Block")

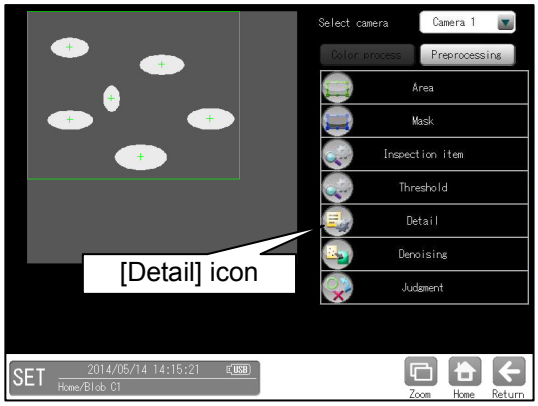
Set the threshold to judge as Black and White (0 to 255).

Note:

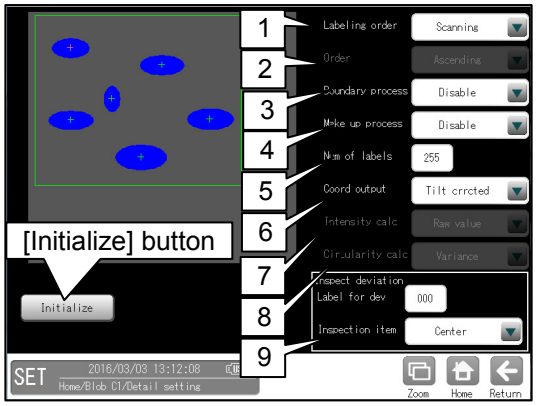
White must be set to a higher value than Black.

[5] [Detail] icon

① Touch the [Detail] icon the Blob module setting screen,



② The detail setting screen will appear.

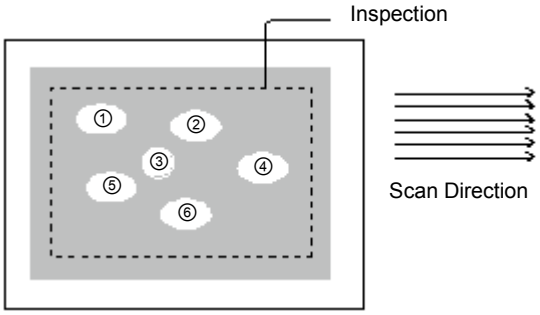


1. [Labeling order] drop down list

Select the labeling order for each blob from the following options.

- **Scanning order**

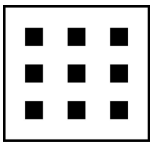
The device scans the inspection area from the upper left to the lower right, and assigns numbers to blobs in the order detected during the scanning.



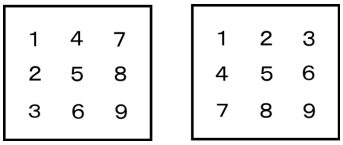
Assigns numbers to the blobs in the order shown above.

- **X->Y order**
  Assigns label numbers to blobs in the ascending order of their Y coordinates.
  Use this when blobs are close to the X-axis.
- **Y->X order**
  Assigns label numbers to blobs in the ascending order of their X coordinates
  Use this when blobs are close to the Y-axis.

  When numbers are assigned to blobs according to the X or Y order of the gravity center of the blobs (as shown below), and if the image is tilted a little, the device may assign labels to such blobs independently of the order of the blobs positions.



  In case of the above image, the labeling result by selecting the "X->Y" or "Y->X" will be as shown below.



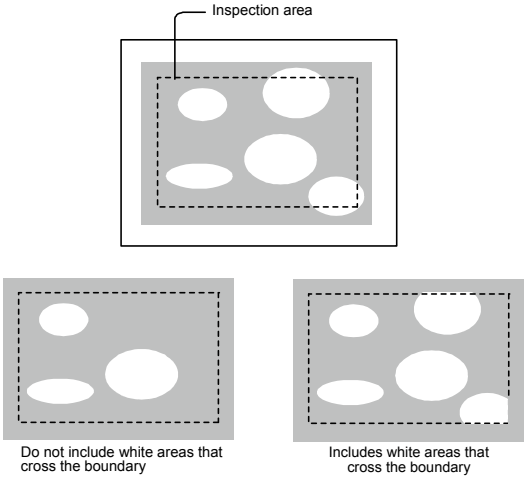
X -> Y order Y -> X order

You can set the label number order as either ascending or descending with the [Order] button for the following:

- **Area size order**
  Assigns label numbers to blobs in the order of the area size of the blobs detected.
- **Perimeter order**
  Assigns label numbers to blobs in the order of their perimeter.
- **Feret diameter X order**
  Assigns label numbers to blobs in the order of their X Feret diameters.
- **Feret diameter Y order**
  Assigns label numbers to blobs in the order of their Y Feret diameters.
- **Gravity Center X order**
  Assigns label numbers to blobs in the order of their gravity center X coordinates.
- **Gravity Center Y order**
  Assigns label numbers to blobs in the order of their gravity center Y coordinates.
- **Center X order**
  Assigns label numbers to blobs in the order of center coordinates in the X direction.
- **Center Y order**
  Assigns label numbers to blobs in the order of center coordinates in the Y direction.
- **Main axis angle order**
  Assigns label numbers to blobs in the order of their main axis angles.

2. **[Order] drop down list**
   Select "Ascending" or "Descending" when an option following “Area size” is selected.

3. **[Boundary process] drop down list**
   Select "Enable" or "Disable".
   (Default setting: Disable)
   The boundary processing is used to select whether or not to include white pixel areas on the boundary of the inspection area as a part of the blob or not.



4. **[Make up process] drop down list**
   Select "Enable" or "Disable".
   (Default setting: Disable)
   Make up process is used to select a processing method when black pixels exist within a detected blob (groups of white pixels).
   Enable: The device will change the black pixels into white.
   Disable: The device will inspect various items (area, gravity, etc.) including the black pixels.

Before make up After make up

5. **[Number of labels] data input box**
   Enter the maximum number of objects (Label 1 to 255) to inspect. When objects more than the set number are found, they will not be inspected.

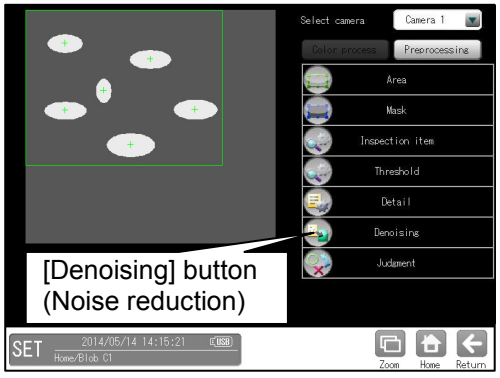
6. **[Coordinates output] drop down list**
   Select "Original" or "Tilt corrected".
   (Default setting: Tilt corrected)
   - **Original:** Outputs the coordinates of the captured image without tilt angle correction of the inspection results.
   - **Tilt corrected:** Outputs the coordinates of the captured image after tilt angle correction of the inspection results.

7. **[Intensity calc] drop down list**
   Select "Raw value", “Distance from lower”, “Min distance” or "Max distance" for intensity calculation.
8. **[Circularity calc] drop down list**
   Select "Variance", “Radius ratio” or “Area ratio” for circularity calculation.
   - **Variance of radius**
     Use the ratio of the variance in θ axis over all the variances in the calculation.
   - **Radius ratio**
     Use the ratio of maximum radius and minimum radius over average radii in the calculation.
   - **Area ratio**
     Use the ratio of area over perimeter length in the calculation.
9. **[Label for dev] data input box and [Inspection item] drop down list**
   Enter the label number for deviation inspection, (0 to 254) and select inspection item.

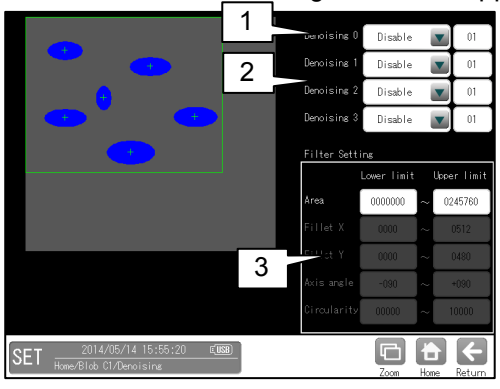
[6] Denoising (Noise reduction)

After a grayscale image is converted into a binary image, pixel noises may appear on the image. The noise reduction function lets the device remove the pixel noises by using "Dilate" and "Erode" processes.
Set the upper and lower limits for the area and X/Y Feret diameters for the white pixel areas to inspect. The device will identify the areas within the range as blobs. Anything outside the range will be treated as noise and will be eliminated.

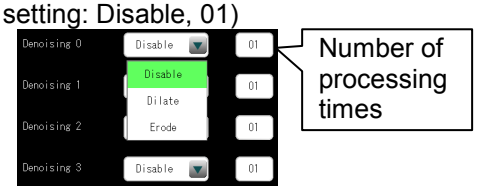
① Touch the [Denoising] button on the Detail setting screen.



② The noise reduction setting screen will appear.



1. [Denoising 0] drop down list
Select "Disable", "Dilate" or "Erode" and then enter the number of times to process the image with the data input box and number keypad (1 to 15).
(Default setting: Disable, 01)

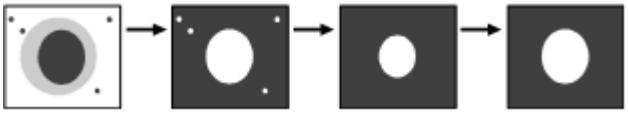


- **Dilate:** When there is even one white pixel near the target area, all of that area will be converted into white.
- **Erode:** When there is even one black pixel near the target area, all of that area will be converted into black.
  Normally, you can remove pixel noises by repeating the "Dilate" or "Erode" processes a few times.
  The more times the image is processed, the clearer the resulting image will be.

2. [Denoising] (1 to 3) drop down lists
From the [Denoising 1] drop down list, select the reverse procedure of the process selected for [Denoising 0] (Dilate or Erode).
Set [Denoising 2] and [Denoising 3] as necessary.

・An example of Dilate -> Erode

・An example of Erode -> Dilate



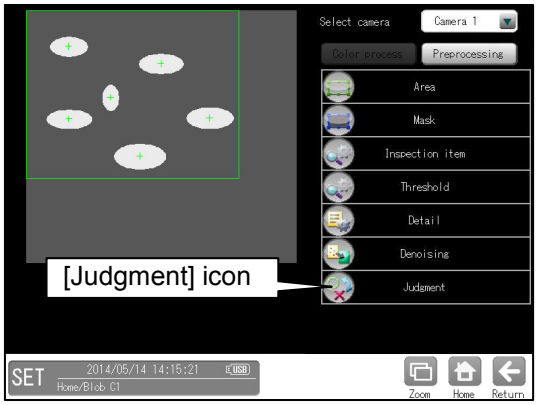
3. [Area], [Feret X], Feret Y], [Axis angle] and [Cirularity] data input boxes
When "Dilate" or "Erode" process is repeated more than needed, or make processing level too strong, the pixels you want to inspect may also be removed. In such a case, it is recommended to remove noises by using Area filter and Feret diameter filter.
To use these functions, set the upper and lower limits for each filter.

- **Upper limit:** The device will not process a white area with an area size or Feret diameter X/Y higher than the upper limit.
- **Lower limit:** The device will not process a white area with an area size or Feret diameter X/Y lower than the lower limit.

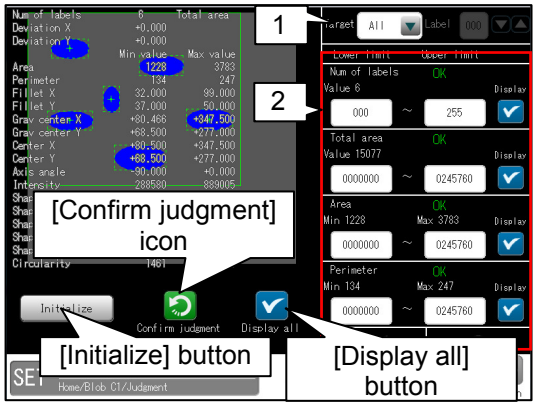
[7] [Judgment] icon

Set the upper and lower limits for OK/NG judgment based on the results of processing the Blob module.
When the inspection result is within the range you set, the device will output an "OK" or "NG" if otherwise.

① Touch the [Judgment] icon on the Blob module setting screen.



② The judgment setting screen will appear.



1. **[Target] drop down list**
   Select "All" or "Specify" for label to judge.
   When "Specify" is selected, enter the label number to use (0 to 254) with the [Label number] data input box and number keypad.

2. **Inspection items, upper and lower limits and judgment data input boxes**
   Enter the judgment criteria (upper and lower limits) for each inspection item.

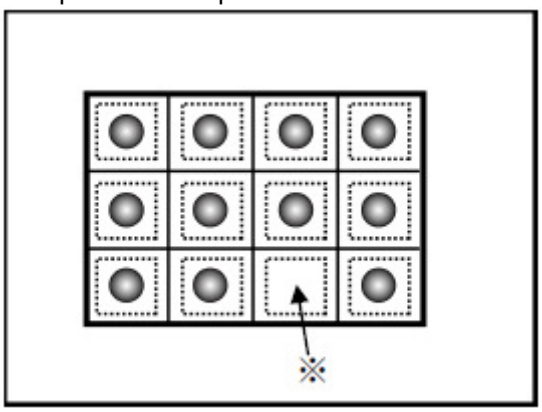
   [Inspection items]
   "Number of labels", "Total area", "Area", "Perimeter", "Feret (diameter) X/Y", "Gravity center X/Y", "Center X/Y", "Axis angle", “Intensity” “Shape center X/Y”, “Shape angle”, “Circularity”, “Shape Length L/S” and “Deviation X/Y”.

- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting.
  It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

4-4-9 Point module

This module sets multiple inspection areas (points) on the captured image and binarizes each point or inspect the intensity of each point for black and white judgment or intensity OK/NG judgment.

・ Inspection example:



Set a point to each section in a box and make judgment based on binarization or intensity difference. In the above example, ※ section is judged as NG.

■ Output details

The following inspection results are output.

● When the Inspection mode is “Binarize”

- **Number of effective inspected points**
- **Color**

● When the Inspection mode is “Gray level”

- **Average intensity**
  Average intensity of the pixels in the point.
- **Maximum intensity**
  Maximum intensity of the pixels in the point.
- **Minimum intensity**
  Minimum intensity of the pixels in the point.
- **Intensity difference**
  Intensity difference between the maximum intensity and minimum intensity in the point.
- **Intensity deviation**
  Intensity deviation of the points.

・OK/NG judgment

The upper and lower limits of each of the above inspection item are set and used as the criteria for "OK" and "NG" judgment.

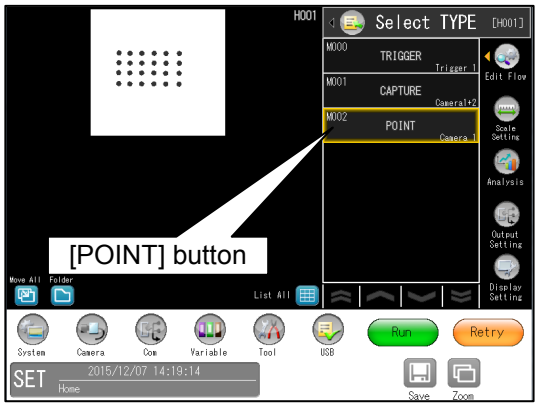
OK: All the inspection results are within the criteria

NG: One or more of the inspection results are out of the criteria.

■ Operation procedures

(The screens shown below are typical example)

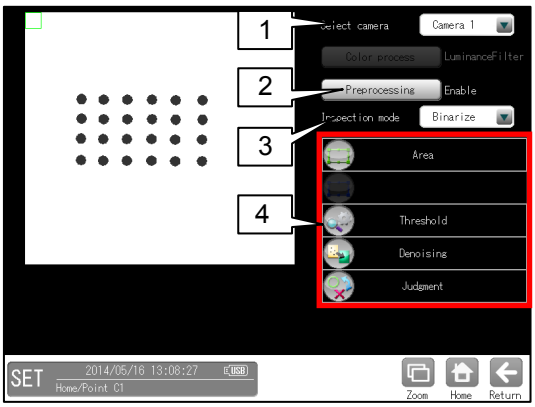
① Touch [POINT] button on the (Home) SET screen.



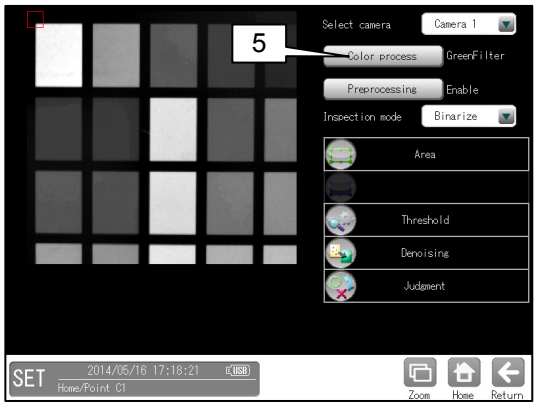
・See page 4-31 for how to edit the module flow.

② The Point module setting screen will appear.

[When a monochrome camera is used]



[When a color camera is used]



1. [Select Camera] drop down list

Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".

In 2 Trigger mode, select a camera depending on the Object type number.

See page 4-6.

2. [Preprocessing] button
Preprocessing will make the captured image easy for inspection.
See page 4-56 for the functions and setting procedures.

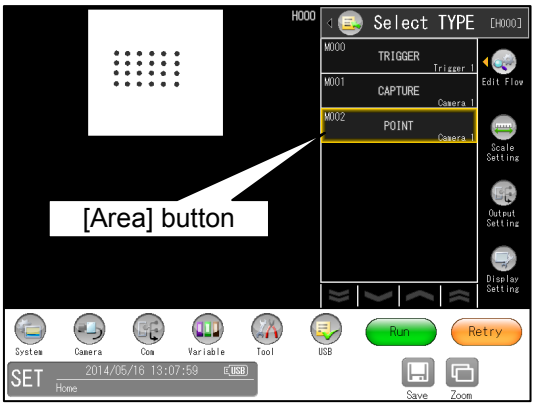
3. [Inspection mode] drop down list
Select “Binarize” or “Gray level”.

4. [Setting] icons
- Area => [1]
- When inspection mode is “Binarize”: Threshold => [2]
- When inspection mode is “Binarize”: Denoising => [3]
- Judgment => [4]

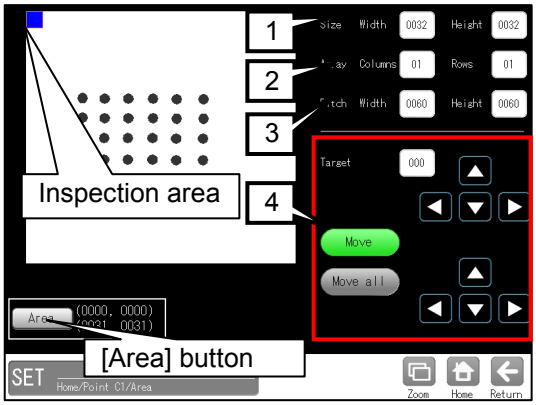
5. [Color preprocess] button (When a color camera is used)
When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)
See page 4-68 for the function and setting procedures.

[1] [Area] icon
Set the inspection areas on captured images.

① Touch the "Area" button on the Point module setting screen.



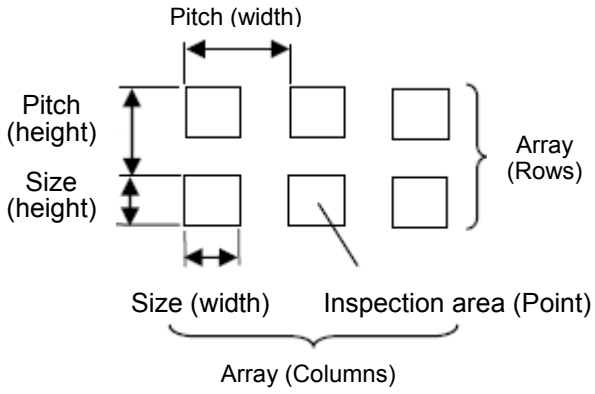
② The Area setting screen will appear.



1. [Size] data input boxes
Enter width and height of the inspection area (point).

2. [Array] data input boxes
Enter number of columns and rows of the array or the inspection areas (points).

3. [Pitch] data input boxes
Enter width and height between the inspection areas (points).

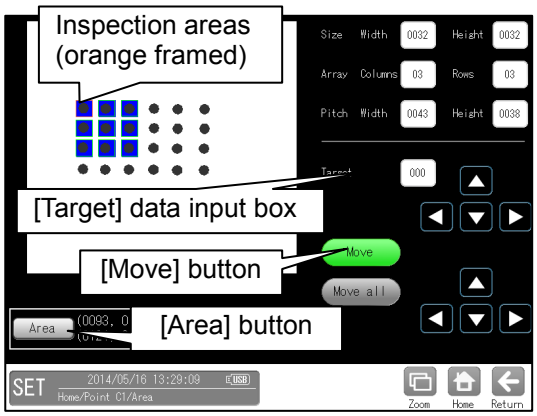


4. [Target] setting buttons

Once the Size, Array and Pitch are set, the inspection areas are shown on the screen.

[Example] Size & Pitch = 32, Array = 3 x 3

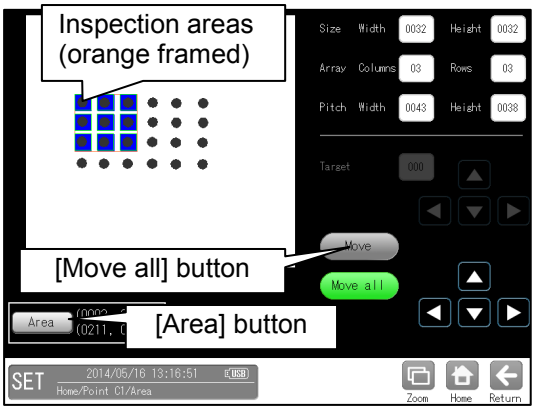
[When the “Move” button is green]



You can move an inspection area by dragging it, with [Area] button or [Directions] buttons. The Target inspection area can be selected with the [Target] data input box.

The Target number starts with 0 and increment by 1 in the order of row and column from the upper left.

[When the “Move all” button is green]



You can move all the inspection areas with [Area] button or [Directions] buttons.

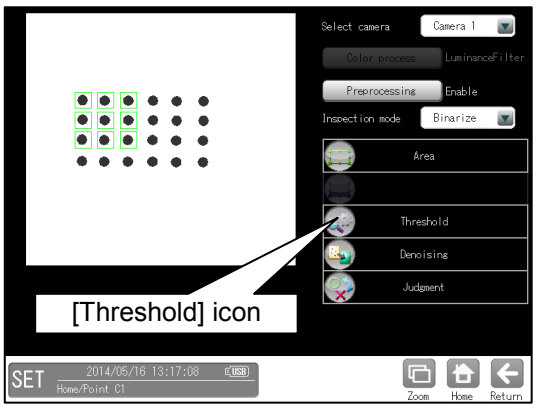
[2] [Threshold] icon

The "threshold" refers to the criteria used to divide a grayscale image (the device captures images as 256 shades of gray) into white and black areas.

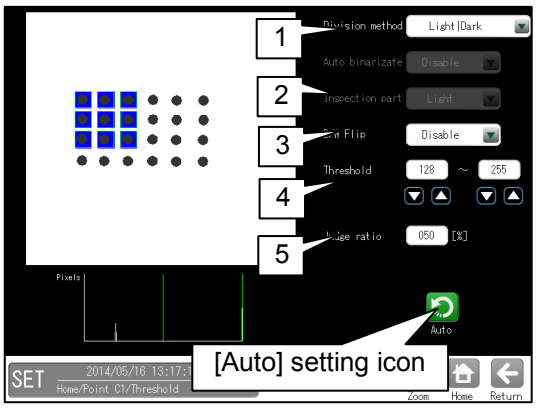
When the gray value of a pixel is larger than this threshold value, it is converted into white or black if otherwise.

In addition, when you select "Light｜Medium｜Dark" as the "Division method", the device will convert the image into the three brightness areas. Further, you can use any two of the three areas to make a combined area ("Light + Medium", "Medium + Dark" and “Light + Dark) as the inspection object.

① Touch the [Threshold] icon on the Point module setting screen.



② The Threshold setting screen will appear.



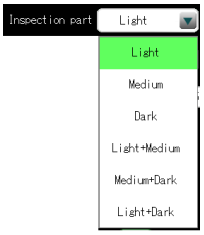
The "Threshold" refers to the criteria used to divide a grayscale image (the device captures images as 256 shades of gray) into white and black areas.

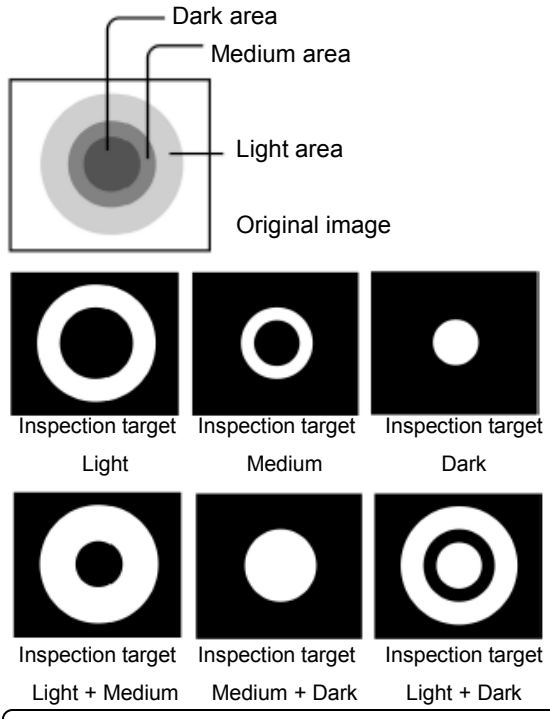
When the gray value of a pixel is larger than this threshold value, it is converted into white or black otherwise.

In addition, when you select "Light｜Medium｜Dark" as the "Division method", the device will convert the image into three brightness areas. Further, you can use any two of the three areas to make a combined area ("Light + Medium", "Medium + Dark" and “Light + Dark) as the inspection object.

1. **[Division method] drop down list**
   Select "Light | Dark" or "Light | Medium | Dark" for conversion of a grayscale image.
   Light | Dark: The device will convert the image into white and black areas
   Light | Medium | Dark: The device will convert the image into white, gray and black areas.

2. **[Inspection part] drop down list**
   Select the inspection target.
   “Light”, “Medium”, “Dark”. „Light + Medium“, “Medium + Dark“ or „Light + Dark“





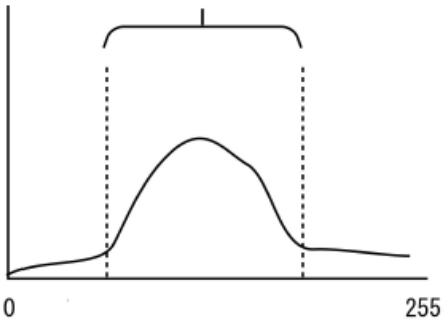
・The white areas are inspection areas

3. **[B/W Flip] drop down list**
   (When the Division method is "Light | Dark")
   Select "Enable" or "Disable".
   Enable: The device will convert the area identified as white into black, and the area identified as black into white.

4. **[Threshold] data input boxes**
   When "Disable" is selected for [Auto binarization] drop down list, set the upper and lower limits with the data input boxes and number keypad or arrow keys.
   Two methods are available for setting the upper and lower limits:
   Manual setting while looking at the captured image, or Auto setting by using an optimum threshold value from the image currently displayed (reference image).

[To set manually]
Touch the [Threshold] data input box (lower or upper limits) and enter a value with the number keypad.
Only the lower limit is set normally.
When the upper limit is set, the device will detect only the areas with gray levels between the upper and lower limits.
The current inspection area is displayed in blue on the background reference image.
Adjust the upper and lower limits such that the inspection area becomes what you want.

If you set the upper and lower limits, the controller will inspect only the areas with gray levels between the upper and lower limits.



[To set automatically]
To set the upper and lower limits automatically, touch the [Auto] icon. The device enters an optimum threshold value automatically on the lower limit data input box.
You may fine tune the settings with the upper and lower limits data input boxes and number keypad after they have been set automatically.

5. **[Judge ratio] data input box**
   Enter the judgment ratio within 0 and 100%.
   The device will judge the inspection area as white if more than the set ratio of the pixels in the inspection area are judged white.

[3] Denoising (Noise reduction) icon

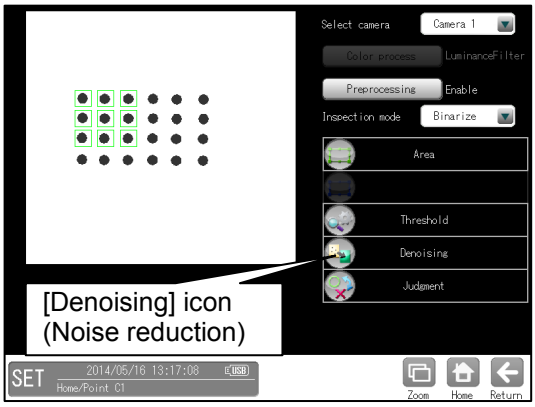
(When Inspection mode is "Binarize")

Set the noise reduction when the inspection mode is Binarize".

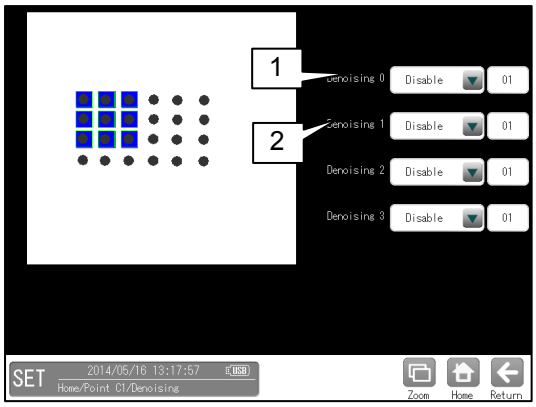
After a grayscale image is converted into a binary image, pixel noises may appear on the image. The noise reduction function lets the device remove the pixel noises by using "Dilate" and "Erode" processes.

Set the upper and lower limits for the area and X/Y Feret diameters for the white pixel areas to inspect. The device will identify the areas within the range as blobs. Anything outside the range will be treated as noise and will be eliminated.

① Touch the [Denoising] icon on the Point module setting screen.



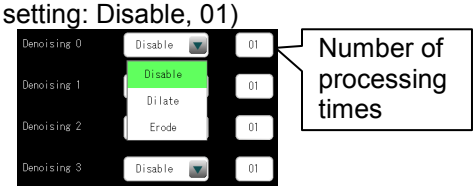
② The noise reduction setting screen will appear.



1. [Denoising 0] drop down list

Select "Disable", "Dilate" or "Erode" and then enter the number of times to process the image with the data input box and number keypad (1 to 15).

(Default setting: Disable, 01)



- **Dilate:** When there is even one white pixel near the target area, all of that area will be converted into white.
- **Erode:** When there is even one black pixel near the target area, all of that area will be converted into black.

  Normally, you can remove pixel noises by repeating the "Dilate" or "Erode" processes a few times.

  The more times the image is processed, the clearer the resulting image will be.

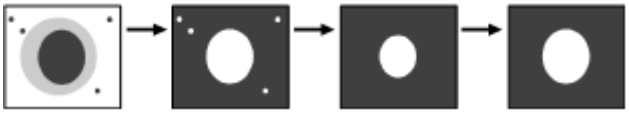
2. [Denoising] (1 to 3) drop down lists

From the [Denoising 1] drop down list, select the reverse procedure of the process selected for [Denoising 0] (Dilate or Erode).

Set [Denoising 2] and [Denoising 3] as necessary.

・An example of Dilate -> Erode

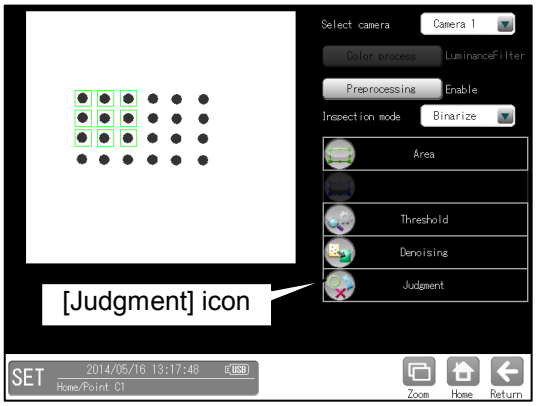
・An example of Erode -> Dilate



[4] [Judgment] icon

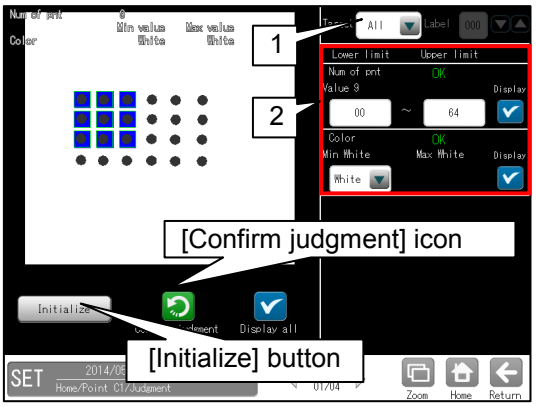
Set the upper and lower limits for OK/NG judgment based on the results (area value) of processing the Point module.
When the inspection result is within the range you set, the device will output an "OK", or "NG" if otherwise.

① Touch the [Judgment] icon on the Point module setting screen.

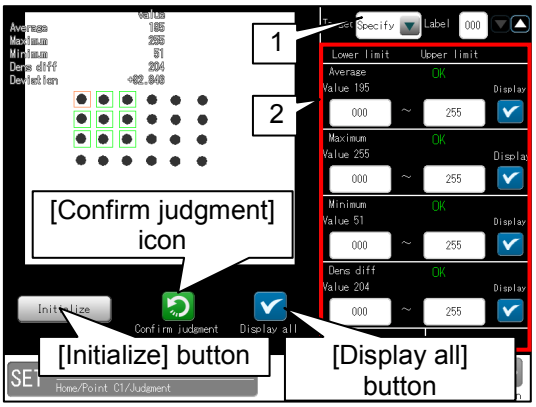


② The Judgment setting screen will appear.

・When Inspection Mode is " Binarize"



・When Inspection Mode is "Gray diff"



1. [Target] drop down list

Select "All" or "Specify" for label to judge.
When "Specify" is selected, enter the label number to use (0 to 254) with the [Label number] data input box and number keypad.

2. Inspection items, upper and lower limits, and judgment data input boxes

Enter the judgment criteria (upper and lower limits) for each inspection item.

[Inspection items]

The items differ depending on the inspection mode:

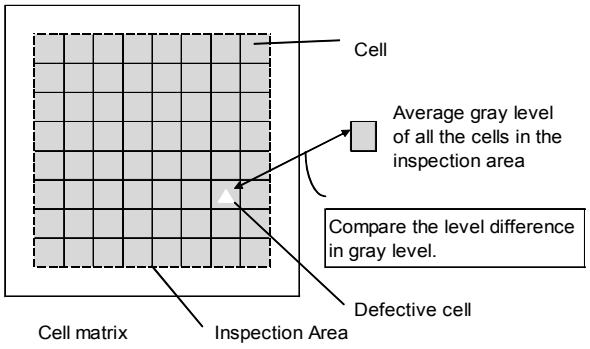
- **When Inspection mode is "Binarize"**
  - "Effective number of points"
  - "Color"
- **When Inspection mode is "Gray diff"**
  - "Average intensity"
  - "Maximum intensity"
  - "Minimum intensity"
  - "Intensity difference"

- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting.
  It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

4-4-10 Defect inspection module

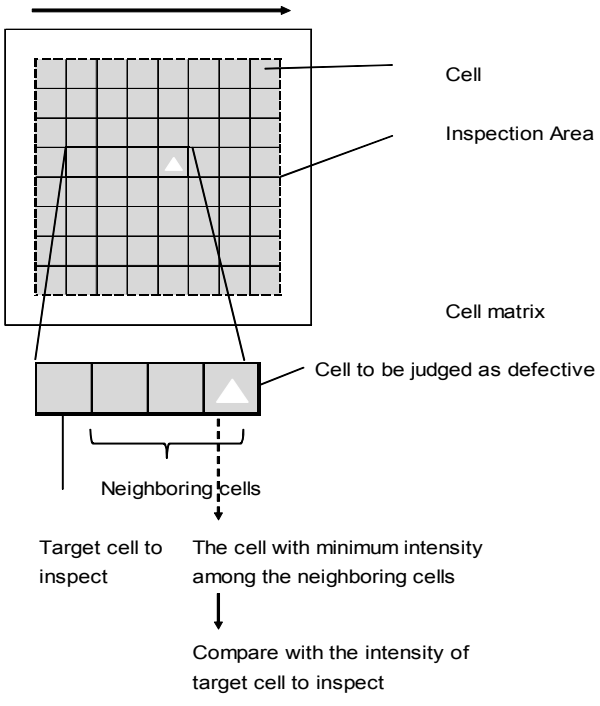
The defect inspection module functions on a cell (a square within an inspection area). It inspects defect cells by comparing the gray level of a cell with the gray level of the whole image or the gray levels of neighboring cells.
The defect inspection module has two inspection modes:
"Compare with the gray level of the whole image" and "Compare with the gray level of neighboring cells" (inspects flaws and stains).

- **Defect inspection by comparing the cell with the whole image**
  The device compares the average gray level of each cell with the average gray level of all cells in the inspection area. Cells with a larger difference than the specified threshold value are determined as defective cells.



- **Defect detection by comparing the cell with neighboring cells (detects flaws and stains)**
  The device compares the average gray level of each cell with average gray level of neighboring cells. Cells with a larger difference than the specified threshold value are determined as defective cells.

When Neighboring cells = "3", scan = "X direction" and Detection target ="Light":



Process flow of the Defect inspection module

This module classifies the inspected cells into defective or normal.

The defective cells are treated as blobs.

Preprocessing

・Preprocesses the image.

Defect inspection (Binarization)

・Classifies the cells into defective or normal.

Labeling

・Assigns labels to the defective cells (blobs).

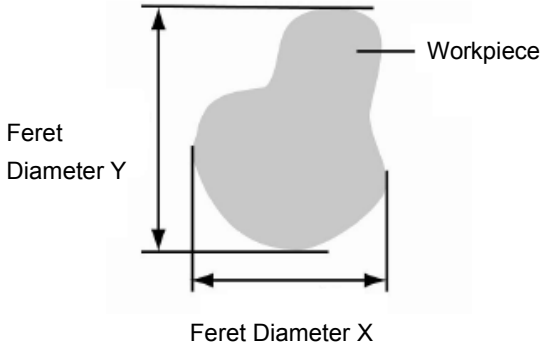
Output results

・Outputs the difference in gray levels and labeling results.

■ **Output details**

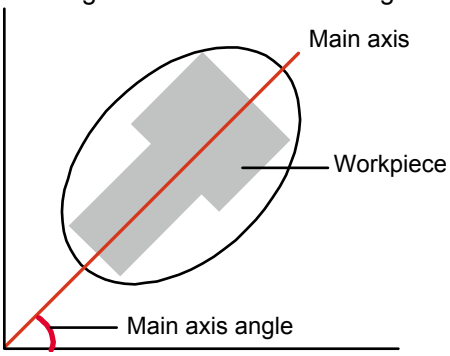
The device outputs the following inspection results.

- **Number of labels**
  The number of blobs detected in the inspection area.
- **Total area size**
  The total area (number of pixels) of all the blobs.
- **Area size**
  The size (number of pixels) of each blob.
- **Perimeter**
  The perimeter of each blob.
- **Feret (diameter)**
  The X and Y Feret diameters of each blob.



・When a minimum rectangle that contains a workpiece is drawn, the length between the two vertical sides of the rectangle is referred to as Feret diameter X and the length between the two horizontal sides is referred to as Feret diameter Y.

- **Gravity center**
  The coordinates of the gravity center of each blob.
- **Center**
  The center coordinates of each blob.
- **Axis angle**
  The angle of the main axis through each blob.



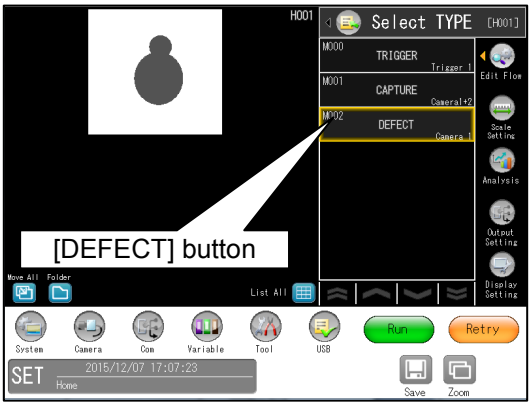
・When a minimum ellipse that contains a workpiece is drawn, a straight line passing through the center of the two ends of the ellipse is referred to as the main axis. The angle made relative to the X-axis (horizontal line) is referred to as the main axis angle.

- **Deviation**
  The coordinates difference between the gravity center (or simply the center) of the reference image and the target image (blob selected by the label number).
- **OK/NG judgment**
  The upper and lower limits of each of the above inspection item are set and used as the criteria for "OK" and "NG" judgment.
  OK: All the inspection results are within the criteria
  NG: One or more of the inspection results are out of the criteria.

■ Operation procedures

(The screens shown below are typical example)

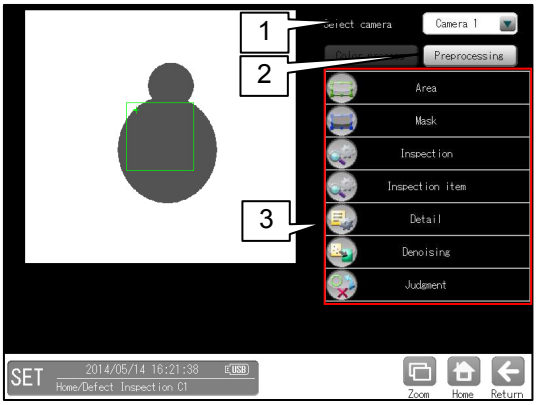
①Touch the [DEFECT] button on the (Home) SET screen.



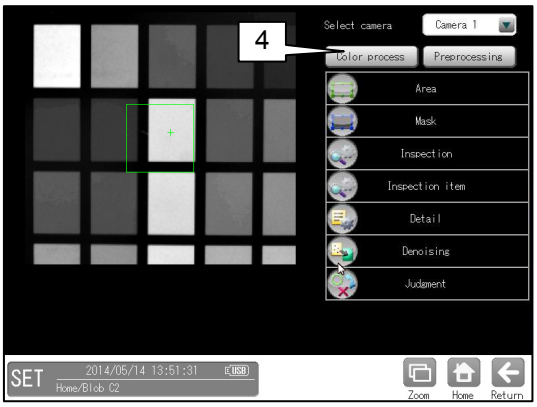
・See page 4-31 for how to edit the module flow.

② The Defect inspection setting screen will appear.

[When a monochrome camera is used]



[When a color camera is used]



1. [Select Camera] drop down list
Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".
In 2 Trigger mode, select a camera depending on the Object type number. See page 4-6.

2. [Preprocessing] button
Preprocessing will make the captured image easy for inspection.
See page 4-56 for the functions and setting procedures.

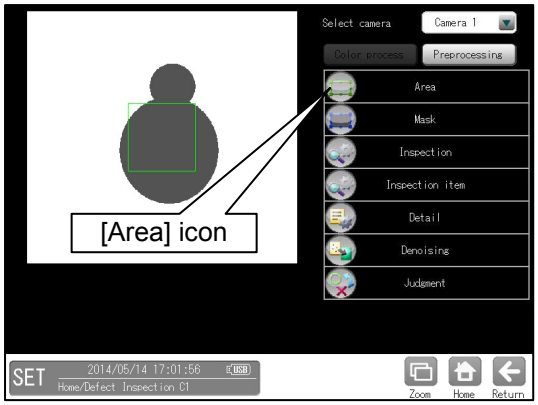
3. [Setting] icons
- Area => [1]
- Mask => [2]
- Inspection => [3]
- Inspection item => [4]
- Detail => [5]
- Denoising => [6]
- Judgment => [7]

4. [Color preprocess] button
(When a color camera is used)
When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)
See page 4-68 for the function and setting procedures.

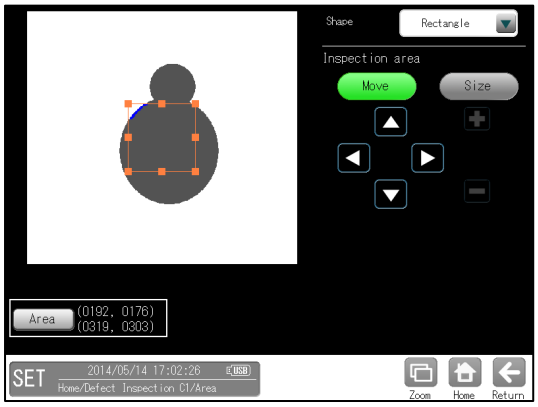
[1] [Area] icon

Set the defect inspection area in captured image.

① Touch the "Area" icon on the Defect inspection module setting screen.



② The Area setting screen will appear.



1. [Shape] drop down list

Select the shape of the inspection area.
"Rectangle", "Circle", "Ellipse", "Polygon", "Rotate rectangle" or "Arc".

2. [Inspection area] buttons

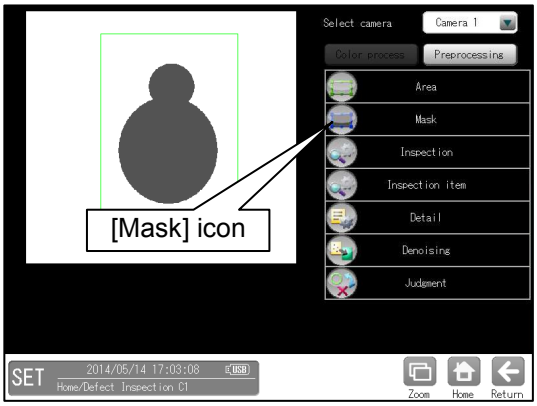
Define the inspection area with the [Area], [Move], [Size], [Direction] and [+] [-] buttons.

・See page 3-6 for setting the inspection area.

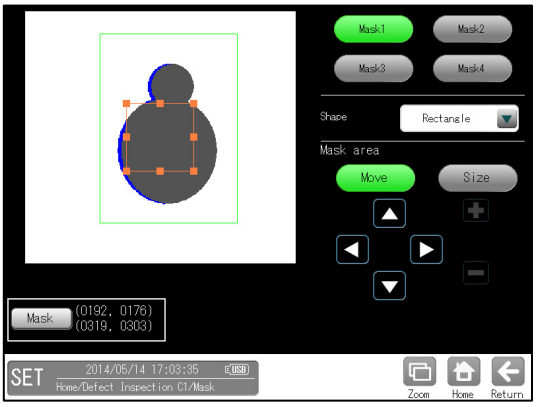
[2] [Mask] icon

When you want to avoid inspecting one or more areas within the inspection area, you can create up to four mask areas.

① Touch the [Mask] icon on the Defect inspection module setting screen.



② The Mask setting screen will appear.
The screens below are when “Rectangle” is selected for the “Shape”.



1. [Mask 1] to [Mask 4] buttons

Touch one of the mask buttons: [Mask 1] to [Mask 4].

2. [Shape] drop down list

Select the shape for the mask area:
"Disable", "Rectangle", "Circle", "Ellipse" or "Polygon".

3. [Mask area] buttons

Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.

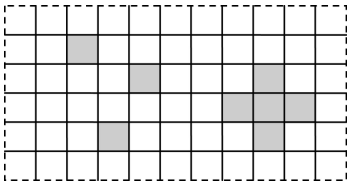
・See page 3-6 for setting the Mask areas.

[3] [Inspection] icon

Select an inspection mode and items for the Defect inspection:
"Whole", "Flaw" or "Stain" inspection modes, inspection items, etc. of the defect inspection.

● When "Whole" is selected as the Inspection mode

The device compares the average gray level of each cell with average gray level of the whole inspection area.
Cells with a larger difference than the specified threshold value are treated as defective cells.



The device judges that cells are defective when they satisfy the following conditions:

Lvl (whole): the average gray level of the whole inspection area
Lvl (cell): the average gray level of the cell

・When the inspection target is set to "light"
Lvl (cell) – Lvl (whole) > Threshold for "light"

・When the inspection target is set to "dark"
Lvl (whole) - Lvl (cell) > Threshold for "dark"

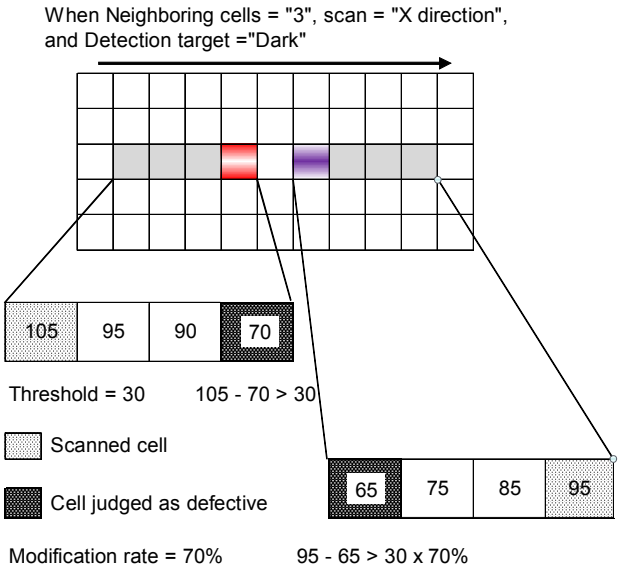
・When the inspection target is set to "light｜dark"
Lvl (cell) – Lvl (whole) > Threshold for " light｜dark "
and
Lvl (whole) – Lvl (cell) > Threshold for " light｜dark "

● When "Flaw" or "Stain" inspection is selected as the Inspection mode

The device compares the average gray level of a cell under inspection with average gray level of the neighboring cells and judges a cell as defective when it satisfies the following conditions.

- **"Flaw inspection", "Stain inspection"**
  The neighboring cell having gray level different from that of the scanned cell is judged as defective.

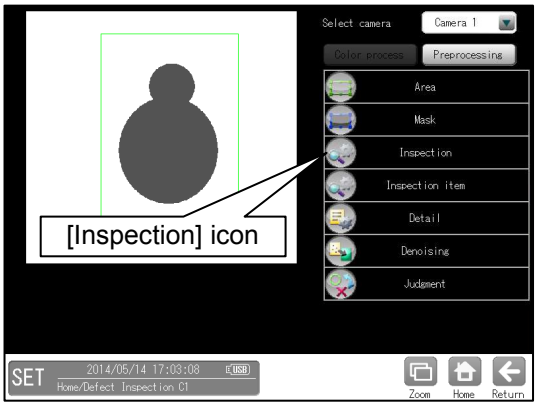
- **"Stain inspection"**
  The scanned cell having gray level different from that of the neighboring cell is judged as defective.
  (Modification rate for the threshold can be used)



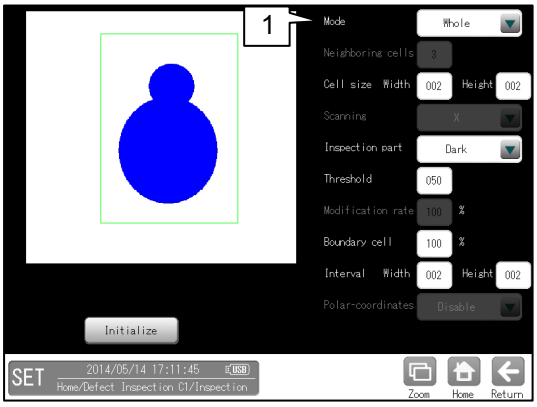
Note:

- **Flaw inspection**
  This inspection is effective when looking for defects of points and lines.
- **Stain inspection**
  This inspection is effective when looking for defects that cover an area. By using this function together with the "Make up process" in the Detail settings, the device can inspect the size of the defects.

① Touch the [Inspection] icon on the Defect inspection module setting screen.



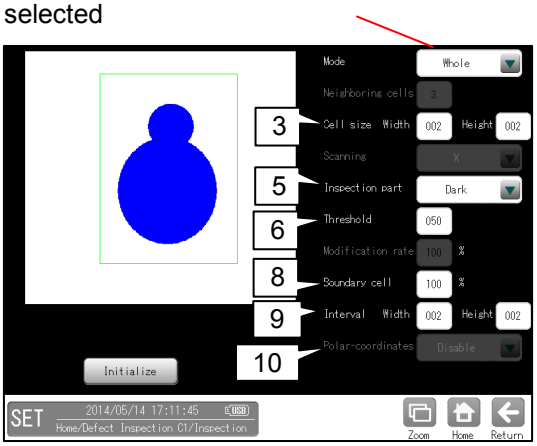
② The Inspection settings screen will appear.



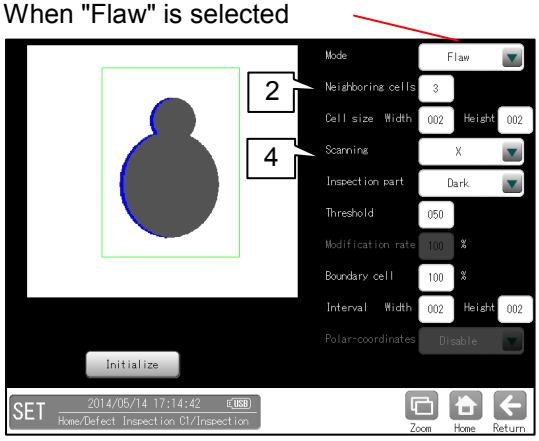
1. [Mode] drop down list

Select the inspection mode to use for the defect inspection.
"Whole", "Flaw" or "Stain"

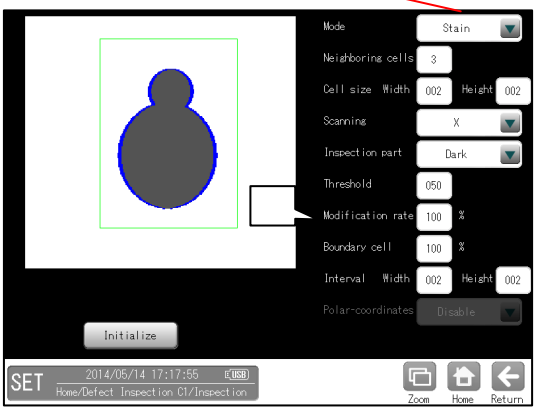
When "Whole (whole image difference)" is selected



When "Flaw" is selected



When "Stain" is selected



2. [Neighboring cells] data input box
(When "Flaw" or "Stain" mode is selected)

Enter the number of neighboring cells (1 to 8) for the gray level comparison.

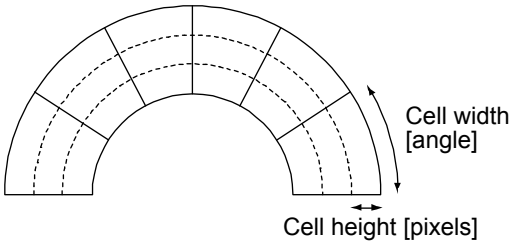
Note:
The 2nd to 9th cells are used as neighboring cells for comparing gray levels.

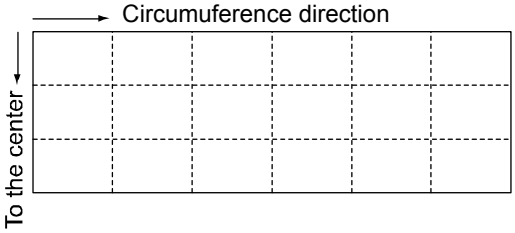
3. [Cell size] (width, height) data input boxes

Enter the cell size within the ranges below.

- **When camera is IV-S300C7/C8, IV-S200C6 or IV-C250C8:**
  Width: 1 to 511, Height: 1 to 149
- **When camera is IV-S300C2/C3/C5, IV-S210C2 or IV-C250C3:**
  Width: 1 to 1599, Height: 1 to 1199

When an "Arc" is selected for the inspection area shape, the device first makes a polar conversion of the arc area into rectangular areas as shown in the figure below.





4. [Scanning] drop down list
(When "Flaw" or "Stain" inspection is selected)

Select direction to inspect defect:
"X", "Y" or "XY" axes.

5. [Inspection target] drop down list

Select the inspection target.
"Light", "Dark" or "Light｜Dark"

6. [Threshold] (Difference in gray levels) data input box

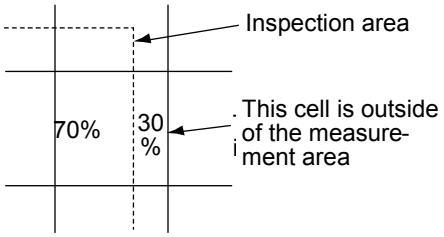
Enter the gray level difference (1 to 255) to be used as the criteria for a defect inspection.

7. [Modification rate] (threshold modification rate) data input box
(When "Stain" inspection is selected)

Enter the rate (50 to 200%) used for modifying the Threshold.
The device will search for defective cells in the set scanning direction and use
Threshold x this Modification rate
as the threshold for the defect inspection.

8. [Boundary cell] data input box

Enter the effective pixel ratio (1 to 100%) for cells on boundaries between the inspection area and the mask area.
The Boundary cell function excludes cells with invalid pixel gray levels near the boundary when calculating the average gray level.



9. [Interval] data input box

Enter the number of pixels between 1 and the full cell size for shifting the cell for inspection.

10. [Polar coordinates (conversion)] drop down list

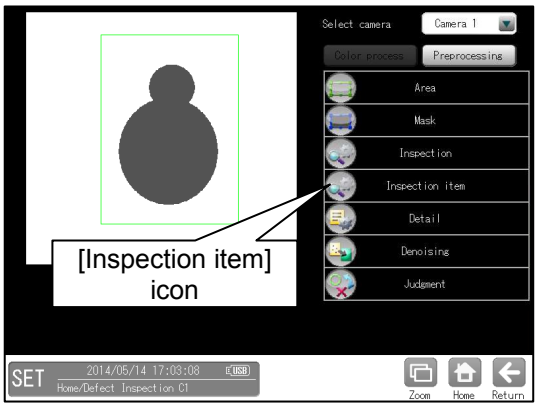
Select "Disable" or "Enable" when a "Rotate rectangle" or "Arc" is selected as the inspection shape.

Enable:
The device will use both the "Rotate rectangle" and "Arc" as a mask pattern to inspect inside the rectangle drawn around a workpiece.
In case of "Arc", the device inspects workpieces by using the distance along the circumference as the X-axis, and the distance from the center as the Y-axis.

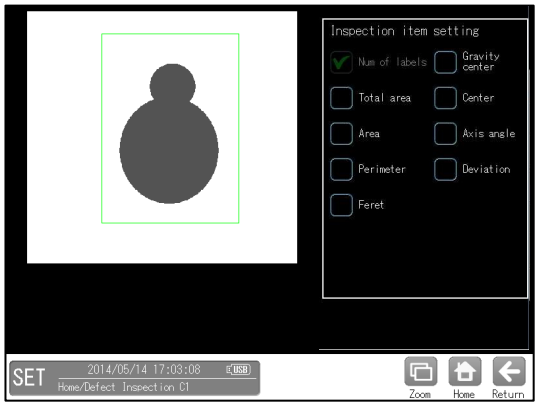
[4] [Inspection item] icon

Set the inspection items.

① Touch the [Inspection item] icon on the Defect inspection module setting screen.



② The Inspection item setting screen will appear.



Touch the check box of the item you want to inspect to show ☑.

[Inspection items] check boxes

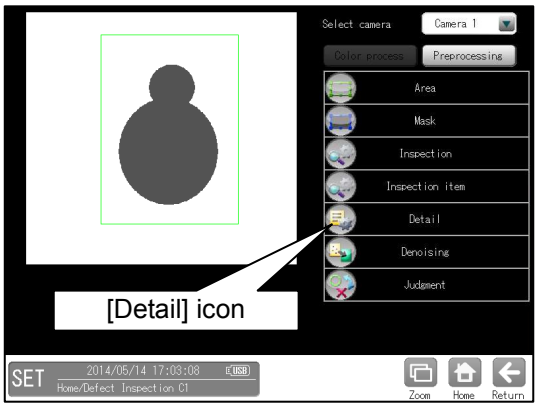
"Total area", "Area", "Perimeter", "Feret (Feret diameter) ", "Gravity center", "Center", "Axis angle (main axis angle)" and "Deviation"

With the defect inspection module, the device assigns unique numbers to the blobs detected on the inspection area (labeling).
You can inspect the number of blobs and total area of all the blobs, as well as any of the above inspection items:
You can select more than one item for an inspection.

[5] [Detail] icon

Set the details for detecting defective cells.

① Touch the [Detail] icon on the Defect inspection module setting screen.



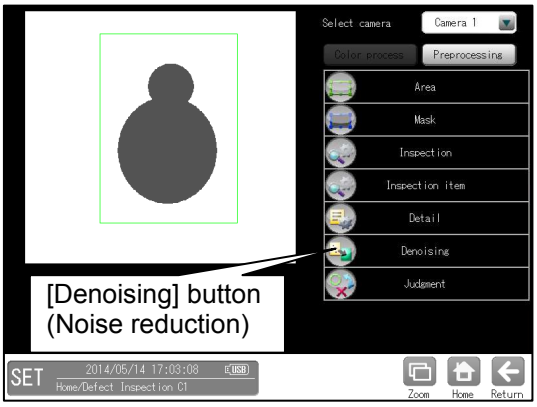
② The Detail setting screen will appear.

See page 4-94 for the setting details.

[6] [Denoising] (Noise reduction)

After a grayscale image is converted into a binary image, pixel noises may appear on the image. The noise reduction function lets the device remove the pixel noises by using "Dilate" or "Erode" process. Set the upper and lower limits for the area and X/Y Feret diameters for the white pixel areas to be inspected. The device will identify the areas within the set limits as blobs. Anything outside the limits will be treated as noise and will be eliminated.

① Touch the [Denoising] button on the Detail setting screen.



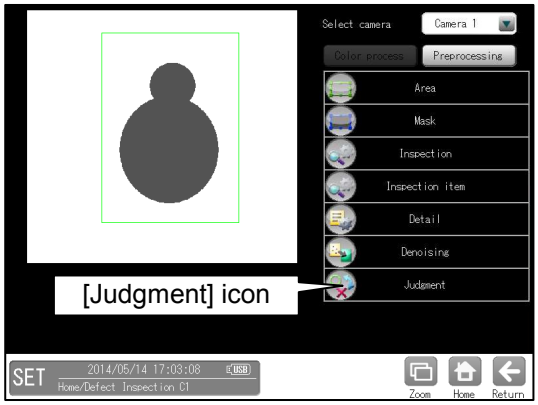
② The noise reduction setting screen will appear.

See page 4-96 for the setting details.

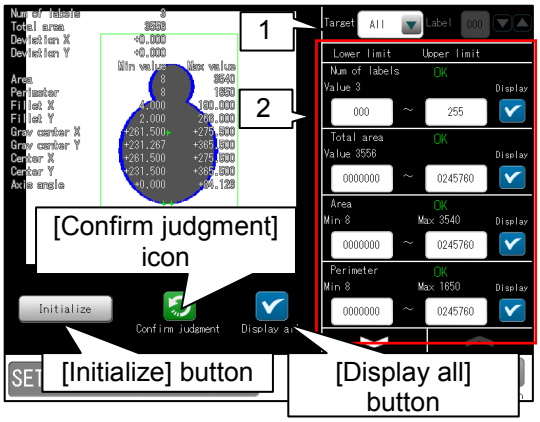
[7] [Judgment] icon

Set the upper and lower limits for OK/NG judgment based on the results (area value) of processing the Defect inspection module.
When the inspection result is within the range you set, the device will output an "OK" or "NG" if otherwise.

① Touch the [Judgment] icon on the Defect inspection module setting screen.



② The Judgment setting screen will appear.
The screens below are when “Whole” is set for “Mode” and “Light｜Dark” for “Inspection target” on the Inspection settings screen.



1. [Target] drop down list
Select "All" or "Specify" for label to judge.
When "Specify" is selected, enter the label number to use (0 to 254) with the [Label number] data input box and number keypad.

2. Inspection items, upper and lower limits and judgment data input boxes
Enter the judgment criteria (upper and lower limits) for each inspection item.
[Inspection items]
"Number of labels", "Total area", "Area", "Perimeter", "Feret (diameter) X/Y", "Gravity center X/Y", "Center X/Y", "Axis angle", “Intensity” “Shape center X/Y”, “Shape angle”, “Circularity”, “Shape Length L/S” and “Deviation X/Y”.

- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting.
  It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

4-4-11 Color Inspection Module

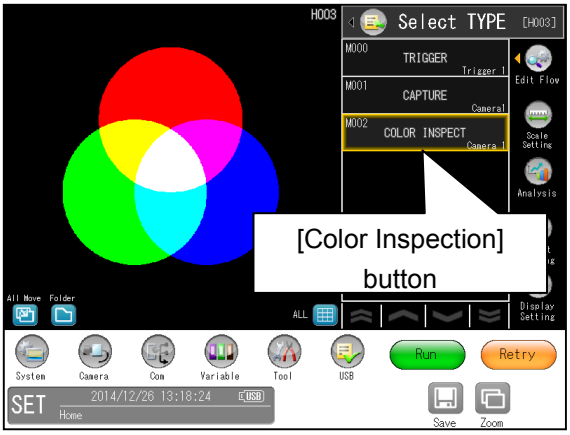
This module inspects the statics of color information of the specified area:
(Statics: Average intensity, Maximum intensity, Minimum intensity, intensity difference and Intensity deviation)
This module can be used for the inspection of color variations, uneven color, etc.

■ **Output Details**

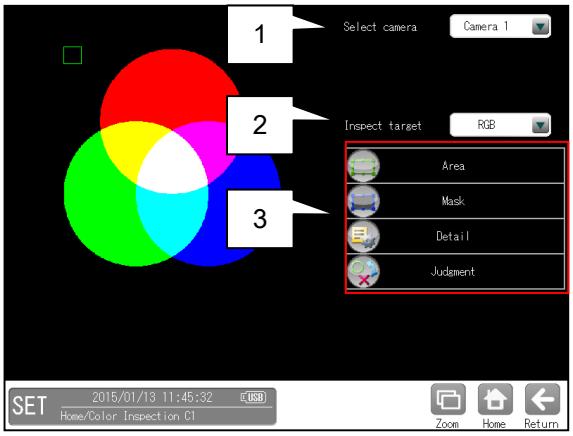
This module outputs the following for each of R・G・B and H・S・L.

- **Average intensity (RGB・HSL)**
  The average of the specified area.
- **Maximum intensity (RGB・HSL)**
  The maximum of the specified area.
- **Minimum intensity (RGB・HSL)**
  The minimum of the specified area.
- **Intensity difference (RGB・HSL)**
  The difference of maximum intensity and minimum intensity of the specified area.

① Touch the [Color Inspection] button on (Home) SET screen.



② Color Inspection Setting screen will appear.



1. **[Select Camera] drop down list**
   Select a "Camera number to use" when enabled this module:
   "Camera 1" or "Camera 2".
   In 2 Trigger mode, select a camera depending on the Object type number.
   See page 4-6.

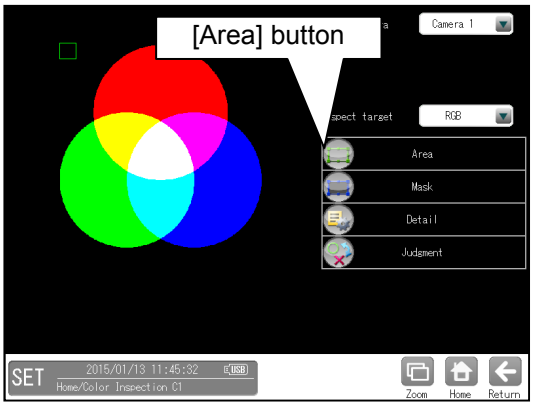
2. **[Inspection Target] drop down list**
   Select the mode for color inspection.
   RGB:
   The statistics of Red (R), Green (G) and Blue (B) are calculated.
   HSL:
   The statistics of Hue (H), Saturation (S) and Luminance (L) are calculated.

3. **[Setting] icons**
   - Area => [1]
   - Mask => [2]
   - Detail => [3]
   - Judgment => [4]

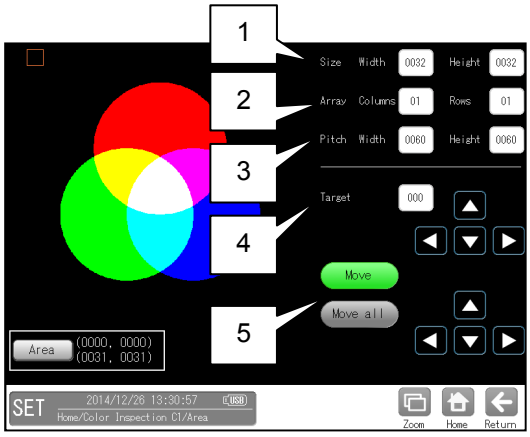
[1] [Area] icon

Set the inspection area.

① Touch the "Area" icon on the Color inspection module setting screen.



① The Area setting screen will appear.



1. [Size] data input boxes

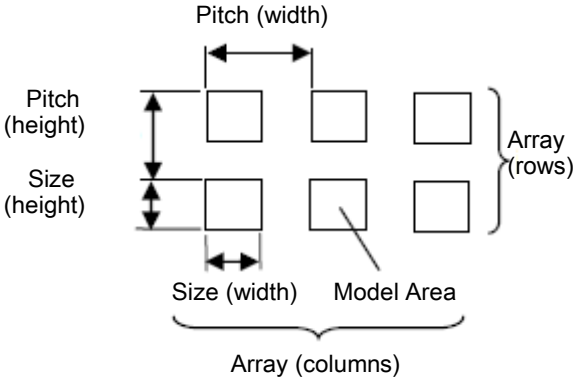
Enter the size (width and height) of the model area.

2. [Array] data input boxes

Enter number of columns and rows of the array of the model area.

3. [Pitch] data input boxes

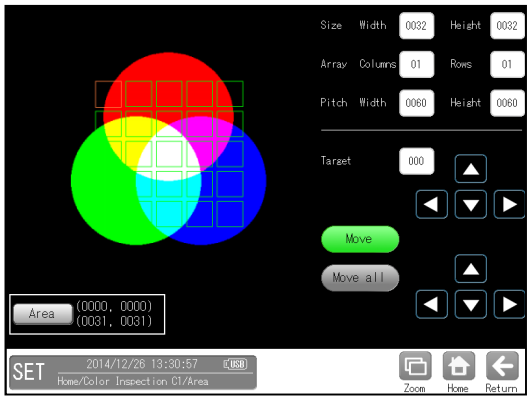
Enter distance (width and height) between the model areas.



4. [Target] setting buttons

Once the Size, Array and Pitch are set, the model area(s) are shown on the screen.

Example:



- A model area can be selected by [Target] data input box or by the arrow keys.
  The model number starts with top left (000) and increments in the order of column and then row.

5. [Move]/ [Move All] buttons

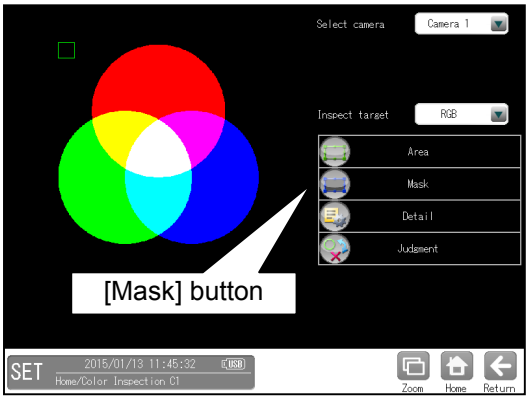
A model area or all the models areas set by the [Target] setting buttons can be moved with the [Move] or [Move All] button.

- When the [Move] /[Move All] button is green, the selected model area(s) can be moved by the [Direction] keys or by dragging the area.

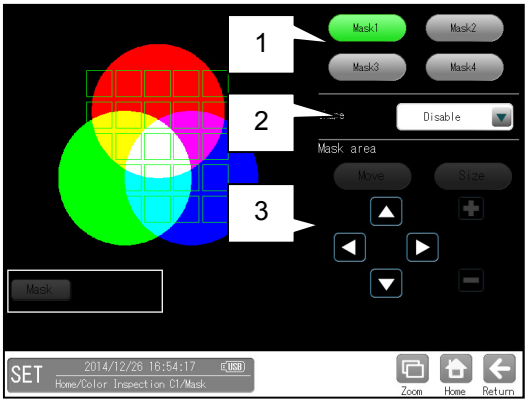
[2] [Mask] icon

When you want to avoid inspecting one or more areas within the inspection area, you can create up to four mask areas.

① Touch the [Mask] icon on the Color Inspection module setting screen.



② Mask setting screen will appear.

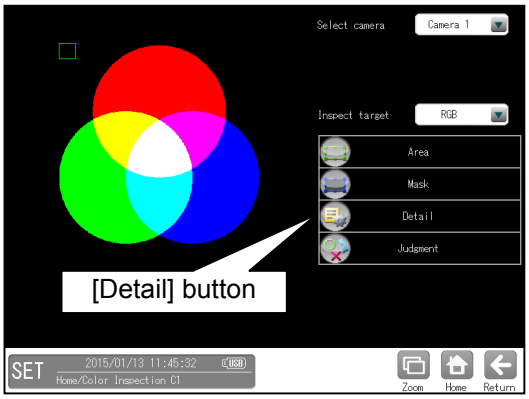


1. **[Mask 1] to [Mask 4] buttons**
   Touch one of the mask buttons:
   [Mask 1] to [Mask 4]
2. **[Shape] drop down list**
   Select a shape for the mask area:
   "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon".
3. **[Mask area] buttons**
   Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.

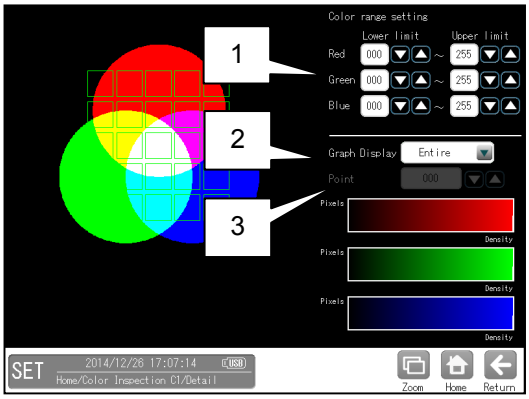
・ See page 3-6 for setting the Mask areas.

[3] [Detail setting] icon

① Touch the [Detail] icon on the Color Inspection module setting screen,



② The detail setting screen will appear.

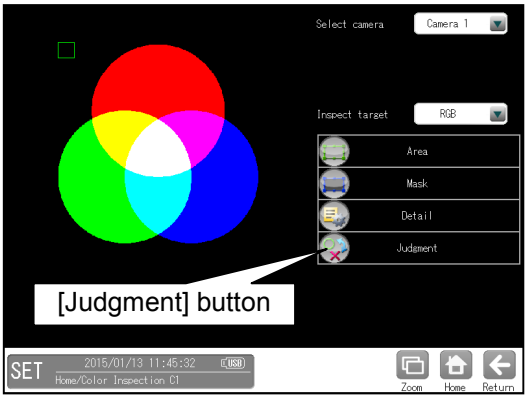


1. **[Color range setting] data input boxes**
   Enter the color detection range, each for color inspection.
   - When the “RGB” is selected for “Inspection target”, set the ranges for each Red (R), Green (G) and Blur (B).
   - When the “HSL” is selected for “Inspection target”, enter the ranges for each Hue, Saturation and Luminance.
2. **[Graph Display] drop down list**
   When “RGB” is selected, select either “Entire” or “Specify” from the Graph Display drop down list.
   Entire: The RGB values of all the points are displayed on the graph.
   Specify: The RGB values of the point specified by the [Point] data input box are displayed on the graph.
3. **[Point] data input box**
   (When “Specify” is selected from [Graph Display] drop down list)
   Enter the point to display.

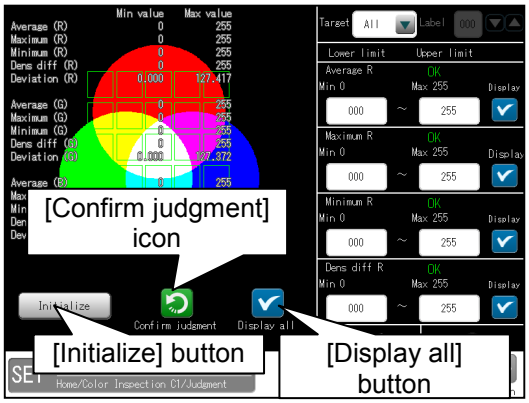
[4] [Judgment] icon

Set the upper and lower limits for OK/NG judgment based on the results of processing Color inspection module.
When the inspection result is within the range you set, the device will output an "OK" or "NG" if otherwise.

① Touch the [Judgment] icon on the Color inspection module setting screen.



② The judgment setting screen will appear.



1. **[Target] drop down list**
   Select "All" or "Specify" for label to judge.
   When "Specify" is selected, enter the label number to use (0 to 63) with the [Label number] data input box and number keypad.

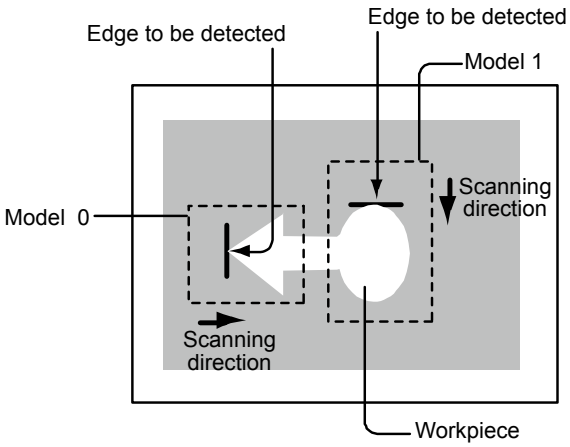
2. **Inspection items, upper and lower limits and judgment data input boxes**
   Enter the judgment criteria (upper and lower limits) for each inspection item.

   [Inspection items]
   "Average RGB/HSL", "Maximum RGB/HSL", "Minimum RGB/HSL", Intensity difference RGB/HSL" and "Deviation RGB/HSL"

- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting.
  It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

4-4-12 Edge module

The Edge module detects areas (edges) where the luminance level changes greatly as the result of scanning the inspection area in the specified scanning direction.
It determines the coordinates of the edges detected and the edges deviation between the inspected image and reference image, etc.
Two inspection areas can be set to one Edge module. After setting two inspection areas, the device can inspect the relative angle between the workpiece in the reference image and the workpiece in the inspection image by drawing a straight line between the edges.



■ Output details

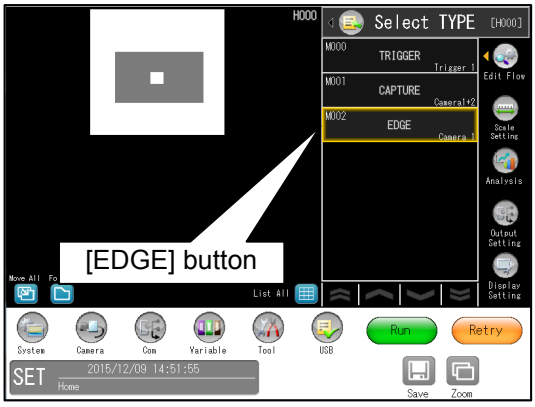
The following inspection results are output.

- **Coordinates**
  The coordinates of the detected edge.
- **Deviation**
  The detected edges deviation between the reference image and the inspection image.
- **Detection**
  Whether an edge was detected or not.
- **Number of labels**
  The number of edges detected in the inspection area.
- **Relative angle**
  (When two inspection areas are set)
  The angle deviation between a straight line drawn between two edges of the reference image and two edges of the inspection image.
- **OK/NG judgment**
  The upper and lower limits of each of the above inspection item are set and used as the criteria for "OK" and "NG" judgment.
  OK: All the inspection results are within the criteria
  NG: One or more of the inspection results are out of the criteria.

■ Operation procedures

(The screens shown below are typical examples)

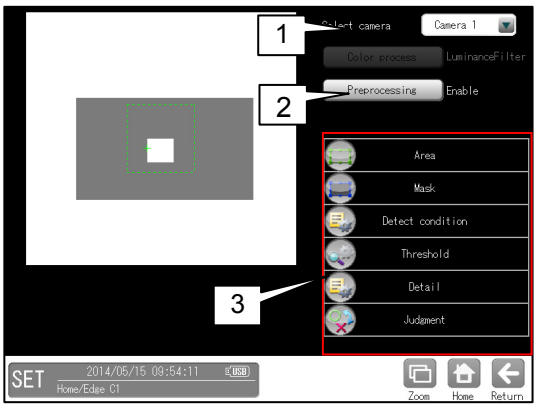
①Touch the [EDGE] button on the (Home) SET screen.



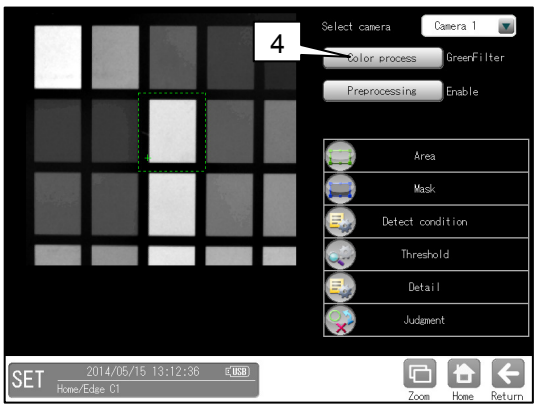
・See page 4-31 for how to edit the module flow.

② The Edge module setting screen will appear.

[When a monochrome camera is used]



[When a color camera is used]



1. [Select Camera] drop down list

Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".
In 2 Trigger mode, select a camera depending on the Object type number. See page 4-6.

2. [Preprocessing] button

Preprocessing will make the captured image easy for inspection.
See page 4-56 for the functions and setting procedures.

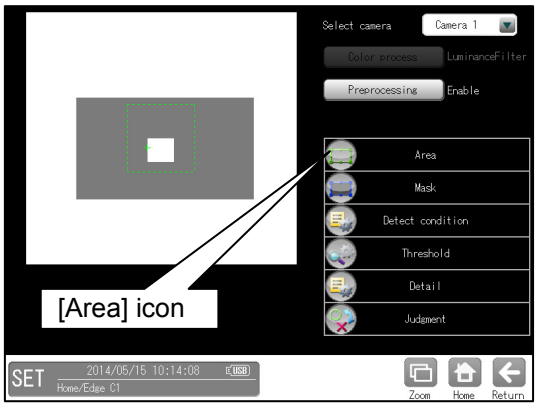
3. **[Setting] icons**
   - Area => [1]
   - Mask => [2]
   - Defect condition => [3]
   - Threshold => [4]
   - Detail => [5]
   - Judgment => [6]

4. **[Color process] button**
   (When a color Camera is used)
   When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)
   See page 4-68 for the function and setting procedures.

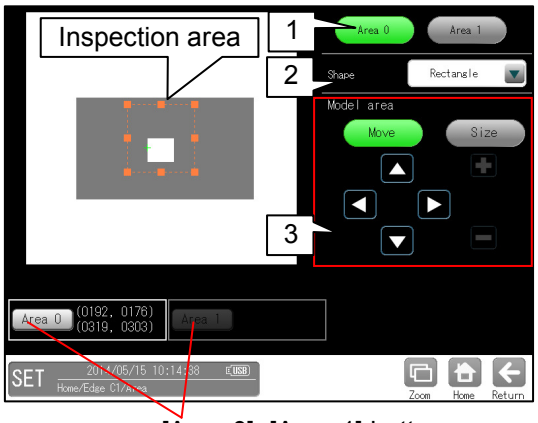
[1] [Area] icon

Set a model area in the captured image for detecting edges.
With the Edge module, you can set two model areas for one module: "Area 0" and "Area 1". (When only one area is used, select "Area 1")

① Touch the [Area] icon on the Edge module setting screen.



② The Area setting screen will appear.



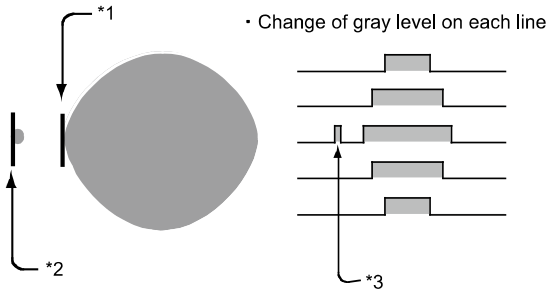
[Area 0], [Area 1] button

1. **[Area 0], [Area 1] buttons at top right**
   Select the model area:
   "Area 0" or "Area 1"

2. **[Shape] drop down list**
   Select the shape of the inspection area.
   "Disable", "Rectangle", "Project rectangle", "Line", "Circle, Ellipse", "Rotate rectangle" or "Project rotate rectangle".

・Projection of Rectangle and Rotate Rectangle

Projection process:
The device scans the inspection area line by line, and calculates the average gray level of each line. Then, the device deletes and eliminates lines with instantly high or low average gray level.



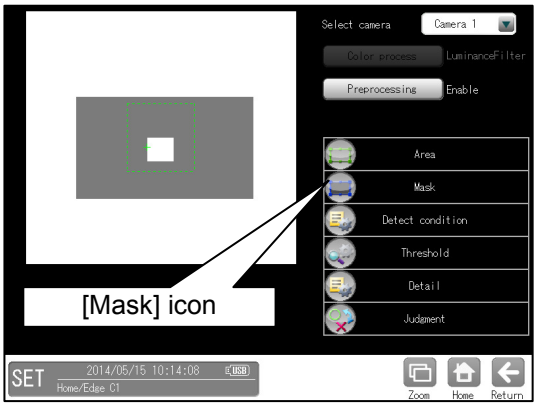
*1: An edge detected with projection process [Enabled].
*2: An edge detected with projection process [Disabled].
*3: When projection process is [Enabled], the device detects gray level change and eliminates instantly high and low gray levels.

3. **[Model area] buttons**
   Define the model area with the [Move], [Size], [Direction] and [+] [-] buttons.
   ・See page 3-6 for setting the model area.

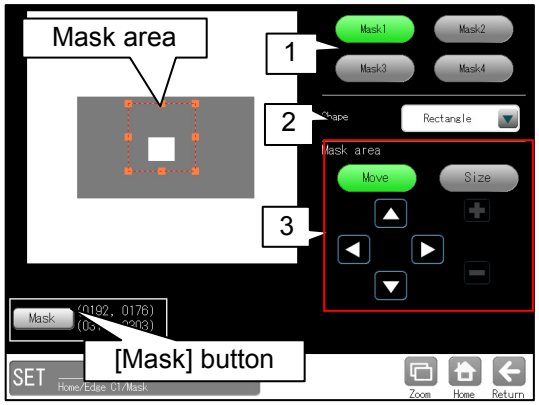
[2] [Mask] icon

When you want to avoid inspecting one or more areas within the model area, you can create up to four mask areas.

① Touch the [Mask] icon on the Edge module setting screen.



② The Mask setting screen will appear.



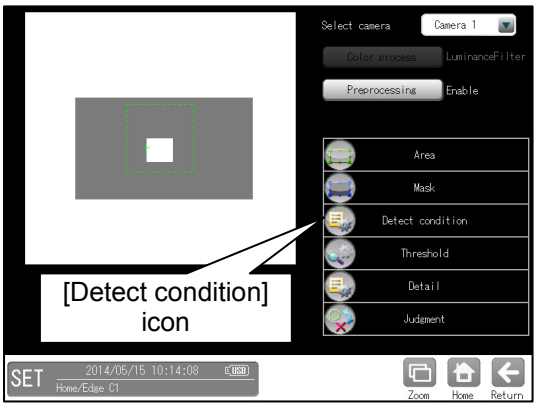
1. [Mask 1] to [Mask 4] buttons
Select one of the mask buttons: [Mask 1] to [Mask 4].

2. [Shape] drop down list
Select a shape for the mask area: "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon".

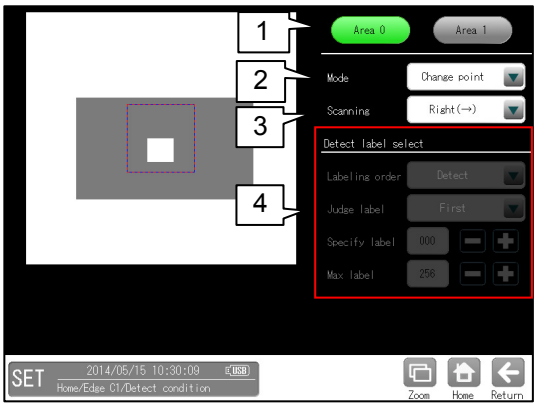
3. [Mask area] buttons
Set the mask area with the [Move], [Size], [Directions] and [+] [-] buttons.
・See page 3-6 for setting the Mask areas.

[3] [Detect condition] icon

① Touch the [Detect condition] icon on the Edge module setting screen.

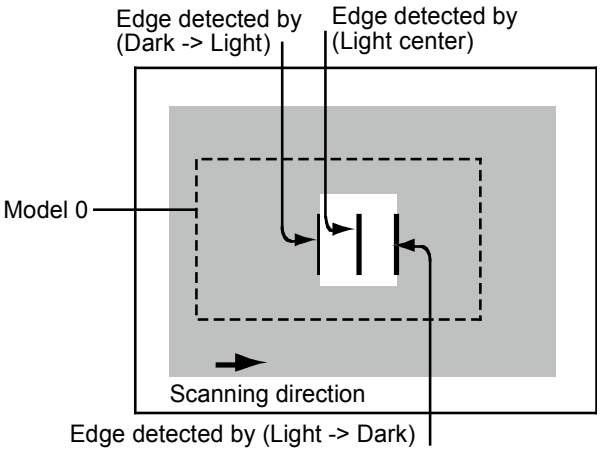


② The Detect condition setting screen will appear.



1. [Model Area] buttons
Touch one of the model area buttons: [Area 0] or [Area 1]

2. [Mode] drop down list
Select the order of the luminance level change to use for detecting edges.
"Change point", "Dark -> Light", "Light -> Dark", "Light center" or "Dark center".
Change point: The device will detect the first change between dark and light when scanning in the specified scanning direction.
Center: The device will use the center coordinates of the detected object as an edge.



3. **[Scanning] drop down list**
   Select the scanning direction.
   "Right (→)","Left (←)","Down (↓) " or "Up (↑)"

4. **[Detect label select] drop down list and data input box**
   When the shape of the model area is Project rectangle, Line, Circle, Ellipse or Project rotate rectangle, multiple edges will be detected. Meantime, the object for judgment is one edge, therefore, an edge (label) must be selected:

   a. **[Labeling order] drop down list**
      - **Detect order** (Default setting)
        A label number is assigned to an edge in the order of first detected when scanning in the specified scanning direction.
      - **Intensity order**
        (When the Threshold method is Intensity)
        A label number is assigned to an edge in the order of higher intensity.

   b. **[Judge label] drop down list**
      Select the label to judge:
      - **First** (Default setting)
        The first label (Label 0) is judged.
      - **Last**
        The last label is judged.
      - Specify
        The label specified by [Specify label] data input box is judged.
        If the specified label does not exist, detection output becomes none.

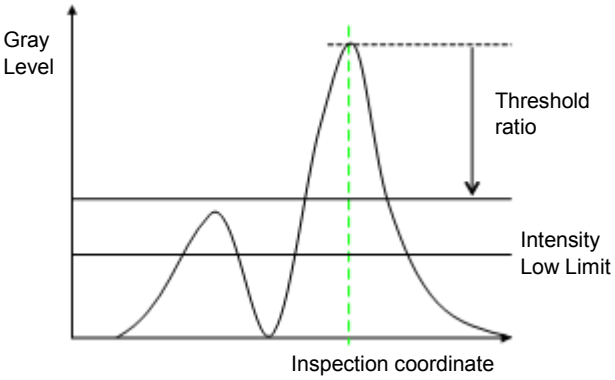
   c. **[Max label] data input box**
      (Default setting is 256)
      Set the maximum number of labels to judge within 1 to 256.
      Note: The process time becomes longer as the number of labels to judge increases.

[4] [Threshold] icon

There are two threshold methods for edge detection:
"Intensity" and "Gray difference"

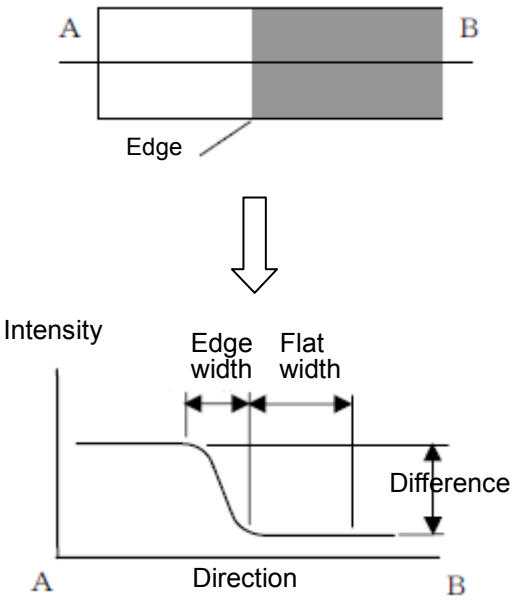
- **When Threshold method is "Intensity":**

  The threshold for Edge detection is set by "Intensity low limit", "Threshold ratio" and "Stabilizing filter".
  The device will identify edges that satisfy all of these conditions.

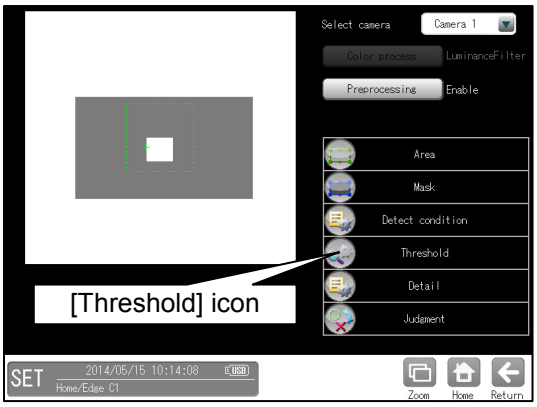


- **When Threshold method "Gray diff" is set.**

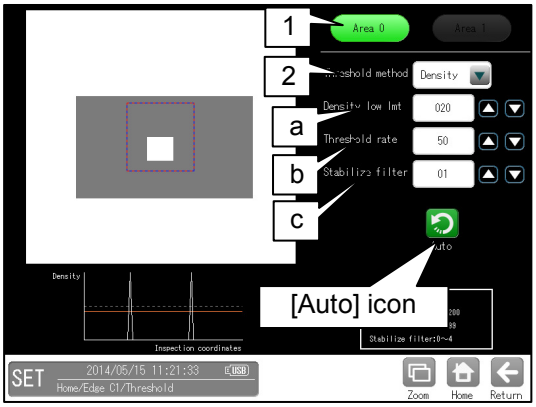
  The threshold for Edge detection is set by "(Intensity) Difference", "(Edge) Width" and "Flat width".
  The device will identify edges that satisfy all of these conditions.



① Touch the [Threshold] icon on the Edge module setting screen.



② The Threshold setting screen will appear.



1. **[Area 0], [Area 1] buttons**
   Select the Area button:
   "Area 0" or "Area 1"
2. **[Threshold method] drop down list**
   Select the method:
   “Intensity” or “Gray difference”.

- **When “Intensity” is set, set the following:**

a. [Intensity low limit] data input box
Enter the lower limit for the edge intensity you want to detect.
The device will detect edges which have a higher intensity than the lower limit you set.

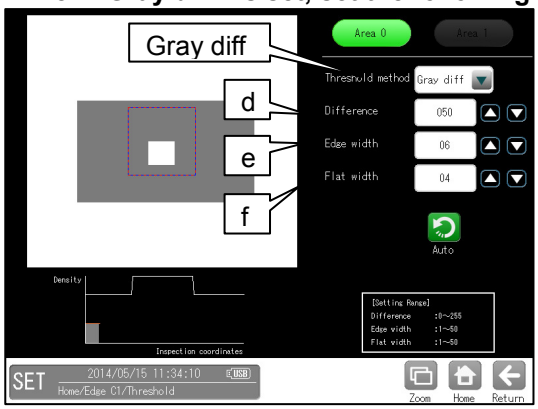
b. [Threshold rate] data input box
Enter a ratio against the maximum intensity in the inspection area. The image that has a intensity below the maximum intensity in the inspection area x Threshold rate is not detected.
Note: The device will use the Threshold rate or the Intensity lower limit set above whichever is larger, therefore, the threshold value changes dynamically and the device can detect edges even when the contrast changes.

c. [Stabilize filter] data input box
The filter will smooth the edge intensity in the inspection area.
Enter a higher value when there are a lot of noises or fluctuations in the position of the object in the image during the detection.

[To set manually]
Enter appropriate values for a to c while viewing the image and the graph on the screen.

[To set automatically]
Touch the [Auto] icon and the device will automatically set the **a** to **c** values.
You may fine tune the settings after they have been set automatically.

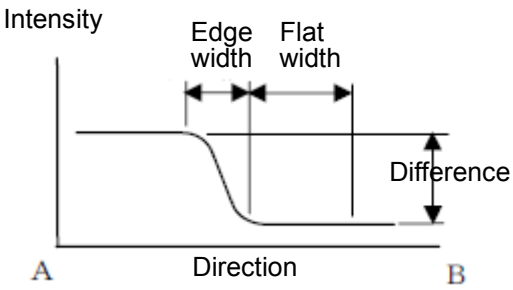
- **When “Gray diff” is set, set the following:**



d. [(Intensity) Difference] data input box
Enter the intensity difference value, 0 to 255, to judge as an edge.
The device will check the image by the unit as designated by the e. Edge width and f. Flat width and detect an edge if the intensity difference is higher than the set intensity difference value within the Edge width and the intensity is stable within the Flat width.

e. [Edge width] data input box
Enter the number of pixels, 1 to 50, for the Edge width.

f. [Flat width] data input box
Enter the number of pixels, 1 to 50, for the Flat width.



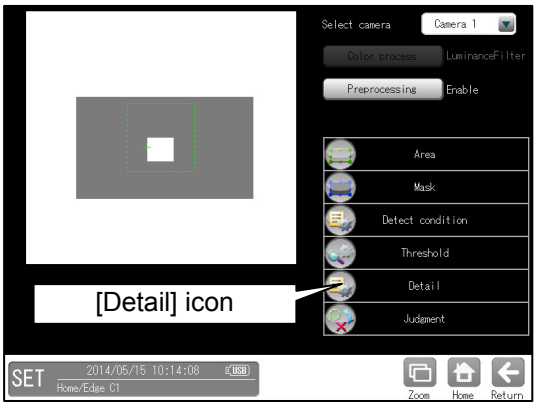
[To set manually]
Enter appropriate values for **d** to **f** while viewing the image and the graph on the screen.

[To set automatically]
Touch the [Auto] icon and the device will automatically set the d to f values.
You may fine tune the settings after they have been set automatically.

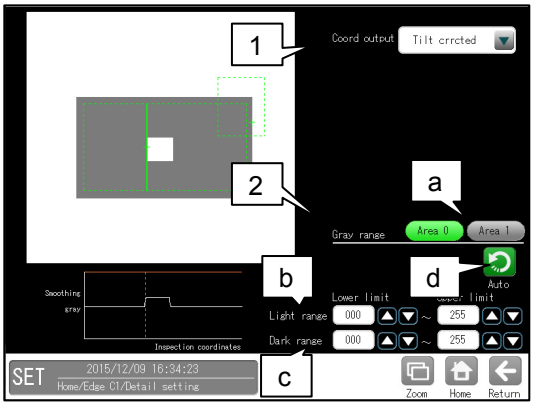
[5] [Detail] icon

When “Tilt correction” is set to the Edge module, the output of Edge Coordinate must be set: “Original” or “Tilt corrected”.

① Touch the [Detail] icon on the Edge module setting screen.



② The Detail setting screen will appear.

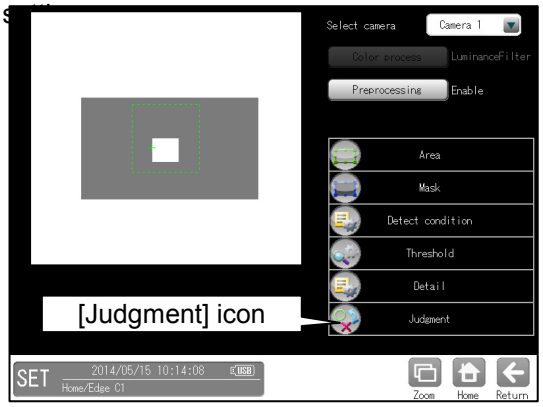


1. **[Coordinates output] drop down list**
   Select "Original" or "Tilt corrected" for the coordinates output.
   - **Original:** Outputs the edge coordinates of the captured image without tilt angle correction.
   - **Tilt corrected:** Outputs the edge coordinates of the captured image after the tilt angle correction.
2. **Gray Range**
   Set the detection area to detect edges. (Only edges with specific intensity can be detected)
   a. **[Area 0]/[Area 1] buttons**
   Select one of the buttons to register an area.
   b. **[Light range] data input box**
   Enter the intensity range to detect as Light area. The edges within the set intensity area are detected.
   c. **[Dark range] data input box**
   Enter the intensity range to detect as Dark area. The edges within the set intensity area are detected.
   d. **[Auto] setting icon**
   Automatically sets detection area based on the intensity information of the inspection area.

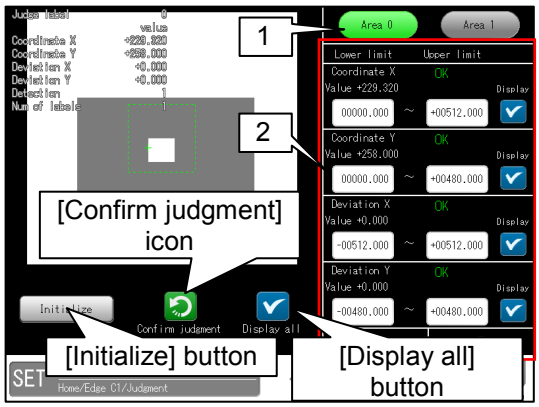
[6] [Judgment] icon

Set the upper and lower limits for OK/NG judgment based on the results of processing the Edge module.
When the inspection result is within the range you set, the device will output an "OK" or "NG" if otherwise.

① Touch the "Judgment" icon on the Edge module



② The Judgment setting screen will appear.



1. **[Area 0], [Area 1] buttons**
   Select "Area 0" or "Area 1" for the Area.

2. **Inspection items, upper and lower limits, and judgment data input boxes**
   Enter judgment criteria (upper and lower limits) for each inspection item.
   [Inspection items]
   "Coordinate X/Y", "Deviation X/Y", "Detection", “Number of labels” and "Relative angle".

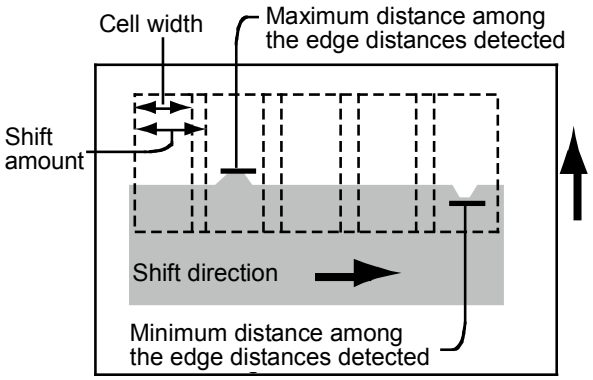
- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting. It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

4-4-13 Shift Edge module

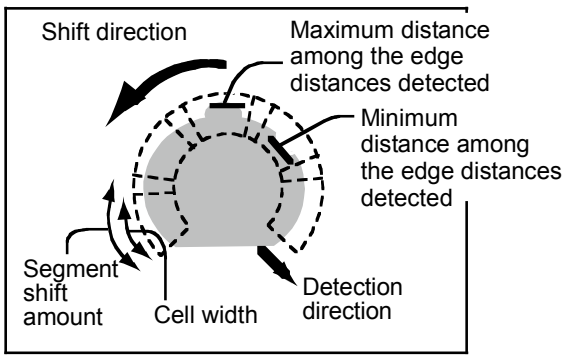
This module moves an inspection cell of arbitrary size in the inspection area and detects the edges within each cell. This module has 3 inspection target types:
"Edge position", "Edge width", and "Defect".
Edge position: Inspects edge coordinates, existence of an edge, distance to the edges, etc.
Edge width: Detects the edges of light and dark areas and inspects the edge coordinates, existence of an edge and width of the edge.
Defect: Inspects the height, width, and area of missing areas and extra parts (filaments, burrs, etc.) of the inspection object.

- **Inspection target "Edge position"**

  - **Inspection area shape: "Rectangle"**

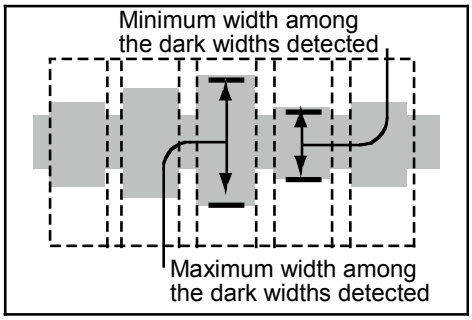


  - **Inspection area shape: "Arc"**

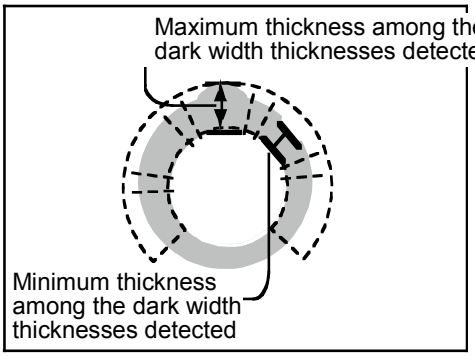


- **Inspection target is "Edge width"**
  Width (light), Width (dark) and Width

  - **Inspection area shape: "Rectangle"**

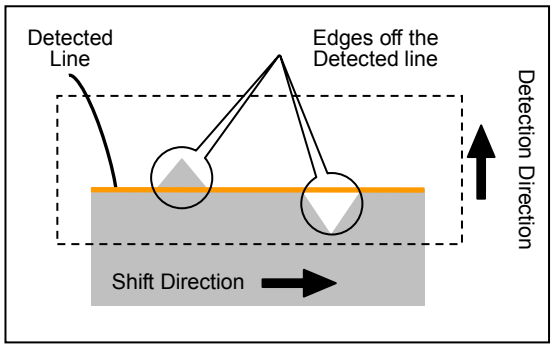


  - **Inspection area shape: "Arc"**

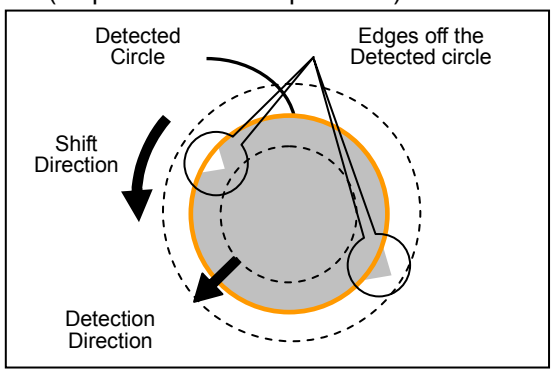


- **Inspection target type is "Defect"**

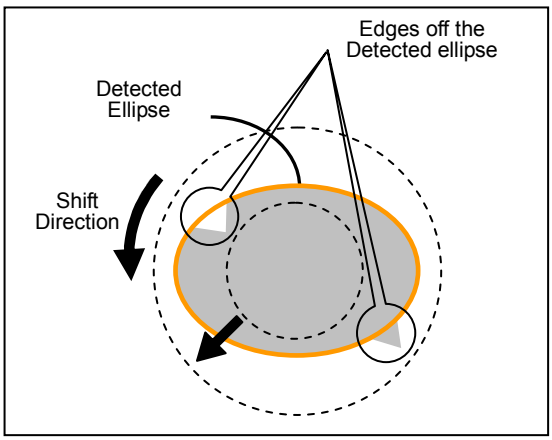
  - **Inspection shape: "Line"**
    (Inspection area shape: "Rectangle")



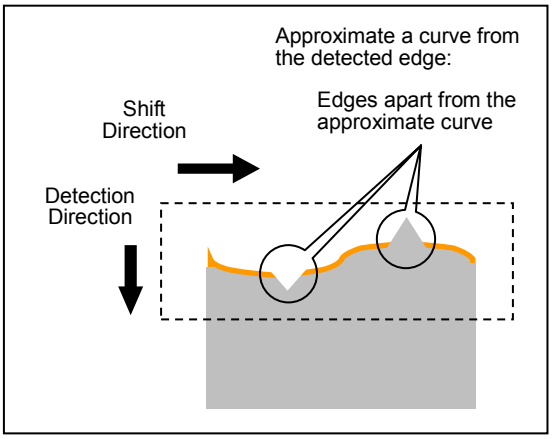
  - **Inspection shape: "Circle"**
    (Inspection area shape: "Arc")



  - **Inspection shape: "Ellipse"**
    (Inspection area shape: "Arc")



• **Inspection shape: "Free line"**
(Inspection area shape: "Arc")



■ **Output details**

The following inspection results are output for each Inspection target setting:

Output common to all inspection targets:

- **OK/NG judgment**

  The upper and lower limits of inspection items are set and used as the criteria for "OK" and "NG" judgment.

  OK: The size is within the criteria

  NG: The size is out of the criteria

● **Edge position**

- **Number of labels**
- **Coordinates**
  The coordinates of each detected edge.
- **Distance**
  The distance between the detected edge and the cell shift start position.
- **Average Distance**
  Average of the Distances of the edges.
- **Detection**
  Whether an edge was detected or not.

[For inspection shape "Arc"]

- **Angle**
  The angle of the detected edge.

● **Edge width**

- **Number of labels**
  The number of labels
- **Width**
  The width of each detected edge.
- **Average Width**
  Average of Width of all the detected edges.
- **Starts point**
  The start point coordinates of each detected width.
- **End point**
  The end point coordinates of each detected width.

[For inspection shape "Arc"]

- **Start point distance**
  The distance between the start point of the detected width area and the center of the cell (arc).
- **Average Start point distance**
  Average of the Start point distance of all the cells.
- **End point distance**
  The distance between the end point of the detected width area and the center of the cell (arc).
- **Average End point distance**
  Average of the End point distance of all the cells.
- **Angle**
  The angle of the edge of each detected width.
- **Detection**
  Whether a width was detected or not.

● **Defect**

- **Number of defects**
  The number of defects detected.
- **Defect position**
  The X/Y coordinates of each detected defect.
- **Defect height**
  The height of the detected defect.
  The defect height is the distance from the detected defect and inspection shape ("Line", “Free curve”, "Circle" or "Ellipse").
- **Detect width**
  The width of the detected defect.
  The defect width is the distance of protrusion or indention of the detected defect from the continuous inspection shape ("Line", "Circle" or "Ellipse").
- **Defect area**
  The area size of the detected defect.

[For inspection shape "Line" / “Free curve”]

- **Starts point**
  The starting point coordinates X/Y of the detected straight line.
- **End point**
  The end point coordinates X/Y of the detected straight line.

[For inspection shape "Circle"]

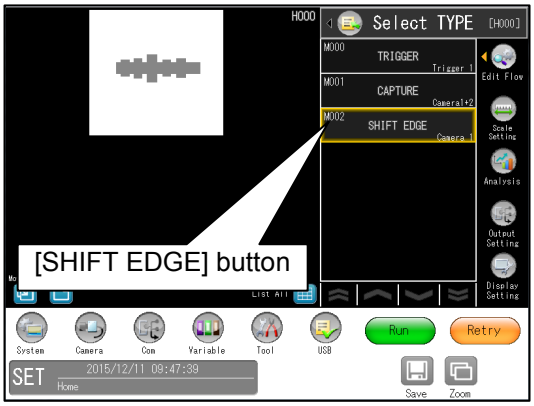
- **Circle center**
  The center coordinates X/Y of the detected circle.
- **Circle radius**
  The radius of the detected circle.

[For inspection shape "Ellipse"]

- **Ellipse center**
  The center coordinates X/Y of the detected ellipse.
- **Ellipse long radius**
  The long radius of the detected ellipse.
- **Ellipse short radius**
  The short radius of the detected ellipse.
- **Ellipse angle**
  The rotation angle of the detected ellipse.

(The screens shown below are typical example)

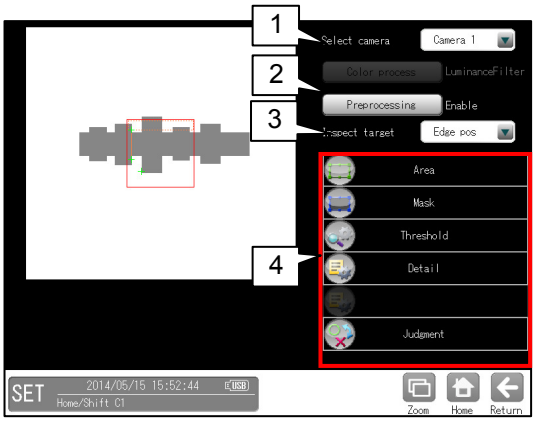
① Touch the [SHIFT EDGE] button on the (Home) SET screen.



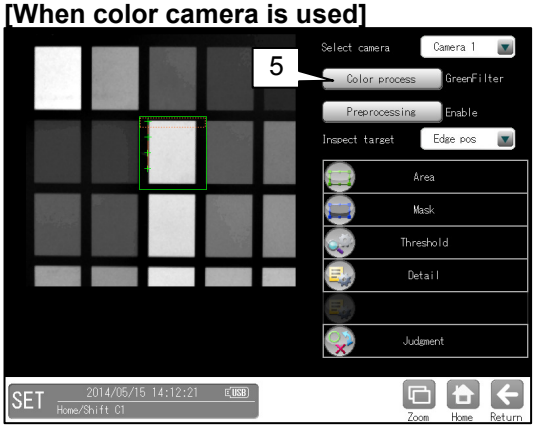
・See page 4-31 for how to edit the module flow.

② The Shift Edge module setting screen will appear.

[When monochrome camera is used]



[When color camera is used]



1. [Select Camera] drop down list

Select a "Camera number to use" when enabled this module:
"Camera 1" or "Camera 2".
In 2 Trigger mode, select a camera depending on the Object type number.
See page 4-6.

2. [Preprocessing] button

Preprocessing will make the captured image easy for inspection.
See page 4-56 for the functions and setting procedures.

3. [Inspection target] drop down list

Select one from "Edge pos", "Width (light)", "Width (dark)", "Defect" or “Width”.

- **Edge position**
  Detects edges within the cell and outputs the edge position coordinates.
  You can identify protrusions and indentations in the inspection areas from the changes in the edge position.
- **Width (light/dark)**
  Detects light areas or dark areas by detecting the edges within the cell and inspects the widths.
- **Defect**
  The device does a continuous edge inspection through the cells, and inspects missing areas (indentations) and filaments and burrs (protrusion) areas and their heights, widths and areas, etc.
- **Width**
  Detects an edge by detecting change in the intensity.

4. [Setting] icons

・Area => [1]
・Mask => [2]
・Threshold => [3]
・Detail => [4]
・Judgment => [6]

For Inspection target “Defect”:
・Check defect setting => [5]

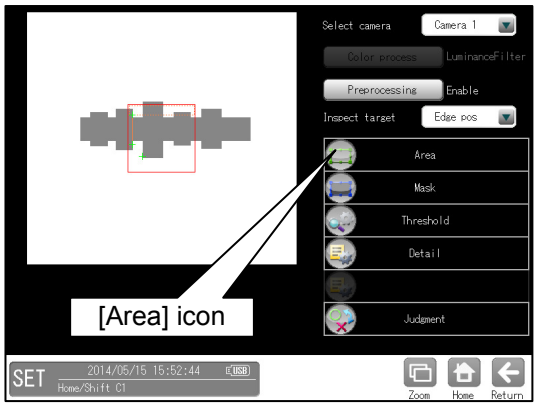
5. [Color process] button
(When a color camera is used)

When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)
See page 4-68 for the function and setting procedures.

[1] [Area] icon

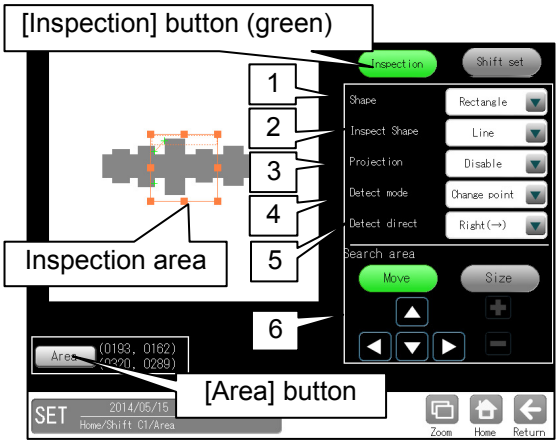
Set an Inspection area shape and shift direction for shift edge inspections.

① Touch the [Area] icon on the Shift edge module setting screen.

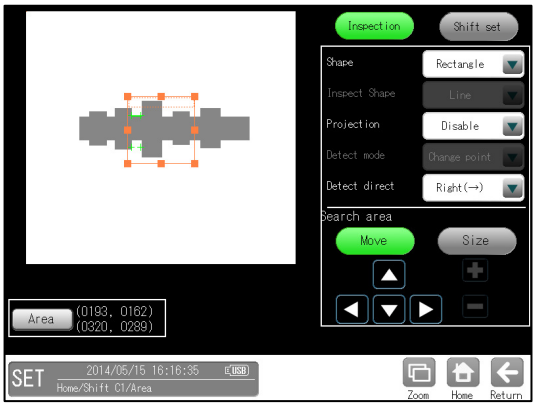


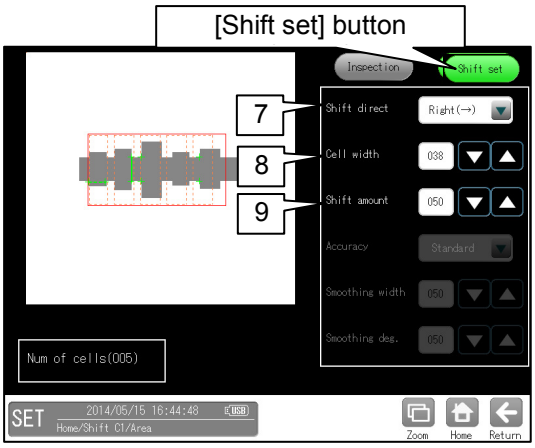
② The Area setting screen will appear.

- **When the inspection target is "Edge position"**

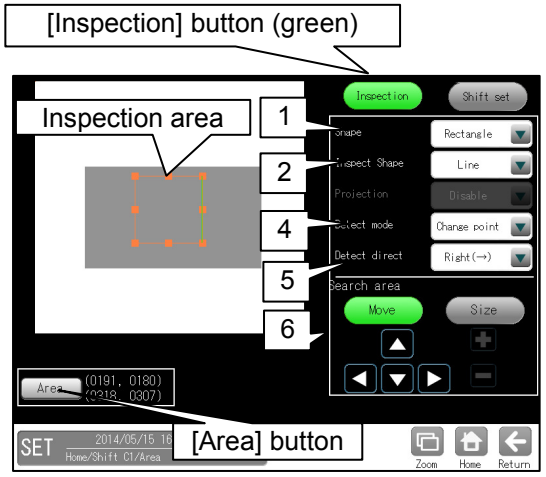


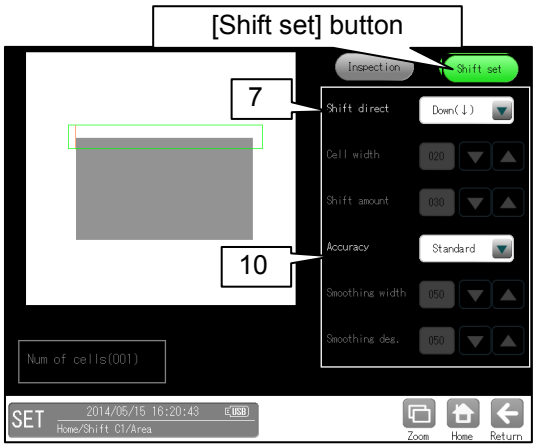
- **When the inspection target is "Width"**





- **When the inspection target is "Defect"**





1. [Shape] drop down list

Select "Rectangle", "Rotated rectangle" or "Arc" for the inspection area shape:

(When the inspection target is "Defect")

- When the Inspection target is "line" or "free curve", select "Rectangle" or "Rotated rectangle".
- When the inspection target is "Circle" or "Ellipse", select "Arc" for inspection area shape.

2. [Inspection shape] drop down list
(When the inspection target is "Defect")

- When the inspection area shape is “Rectangle" or "Rotated rectangle”, select “Line” or “Free curve” for the inspection shape.
- When the inspection area shape is “Arc", select “Circle”, “Ellipse” or "Free curve” for the inspection shape.

3. [Projection] drop down list
(When the inspection target is "Edge position / width")

Select "Enable" or "Disable".
Enable: The projection process is enabled.
See page 4-117 for the details of the projection process.

4. [Detection mode] drop down list

Select the order of the luminance level change for detecting an edge.
"Change point**"**, **"**Dark -> Light**"**, **"**Light -> Dark**"**, **"**Light center**"** or **"**Dark center**".**
See page 4-118 for how to detect the edge.

5. [Detection direction] drop down list

Select the direction to scan in the inspection area.
Select the direction depending on the selected inspection area shape:
"Rectangle", "Rotate rectangle" or "Arc"

Right (->): Scans the area from left to right.
Left (->): Scans the area from right to left.
Down (↓): Scans the area from up to down.
Up (↑): Scans the area from down to up.
In → Out: Scans from inside to outside.
Out → In: Scans from outside to inside.

- **When "Rotate rectangle" is selected**

When "Rotate rectangle" is selected, the inspection area can be rotated freely and an orange arrow showing the shift direction is displayed.
Set the arrow direction to your desired scan direction.

See page 3-9 for the setting procedure.

6. [Search area] buttons

Set the inspection area with the [Move], [Size], [Directions], [+] [-], and [Area] buttons.
- See page 3-6 for setting the Inspection area.

7. [Shift direction] drop down list

Select the direction to shift the cell.
Select the directions depending on the inspection shape.
"Rectangle", "Rotate rectangle" or "Arc".

- **When "Rectangle" is selected**
  Right (->) or Down (↓)
- **When "Rotate rectangle" is selected**
  Down (↓)
- **When "Arc" is selected**
  CCW (Counter clockwise)

8. [Cell width] data input box
(When the inspection target is not "Defect")

Enter the cell width size.
(1 to 999: Default 20)

9. [Shift amount] data input box
(When the inspection target is not "Defect")

Enter the cell shift amount.
(1 to 999: Default 30)

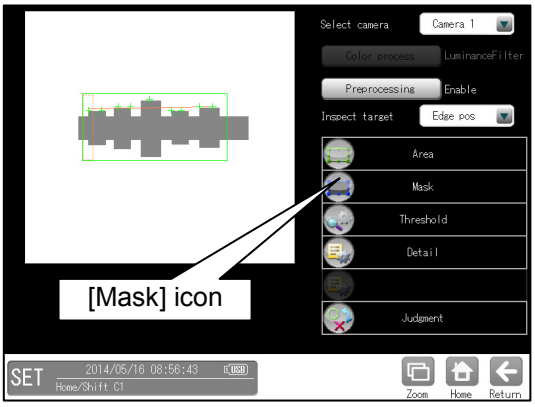
10. [Accuracy] drop down list
(When the inspection target is "Defect")

Select the accuracy for detecting a "Line", "Circle" or "Ellipse".
"High accuracy", "Standard", "High speed", "Super high speed".

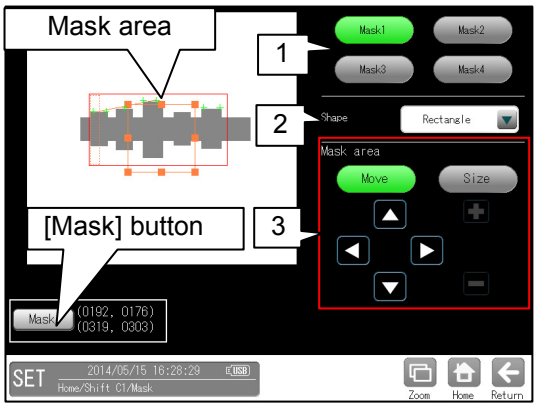
[2] [Mask] icon

If you want to avoid inspecting one or more areas within the inspection area, you can create up to four mask areas.

① Touch the [Mask] icon on the Shift Edge module setting screen,



② The Mask setting screen will appear.



1. [Mask 1] to [Mask 4] buttons
Select one of the Mask n buttons: [Mask 1] to [Mask 4].

2. [Shape] drop down list
Select a shape for the mask area: "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon".

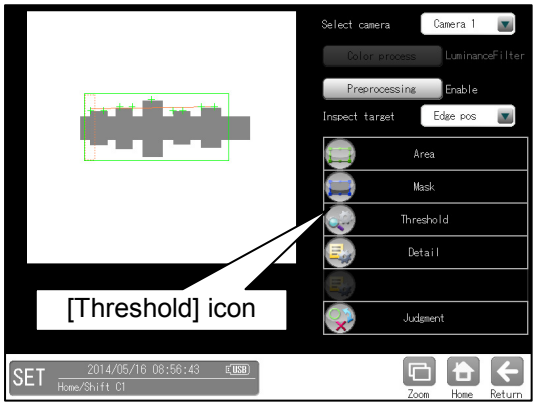
3. [Mask area] buttons
Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.

・See page 3-6 for setting the Mask areas.

[3] [Threshold] icon

There are two threshold methods for edge detection: “Intensity” and “Gray difference”. See page 4-119 for the details.

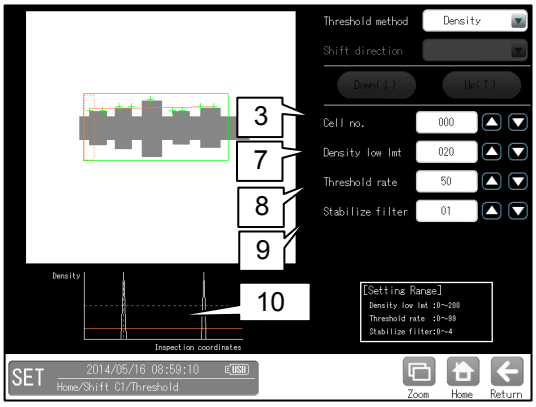
① Touch the [Threshold] icon on the Shift edge module setting screen.



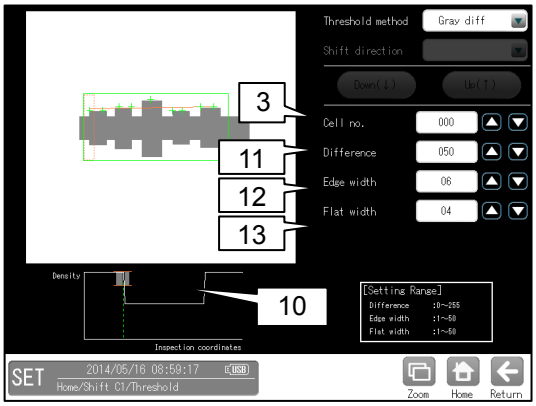
② The Threshold setting screen will appear.

● When the Inspection target is "Edge position"

・When the Threshold method is “Intensity”

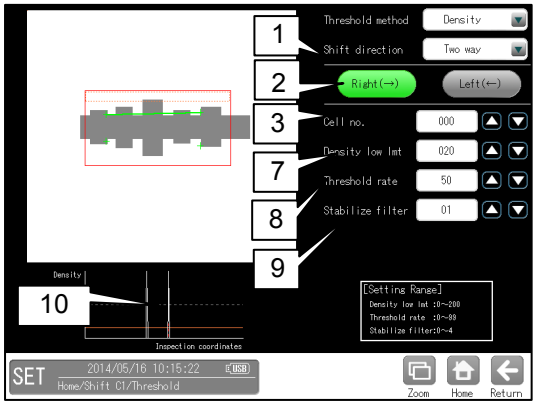


・When the Threshold method is “Gray diff”

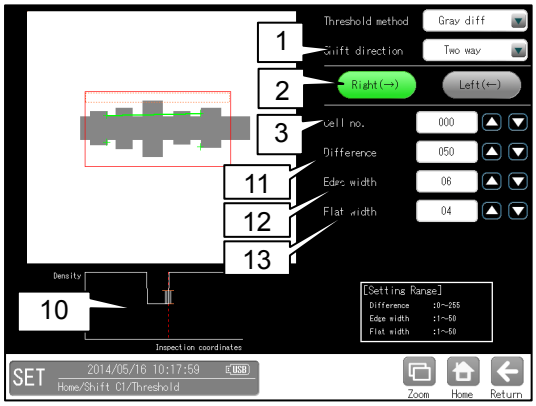


● **When the Inspection target is "Width"**

・When the Threshold method is “Intensity”

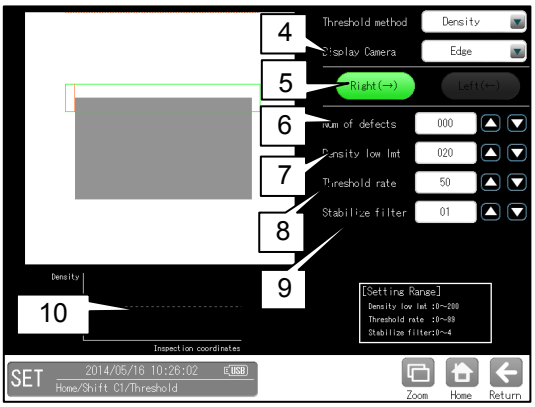


・When the Threshold method is “Gray diff”

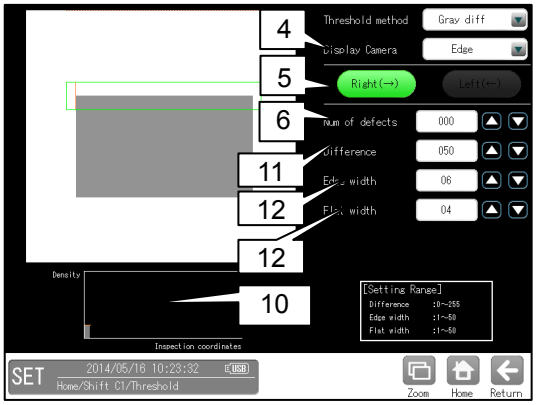


● **When the inspection target is "Defect".**

・When the Threshold method is “Intensity”



・When the Threshold method is “Gray diff”



1. [Shift direction] drop down list (When the inspection target is "Width")

Select one from "One way (One direction)" or "Two way (Two directions)".

- **One way (One direction)**
  Detects the positions of the left/right or top/down edges of an image in a cell by scanning in one direction specified. Thus, the device will detect first 2 edges in the detection direction.
- **Two way (Two directions)**
  Detects the positions of the left/right or top/down edges of an image in a cell by scanning in two directions specified. Thus the device detects the position of first edge of an image in a cell with the 1st scan, and then first edge position on the opposite side in a cell by the 2nd scan. Thus, the device can detect the edges nearest to the both sides of the cell.

2. [Scanning direction] buttons (When the inspection target is "Width")

Select the direction depending on the inspection shape:
"Rectangle", "Rotate rectangle" or "Arc".

- **For “Rectangle” or "Rotate rectangle**:
  When "One way" is selected: "Right (->)".
  When "Two way" is selected: "Right (->)" or "Left (<-)".
- **For “Arc”:**
  When "One way" is selected: "IN -> OUT".
  When "Two way" is selected: "IN ->OUT" or "OUT -> IN".

3. [Cell number] data input box (When the inspection target is "Edge position / Width")

Enter the cell number to set the threshold value.
The maximum number varies with the total number of cells.

4. [Display Camera] drop down list (When the inspection target is "Defect")

Select the image to display from "Original", "Edge" or "Defect".

- **Original image**
  Displays the reference image as is.
- **Edge**
  Displays a detected edge in green, detected straight line / circle / ellipse in orange and defects in blue.
- **Defect**
  Displays the defect positions in blue.

5. [Scanning direction] button
(When the inspection target is "Defect")
Select the direction depending on the inspection shape.
"Rectangle", "Rotate rectangle" or "Arc".

- **For Rectangle or Rotate rectangle**
  Right (->)
- **For Arc**
  In -> out

6. [Defect number] data input box
(When the inspection target is "Defect")
Enter the number of the defect to display its intensity histogram on the screen.

7. [Intensity low limit] data input box
(When the Threshold is "Intensity")
Enter the lower limit for the edge intensity you want to detect.
The device will detect edges which have a higher intensity than the lower limit you set.

8. [Threshold rate] data input box
(When the Threshold is "Intensity")
Enter a ratio against the maximum intensity in the inspection area. The image that has a intensity below the maximum intensity in the Search area x Threshold rate is not detected.
Note:
The device will use the Threshold rate or the Intensity lower limit set above whichever is larger, therefore, the threshold value changes dynamically and the device can detect edges even when the contrast changes.

9. [Stabilize filter] data input box
(When the Threshold is "Intensity")
The filter will smooth the edge intensity in the inspection area.
Enter a higher value when there are a lot of noises or fluctuations in the position of the object in the image during the detection.

10. "Intensity Histogram" display
Displays the histogram that shows the positions of detected edges by green or red dotted lines and the intensity toward the scanning direction. You can use this as a visual guideline for setting appropriate threshold values.

The following items are when the Threshold method" is "Gray diff":
See page 4-119 for the details.

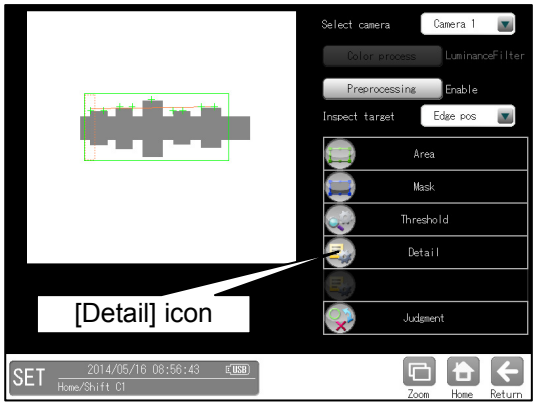
11. "(Intensity) Difference" data input box
Enter the intensity difference value, 0 to 255, to judge as an edge.
The device will check the image by the unit as designated by the following 12. Edge width and 13. Flat width and detect an edge if the intensity difference is higher than the set intensity difference value within the Edge width and the intensity is stable within the Flat width.

12. [Edge width] data input box
Enter the number of pixels, 1 to 50, for the Edge width.

13. [Flat width] data input box
Enter the number of pixels, 1 to 50, for the Flat width.

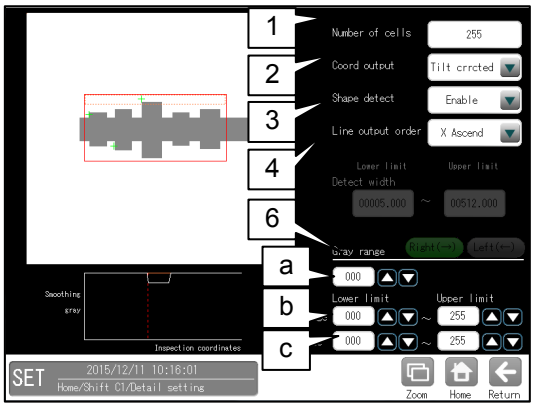
[4] [Details] icon

① Touch the [Detail] icon on the Shift edge module setting screen.

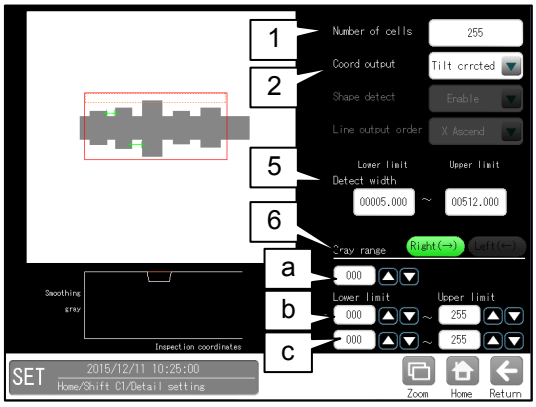


② The Detail setting screen will appear.

● When the inspection target is "Edge position "



● When inspection target is “Width (light), With (dark) or Width”



1. [Number of cells] data input box
Enter maximum number of cells to output.

2. [Coordinate output] drop down list
Select "Original" or "Tilt corrected" for the coordinates output.

- **Original:**
  Outputs the edge coordinates of the captured image without tilt angle correction.
- **Tilt corrected:**
  Outputs the edge coordinates of the captured image after the tilt angle correction.

3. [Shape detect] drop down list
(When inspection target is “Edge position”)
Select either “Disable” or “Enable”.

4. [Detected line output order] drop down list (When inspection shape is “Line”)
Select one from “X Ascend”, “X Descend”, “Y Ascend” and “Y Descend”.

5. [Detect width] data input box
(When inspection target is “Width (light), With (dark) or Width”)
Enter the lower and upper limits of the edge width for inspection.

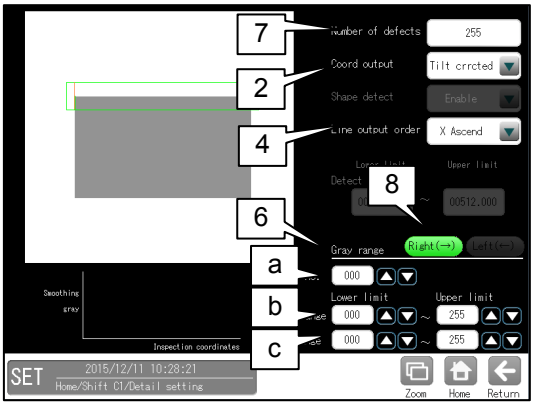
6. Gray range
Set the detection area to detect edges.

a. [Cell no.] data input box
Enter a number.
The graph displays the intensity plot at the entered number cell position.

b. [Light range] data input box
Enter the intensity range to detect as Light area. The edges within the set intensity area are detected.

c. [Dark range] data input box
Enter the intensity range to detect as Dark area. The edges within the set intensity area are detected.

● **When the inspection target is "Defect"**



6. Gray range

d. [Defect no.] data input box

Enter a defect number.

The graph displays the intensity plot of the entered number defect.

7. [Number of defects] data input box

Enter the maximum number of defects to output (0 to 255).

8. Scan Direction display

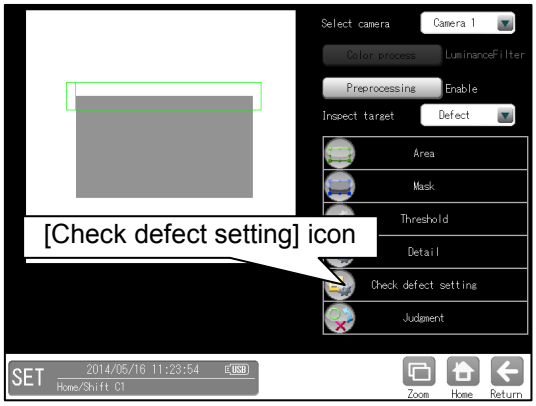
Displays the scan direction set.

[5] [Check defect setting] icon

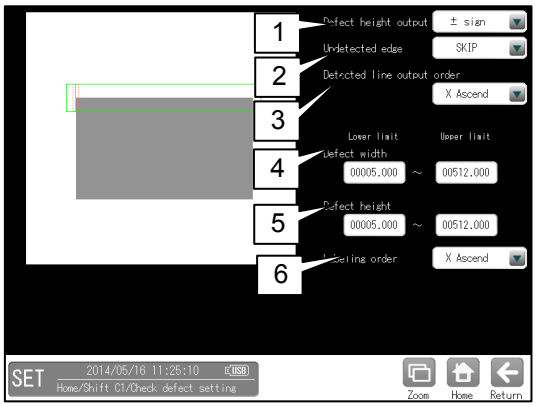
(When the inspection target is "Defect")

Enter the setting details for the defect inspection.

① Touch the [Check defect setting] icon on the Detail setting screen.

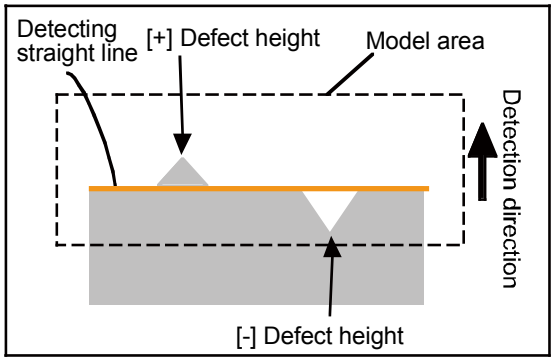


② The Check defect setting screen will appear.



1. [Defect height output] drop down list

For the "Straight line", "Circle" and "Ellipse" inspection shapes, the device assigns a [-] (minus) or [+] (plus) to a height defect it detected in the forward or backward detection direction, respectively.



Select "± sign" or "Absolute value" for the defect height output.

± sign: Outputs the detected defect height with a sign.

Absolute value: Outputs the detected defect height as an absolute value.

2. [Undetected edge] drop down list

There is a case no edge can be detected in the part of the inspection area because of such as a very high object.

In such a case, select either "SKIP" or "NG".

SKIP: When the device cannot detect an edge in the part of the inspection area, judge the inspection excluding such part.

NG: When the device cannot detect an edge in the inspection area, make the judgment result as NG.

3. [Detected line output order] drop down list

Set this item when "Line" is selected as the inspection shape.

Select the output order of the line start point/end point coordinates.

"X ascend", "X descend ",
"Y ascend " or "Y descend "

4. [Defect width]* data input box

Enter the upper/lower limits for the defect width you want to detect.

5. [Defect height]* data input box

Enter the upper/lower limits for the defect height you want to detect.

6. [Labeling order] drop down list

Select the output order of the defect data.

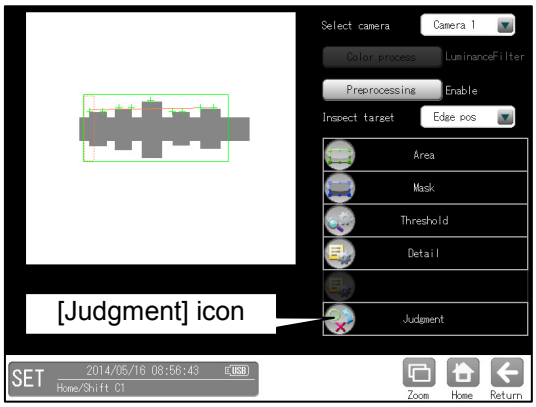
- **When the inspection shape is "Line"**
  "X ascend", "X descend ",
  "Y ascend" or "Y descend ",
  "Height ascend" or " Height descend ",
  "Width ascend" or " Width descend ",
  "Area ascend" or " Area descend ",
- **When the inspection shape is "Circle" and "ellipse"**
  "CW" or "CCW"

* The device will only detect defects that satisfy both of the conditions specified for the "Defect width" and the "Defect height".

[6] [Judgment] icon

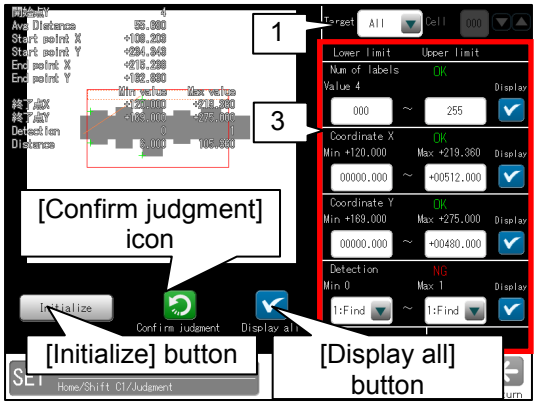
Set the upper and lower limits for OK/NG judgment based on the results of processing the Shift edge module.
When the inspection result is within the range you set, the device will output an "OK", or "NG" if otherwise.

① Touch the [Judgment] icon on the Shift edge module setting screen.

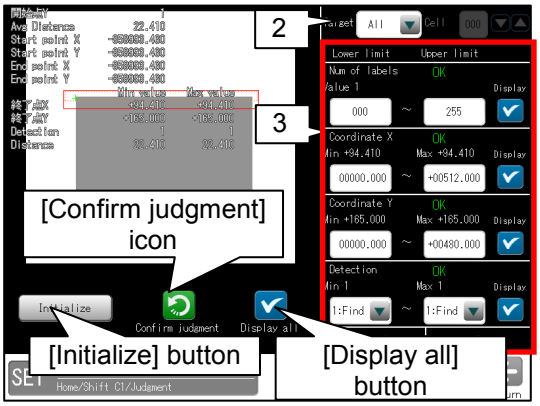


② The Judgment setting screen will appear.

- **When the inspection target is "Edge position/ width"**



- **When the inspection target is "Defect"**



1. [Target cell] drop down list (When the inspection target is "Edge position / width")
Select "All" or "Specify".
When "Specify" is selected, enter the cell number to judge (0 to 254).

2. [Target defect] drop down list (When the inspection target is "Defect")
Select "All" or "Specify".
When "Specify" is selected, enter the cell number to judge (0 to 254).

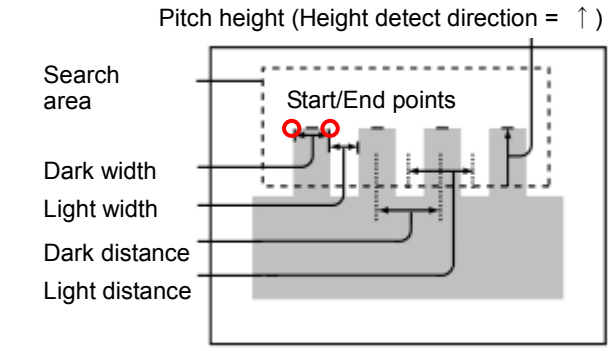
3. Inspection items, lower and upper limits, and display buttons
Enter judgment criteria (lower and upper limit values) for each inspection item.
[Inspection items]
The inspection items to enter limits vary depending on the inspection target type, inspection shape and Inspection area shape selected.

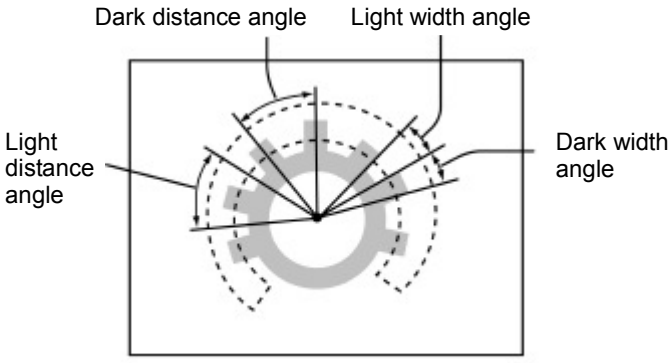
- **When the inspection target is "Edge position"**
  "Number of labels" (number of detections), "Coordinates X/Y", "Detection", "Distance" and "Average distance"
  (When the Inspection area shape is "Arc," add "Angle").
- **When the inspection target is "Width (light/dark)"**
  " Number of labels" (number of detections), "Width", "Average width", "Start point coordinates X/Y", "End point coordinates XY", "Average start point distance" and "Average end point distance"
  (When the Inspection area shape is "Arc," add "Starting point distance", "End point distance" and "Angle").
- **When the inspection target is "Defect"**
  "Number of defects", "Defect position X/Y", "Defect height", "Defect width" and "Defect".
  (When the Inspection area shape is "Straight line", add the starting point coordinates X/Y and end point coordinates X/Y).
  (When the Inspection area shape is "Circle", add the circle center X/Y and radius).
  (When the Inspection area shape is "Arc", add the ellipse center X/Y, ellipse long radius, ellipse short radius and angle).

- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting. It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

4-4-14 Pitch module

This module detects edges in the image in the inspection area that has repeated protrusions (pitch) like leads of an IC chip and connector pins and inspects the number of pitches and the height and width, etc.





■ Output details

The following inspection results are output.

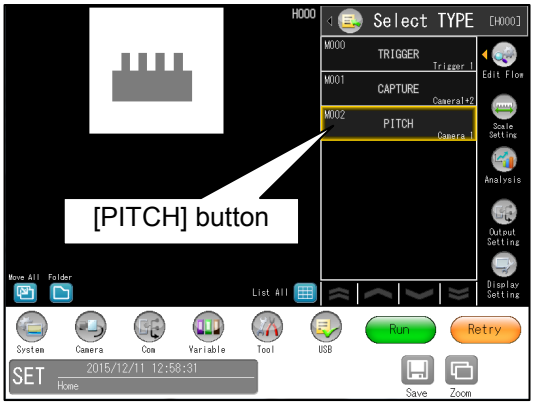
- **Number of pitches**
  The number of detected pitches.
- **Light/Dark width**
  The width of light or dark pitch.
- **Light/Dark distance**
  The distance between two consecutive light or dark pitches.
- **Pitch Height**
  The distance between scan start position and the edge of a pitch detected by the set scan direction.
- **Coordinate**
  (Start/End point coordinates X/Y)
  The start and end point coordinates of a pitch.
  [When Inspection Area shape is "Arc"]
  - **Light/Dark width angle**
    The angle of width of a light or dark pitch against the center of the arc.
  - **Light/Dark distance angle**
    The angle of the center of two consecutive light or dark pitches against the center of the arc.
- **OK/NG judgment**
  The upper and lower limits of each of the above inspection item are set and used as the criteria for "OK" and "NG" judgment.

OK: All the inspection results are within the criteria
NG: One or more of the inspection results are out of the criteria.

■ Operation procedures

(The screens shown below are typical example)

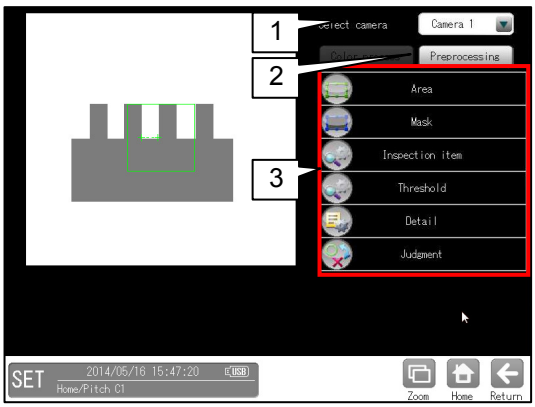
① Touch the [PITCH] button on the (Home) SET screen.



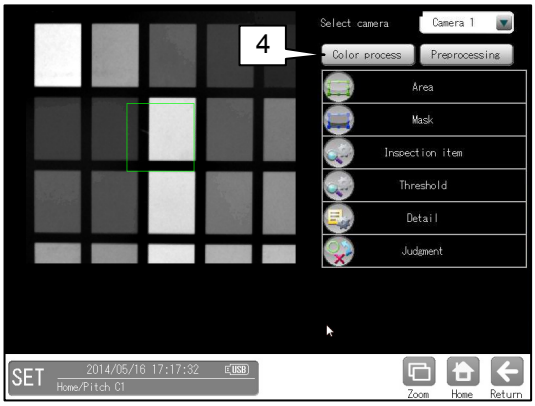
・See page 4-31 for how to edit the module flow.

② The Pitch module setting screen will appear.

[When monochrome camera is used]



[When color camera is used]



1. **[Select Camera] drop down list**
   Select a "Camera number to use" when enabled this module:
   "Camera 1" or "Camera 2".
   In 2 Trigger mode, select a camera depending on the Object type number.
   See page 4-6.

2. **[Preprocessing] button**
   Preprocessing will make the captured image easy for inspection.
   See page4-56 for the functions and setting procedures.

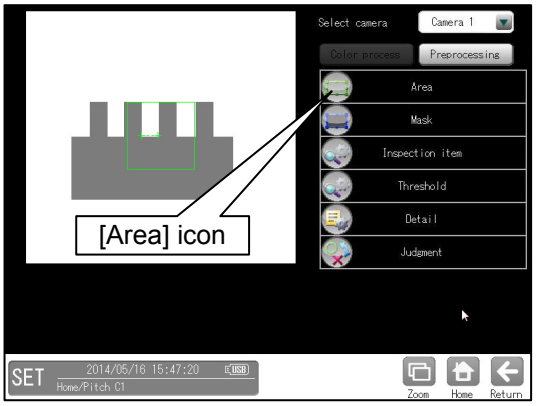
3. **[Setting] icons**
   - Area => [1]
   - Mask => [2]
   - Inspection item => [3]
   - Threshold => [4]
   - Detail => [5]
   - Judgment => [6]

4. **[Color preprocess] button**
   (When a color camera is used)
   When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)
   See page 4-68 for the function and setting procedures.

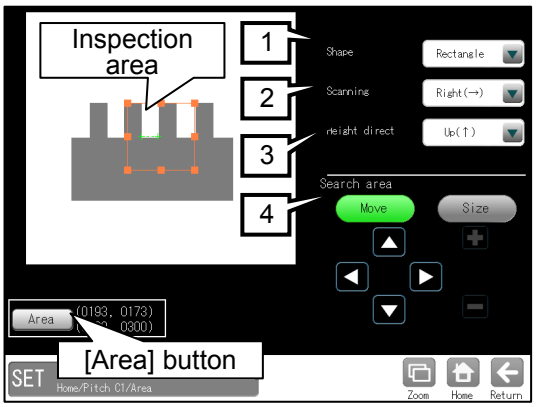
[1] [Area] icon

Set the inspection area on captured images.

① Touch the "Area" icon on the Pitch module setting screen.



② The Area setting screen will appear.



1. **[Shape] drop down list**
   Select the shape of the inspection area:
   "Rectangle", "Rotate rectangle" or "Arc".
   - "Arc" should be selected when searching the pitches of circle shaped object like a gear.

2. **[Scanning] drop down list**
   Select the scanning direction.
   - **For the Inspection area shape is "Rectangle":**
     "Right (->)" or "Down (↓)"
   - **For the Inspection area shape is "Rotate rectangle":**
     "Right (->)"
   - **For the Inspection area is "Arc":**
     “CW": for scanning clockwise
     “CCW": for scanning counter clockwise

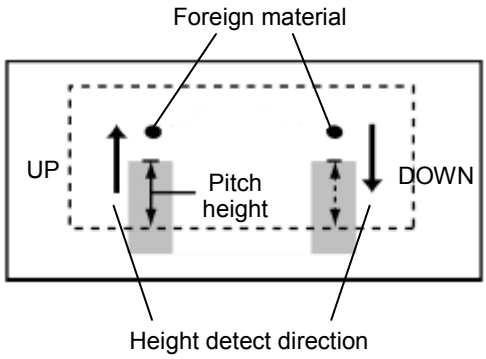
3. [Height direction] button

Set the scanning direction of pitch height.

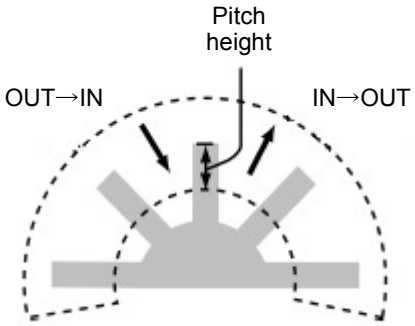
- **For the Inspection area shape is "Rectangle" and Scanning is "Right (→)":**
  "Up (↑)" or "Down (↓)"
- **For the Inspection area shape is "Rectangle" and Scanning is "Down (↓)":**
  "Right (→)" or "Left (←)"
- **For the Inspection area shape is "Rotate rectangle":**
  "Up (↑)" or "Down (↓)"
- **For the Inspection shape is "Arc":**
  "IN→OUT" or "OUT→IN"

[Examples]

- **When the Inspection area shape is "Rectangle" or "Rotate rectangle":**
  In the following example, the edge can be detected properly without being affected by the foreign material by setting height detect direction to up (↑).



- **When the Inspection area shape is "Arc":**



Height detect direction

4. [Inspection area] buttons

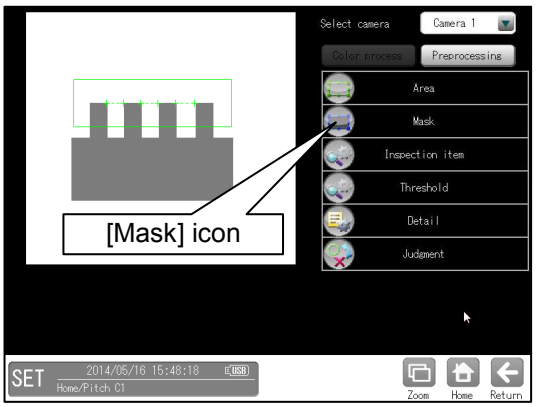
Set the inspection area with the [Move], [Size], [Directions], [+] [-] buttons and the [Area] button at bottom left.

・See page 3-6 for setting the Inspection area.

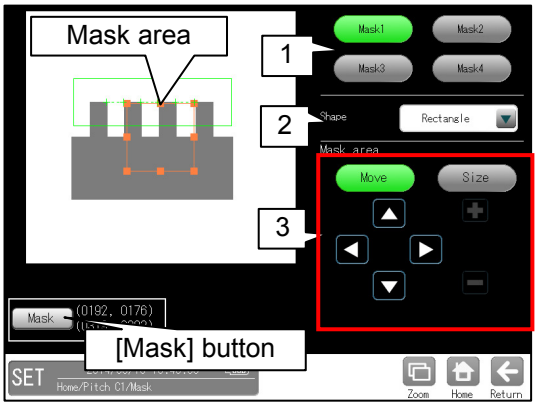
[2] [Mask] icon

When you want to avoid inspecting one or more areas within the Inspection area, you can create up to four mask areas.

① Touch the [Mask] icon on the Pitch module setting screen.



② The Mask setting screen will appear.



1. [Mask 1] to [Mask 4] buttons

Select one of the mask buttons: [Mask 1] to [Mask 4].

2. [Shape] drop down list

Select a shape for the mask area: "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon".

3. [Mask area] buttons

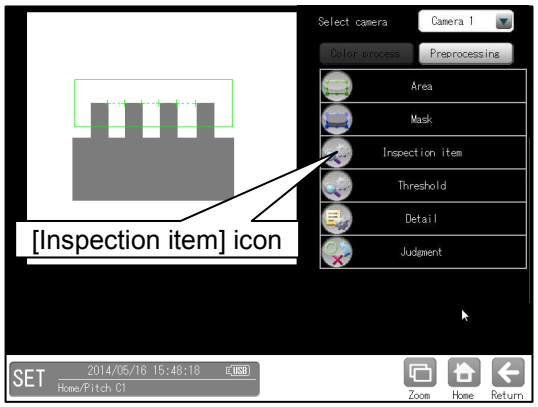
Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.

・See page 3-6 for setting the Mask areas.

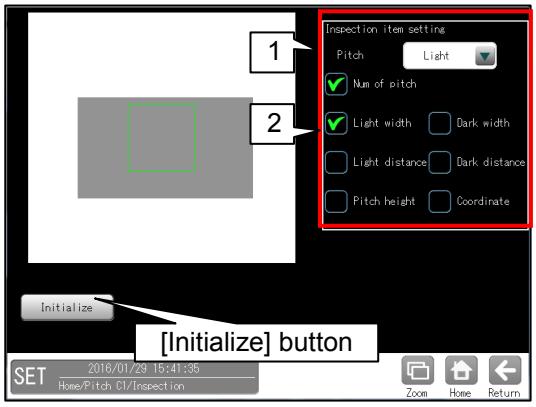
[3] [Inspection item] icon

Set the "Number of pitches", "Light and Dark widths", "Light and Dark distances", etc.

① Touch the [Inspection item] icon on the Pitch module setting screen.



② The Inspection item setting screen will appear.



1. [Pitch] drop down list
Select either "Light" or "Dark".

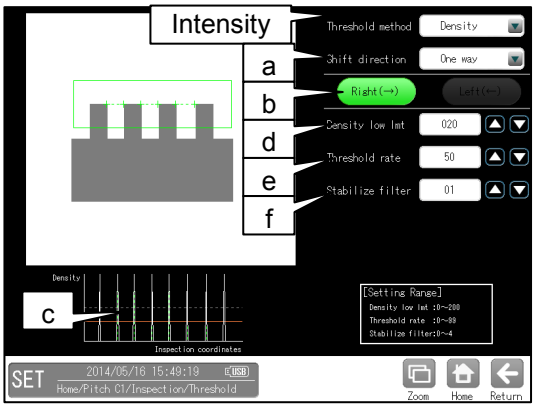
2. [Inspection item] check boxes
Check the box of the item to inspect.
[Inspection items]
Number of pitches
Light width/Dark width
Light distance/Dark distance
Pitch height
Coordinate

[4] [Threshold] icon

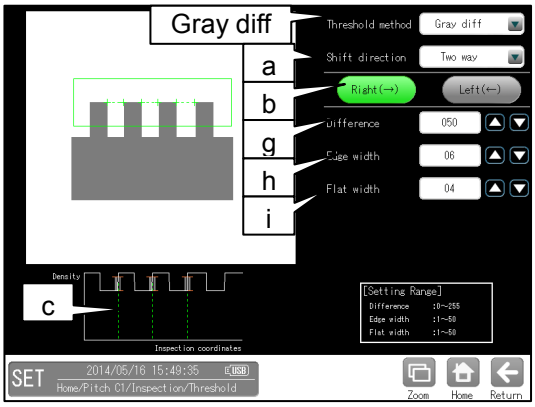
There are two threshold methods for edge detection: “Intensity” and “Gray difference”.
See page 4-119 for the details.

Touch the [Threshold] icon on the Pitch module setting screen.

- **When the Threshold method is "Intensity":**



- **When the Threshold method is “Gray diff”:**



a. [Shift direction] drop down list
Select either “One way” or “Two way”.

- **One way (One direction)**
  Detects the positions of the left and right edges of a pitch in the Inspection area by canning in the direction specified.
  Therefore the first edges close to a side is searched.
- **Two way (Two directions)**
  Detects the positions of the left and right edges of each pitch in the Inspection area by scanning in the two directions specified.
  The device detects the position of the left and right edges of each pitch in the Inspection area with the 1st scan by scanning in the direction specified, and then do the same by the 2nd scan which scanning direction is the opposite of the 1st scan.
  Therefore, the edges closer to both sides are searched.

b. [Scanning direction] buttons
Select the direction depending on the Inspection area shape:
"Rectangle", "Rotate rectangle" or "Arc".
- **For “Rectangle“ or “Rotated rectangle“:**
  When "One way" is selected: "Right (->)".
  When "Two way" is selected: "Right (->)" or "Left (<-)".
- **For “Arc “:**
  When “One way” is selected: "CW".
  When “Two way” is selected: "CW" or "CCW"

c. Intensity histogram
Displays the histogram that shows the positions of detected edges by green or red dotted lines and the intensity toward the scanning direction.
You can use this as a visual guideline for setting appropriate threshold values.

[When Threshold method is “Intensity”]

d. [Intensity low limit] data input box
Enter the lower limit for the edge intensity you want to detect.
The device will detect edges which have a higher intensity than the lower limit you set.

e. [Threshold rate] data input box
Enter a ratio against the maximum intensity in the inspection area. The image that has a intensity below the maximum intensity in the inspection area x Threshold rate is not detected.
Note:
The device will use the Threshold rate or the Intensity lower limit set above whichever is larger, therefore, the threshold value changes dynamically and the device can detect edges even when the contrast changes.

f. [Stabilize filter] data input box
The filter will smooth the edge intensity in the inspection area.
Enter a higher value when there are a lot of noises or fluctuations in the position of the object in the image during the detection.

[When Threshold method is “Gray diff”]

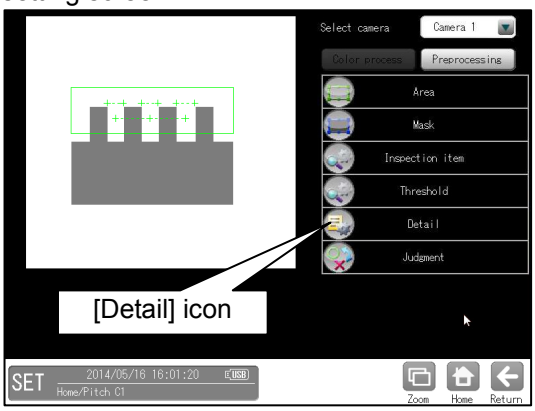
g. "(Intensity) Difference" data input box
Enter the intensity difference value, 0 to 255, to judge as an edge.
The device will check the image by the unit as designated by the h. Edge width and i. Flat width and detect an edge if the intensity difference is higher than the set intensity difference value within the Edge width and the intensity is stable within the Flat width.

h. [Edge width] data input box
Enter the number of pixels, 1 to 50, for the Edge width.

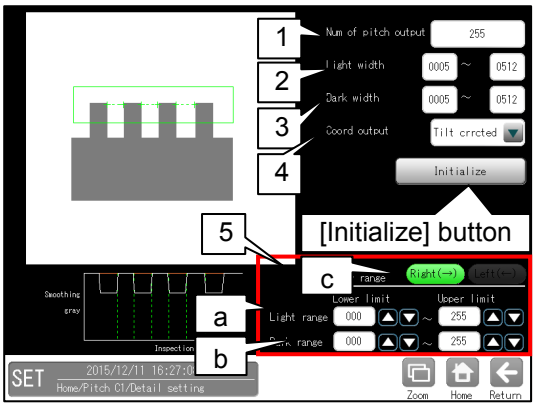
i. [Flat width] data input box
Enter the number of pixels, 1 to 50, for the Flat width.

[5] [Details] icon

① Touch the [Detail] icon on the Pitch module setting screen.



② The Detail setting screen will appear.

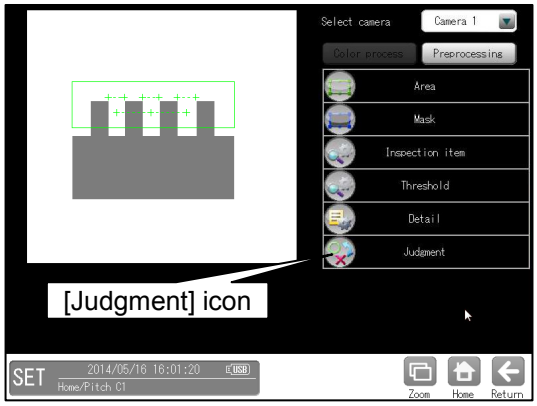


1. **[Number of pitch output] (Maximum number of cells output) data input box**
   Enter the maximum number of pitches to output.
2. **[Light width] data input boxes**
   Enter the light widths.
3. **[Dark width] data input boxes**
   Enter the dark widths.
4. **[Coordinates output] drop down list**
   Select "Original" or "Tilt corrected".
   (Default setting: Tilt corrected)
   - **Original:**
     Outputs the detected coordinates on the captured image.
   - **Tilt corrected:**
     Outputs the detected coordinates on the image after the tilt angle correction.
5. **Gray range**
   a. **[Light range] data input box**
      Enter the intensity range to detect as Light area. The edges within the set intensity area are detected.
   b. **[Dark range] data input box**
      Enter the intensity range to detect as Dark area. The edges within the set intensity area are detected.
   c. **Scan Direction display**
      Displays the scan direction set.

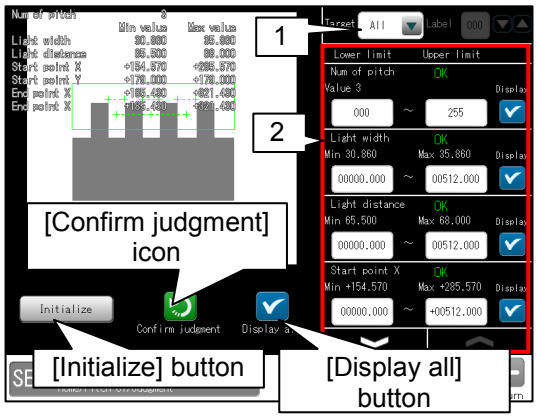
[6] [Judgment] icon

Set the upper and lower limits for OK/NG judgment based on the results of processing the Pitch module.
When the inspection result is within the range you set, the device will output an "OK" or "NG" if otherwise.

① Touch the "Judgment" icon on the Pitch module setting screen.



② The Judgment setting screen will appear.



1. [Target] drop down list
Select "All" or "Specify" for label to judge.
When "Specify" is selected, enter the label number to use (0 to 254) with the [Label number] data input box and number keypad.

2. Inspection items, upper and lower limits, and judgment data input boxes
Enter judgment criteria (upper and lower limit values) for each inspection item.

[Inspection items]

・When the Area is “Rectangle“ or “Rotated rectangle“:
"Number of pitches",
"Light width", "Dark width",
"Light distance", "Dark distance",
“Pitch height”,
“Start point X”, “Start point Y”,
“End point X” and “End point Y”.

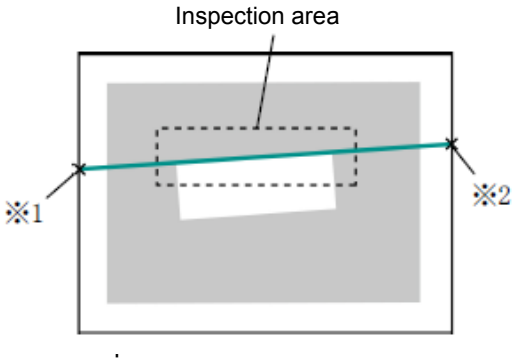
・When Threshold method is “Arc”
"Number of pitches",
"Light ", "Dark width",
"Light width angle", "Dark width angle",
"Light distance", "Dark distance",
"Light distance angle", "Dark distance angle",
“Pitch height”,
“Start point X”, “Start point Y”,
“End point X” and “End point Y”.

- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting.
  It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

4-4-15 Shape module

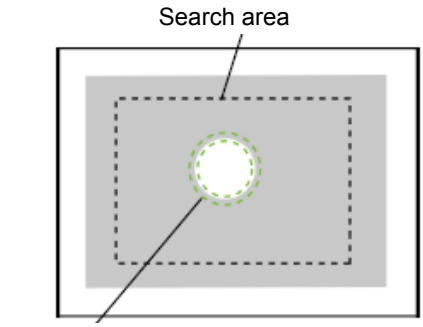
This module detects a line, circle and corner in the inspection area.

● **When the inspection shape is "Line":**
Detects the longest line among the lines it detected and inspects the coordinates of the start and end points and number of lines detected in the inspection area.

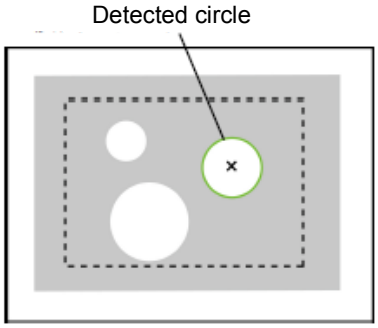


※2: End point coordinate

● **When the inspection shape is "Circle":**
Detects one circle with the specified size and inspect the center coordinate, radius and deviation from the reference circle and circle detection result.



・After the module is processed:



● **When the inspection shape is "Corner":**
Detects the intersection of 2 lines detected by line detection and inspect the coordinate and angle of the 2 lines.

■ **Output details**
The following inspection results are output.

● **When the inspection shape is "Line":**
- **Number of detection**
  Number of lines detected.
- **Center Coordinates**
  The center coordinates of the detected line.
- **Angle**
  The angle of the detected line.
- **Start and End points Coordinates**
  The start and end points coordinates of the detected line.

● **When the inspection shape is "Circle":**
- **Center Coordinates**
  The center coordinates of the detected circle.
- **Deviation (X/Y)**
  The deviation of the center coordinates of the detected circle from those of the reference circle.
- **Radius**
  The radius of the detected circle.
- **Circularity**
  The circularity of the detected circle.
  10000 = Perfect circularity
- **Detection**
  Whether a circle was detected or not.

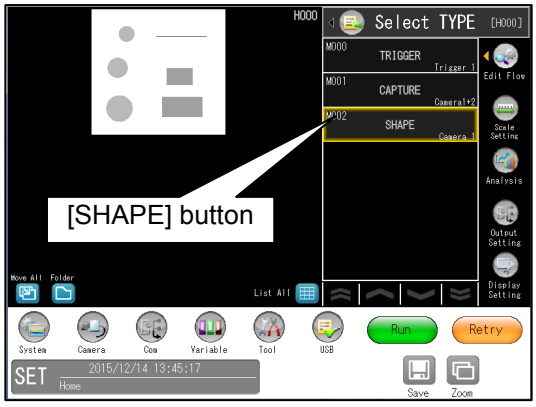
● **When the inspection shape is "Corner":**
- **Number of detection**
  Number of intersections detected.
- **Coordinates**
  The coordinates of the detected intersection.
- **Angle**
  The angle of the detected 2 lines.
- **Deviation (X/Y)**
  The deviation of the detected corner coordinates from those of the reference image.

- **OK/NG judgment**
  The upper and lower limits of each of the above inspection item are set and used as the criteria for "OK" and "NG" judgment.
  OK: All the inspection results are within the criteria
  NG: One or more of the inspection results are out of the criteria.

■ **Operation procedures**

(The screens shown below are typical example)

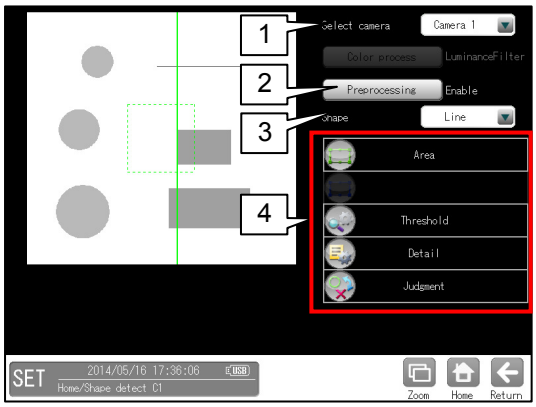
① Touch the [SHAPE] icon on the (Home) SET screen.



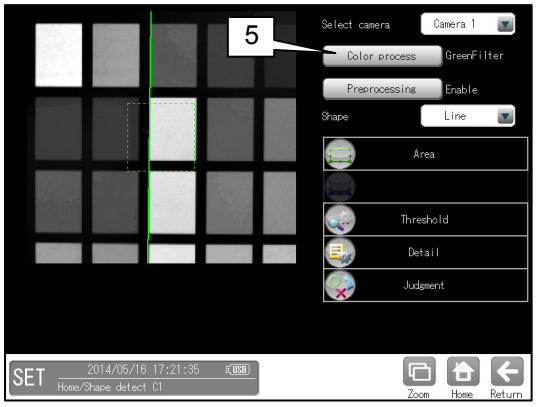
・See page 4-31 for how to edit the module flow.

① The Shape module setting screen will appear.

[When monochrome camera is used]



[When color camera is used]



1. [Select Camera] drop down list

Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".

In 2 Trigger mode, select a camera depending on the Object type number.

See page 4-6.

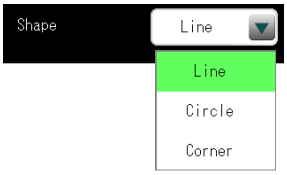
2. [Preprocessing] button

Preprocessing will make the captured image easy for inspection.

See page 4-56 for the functions and setting procedures.

3. [Shape] drop down list

Select one from "Line", "Circle" or "Corner" for the inspection shape.



4. [Setting] icons

- Area => [1]
- Mask => [2]
- Threshold => [3]
- Detail => [4]
- Judgment => [5]

5. [Color preprocess] button (When a color camera is used)

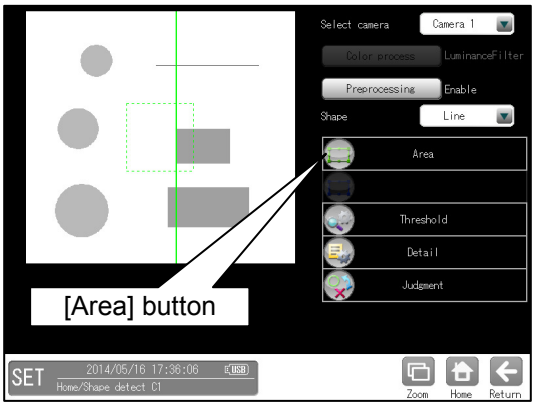
When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)

See page 4-68 for the function and setting procedures.

[1] [Area] icon

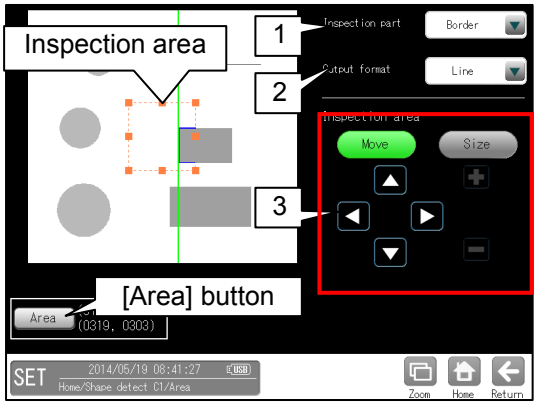
Set the inspection area on captured images.

① Touch the [Area] icon on the Shape module setting screen.

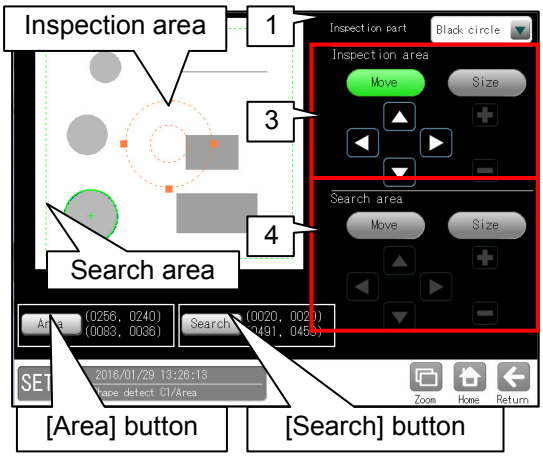


② The Area setting screen will appear.

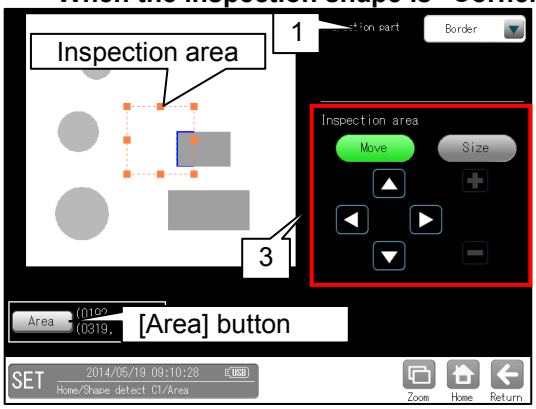
- **When the inspection shape is "Line":**



- **When the inspection shape is "Circle":**



- **When the inspection shape is "Corner":**



1. [Inspection part] drop down list

Select the inspection part.

- **When the inspection shape is "Line" or "Corner":**
  "Board", "Black line" or "White line".
- **When the inspection shape is "Circle":**
  "White circle", "Black circle" or "Board circle".

2. [Output format] drop down list (When the inspection shape is "Line" or "Corner")

Select "Line" or "(Line) Segment".
Line: A whole line is displayed.
Segment:
Segment of the detected line is displayed.

3. [Inspection area] buttons

Set the inspection area with the [Move], [Size], [Directions], [+] [-] buttons and the [Area] button at bottom left.

- See page 3-6 for setting the Inspection area.
- When the inspection shape is “Circle”, the inspection area is set by two dotted line circles.
  Set the two circles such that the profile of the circle to detect falls between them.

4. [Search area] buttons (When the inspection shape is "Circle")

Set the search area with the [Move], [Size], [Directions], [+] [-] buttons and the [Area] button at bottom left.

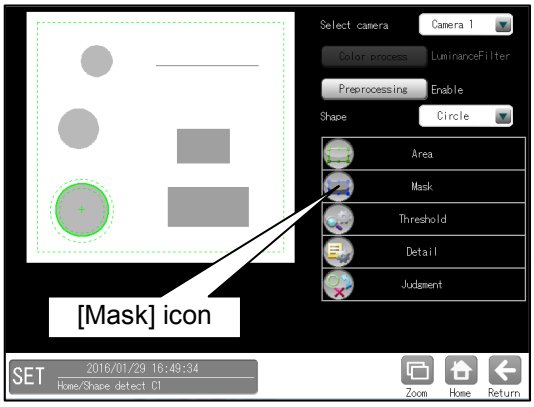
- See page 3-6 for setting the Inspection area.

[2] [Mask] icon

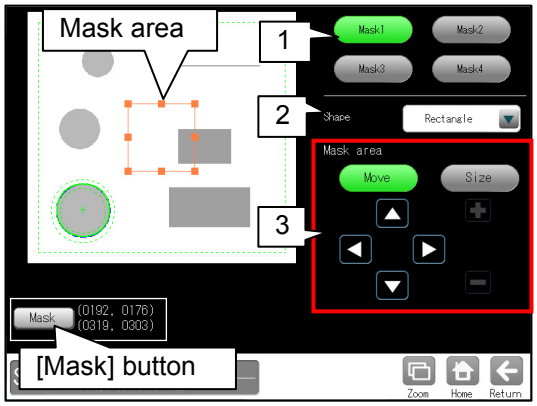
(When the inspection shape is "Circle")

If you want to avoid inspecting one or more areas within the inspection area, you can create up to four mask areas.

① Touch the [Mask] icon on the Shape module setting screen,



② The Mask setting screen will appear.



1. [Mask 1] to [Mask 4] buttons

Touch one of the mask buttons: [Mask 1] to [Mask 4].

2. [Shape] drop list

Select a shape for the mask area: "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon".

3. [Mask area] button

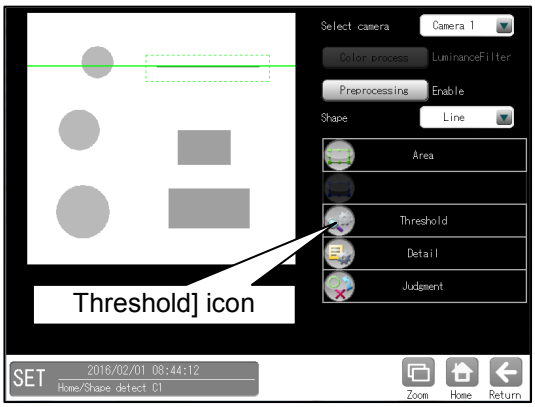
Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.

・See page 3-6 for setting the Mask areas.

[3] [Threshold] icon

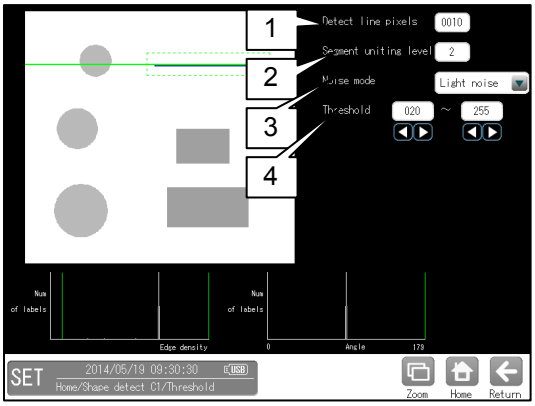
Set the binarized threshold for the detection of a "Line", “Circle” or “Corner”.

① Touch the [Threshold] icon on the Shape module setting screen.

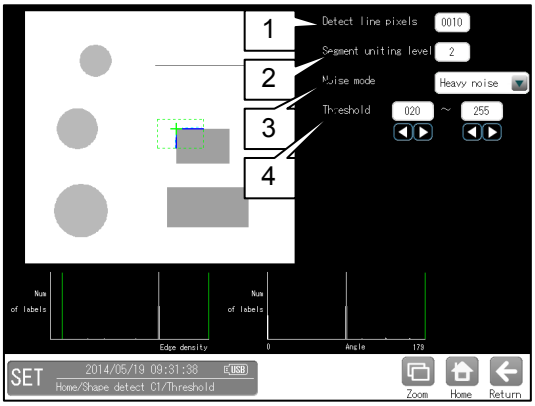


② The Threshold setting screen will appear.

■ When the inspection shape is "Line"



■ When the inspection shape is "Corner"



1. [Detect line pixels] data input box

Enter the number of series of pixels to judge as a line.

2. [Segment uniting level] data input box

Enter the level to unite detected line segments.

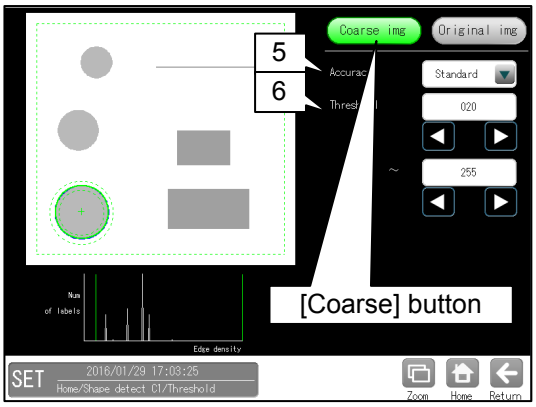
3. [Noise mode] drop down list

Select "Heavy noise" or "Light noise" for processing the noises on a line segment.

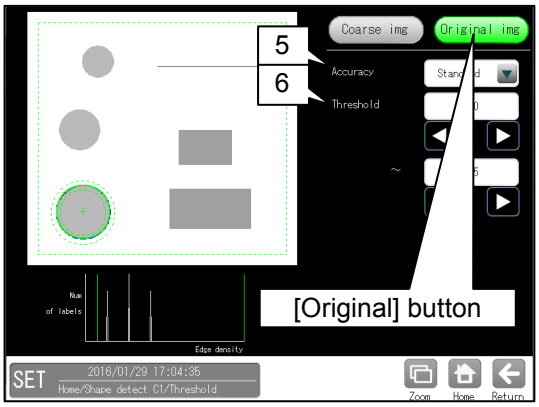
4. [Threshold] data input boxes
Enter the upper and lower limits of the threshold for the edge detection.

■ When the inspection shape is "Circle"
To shorten the module process time, the device first performs search on a coarse (shrunk) image and then on the original image.
Threshold need to be set for each Coarse and Original images.

・Setting for Coarse image



・Setting for Original image



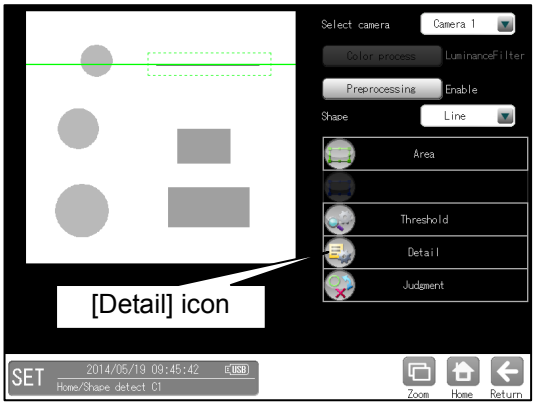
5. [(Detection) Accuracy] drop down list
Select "H-accuracy", “Standard” or "H-speed".

6. [Threshold] data input boxes
Enter the upper and lower limits of the threshold for the detection of a "Circle”.

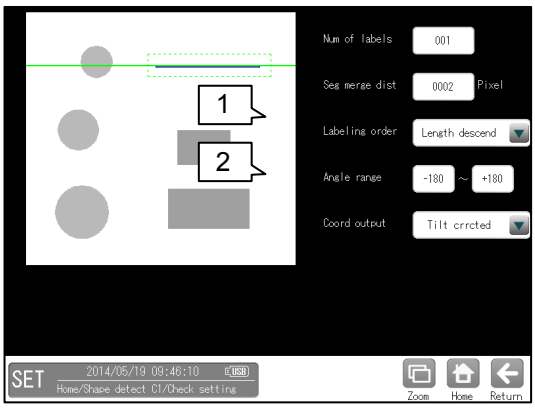
- When selected image is “Coarse image”: Shrunk image is displayed at top left. Set the threshold such that the circumference of a circle is shown in blue clearly.
- When selected image is “Original image”: Set the threshold such that the circumference of the target circle is shown in blue clearly.

[4] [Details] icon

① Touch the [Detail] icon on the Shape module setting screen.

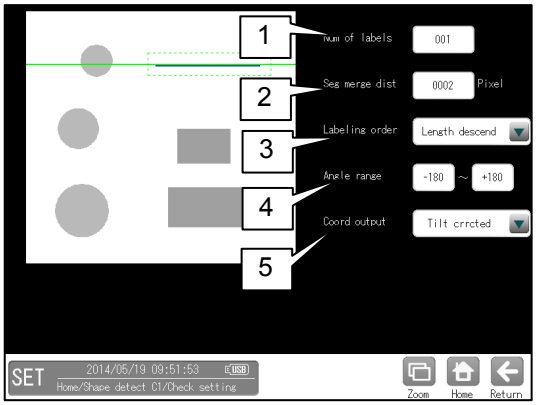


② The Detail setting screen will appear.



The setting screen is depending on the inspection shape.

(1) **When the inspection shape is "Line":**



1. [Number of labels] data input box
Enter the maximum number of lines to detect.

2. [Seg merge dist] data input box
Enter the number of pixels for the distance between line segments by which the device judges as a straight line or not by uniting line segments. (0 – 1000 pixels)

3. [Labeling order] drop down list
Select the labeling order:
"Length descend", "Length ascend",
"Start X ascend", "Start X descend",
"Start Y ascend", "Start Y descend",
"End X ascend", "End X descend",
"End Y ascend", "End Y descend",
"Center X ascend", "Center X descend",
"Center Y ascend", "Center Y descend",
"Angle ascend" or "Angle descend".

4. [Angle range] data input boxes
Enter angle range to detect a line.
The angle range is depending on the noise mode and inspection shape setting.

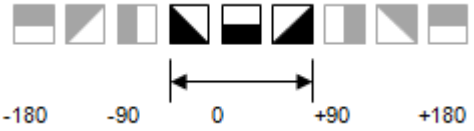
Inspection Part	Noise Mode	Angle Range
Border	Light noise	-180 to +180
	Heavy noise	-90 to +90
Black/White Line	Light/Heavy Noise	-90 to +90

■ Setting Examples

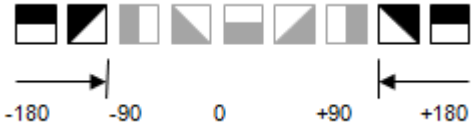
① Inspection Part = Boarder and Noise Mode = Light noise

Setting example 1: -180 to +180 (360°)

Setting example 2: -45 to +45

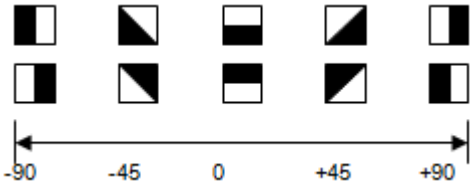


Setting example 3:+135 to -135

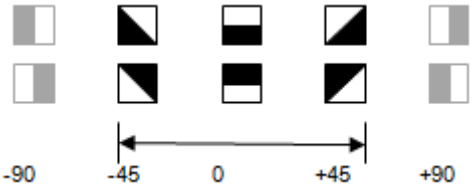


② Inspection Part = Boarder and Noise Mode = Heavy noise

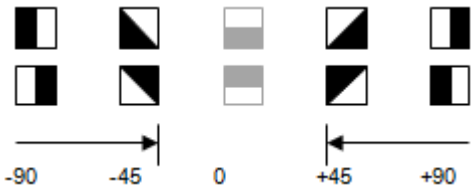
Setting example 1: -90 to +90 (360°)



Setting example 2: -45 to +45

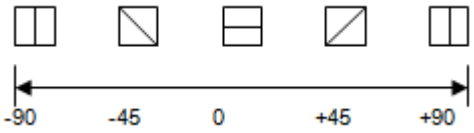


Setting example 3:+45 to -45

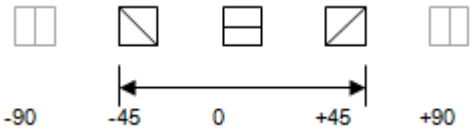


③ Inspection Part = Black Line

Setting example 1: -90 to +90 (360°)



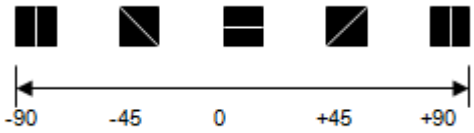
Setting example 2: -45 to +45



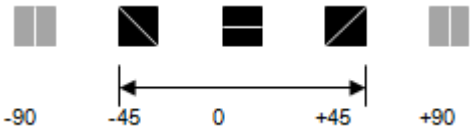
Setting example 3:+45 to -45

④ Inspection Part = White Line

Setting example 1: -90 to +90 (360°)



Setting example 2: -45 to +45

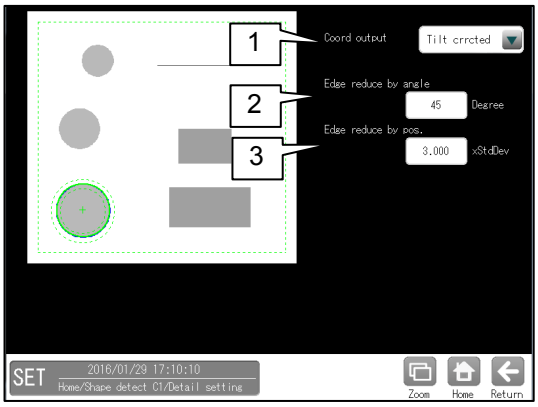


Setting example 3:+45 to -45

5. [Coordinates output] drop down list
Select "Original" or "Tilt corrected".
(Default setting: Tilt corrected)

- **Original:**
  Outputs the detected coordinates on the captured image.
- **Tilt corrected:**
  Outputs the detected coordinates on the image after the tilt angle correction.

(2) When the inspection shape is "Circle":



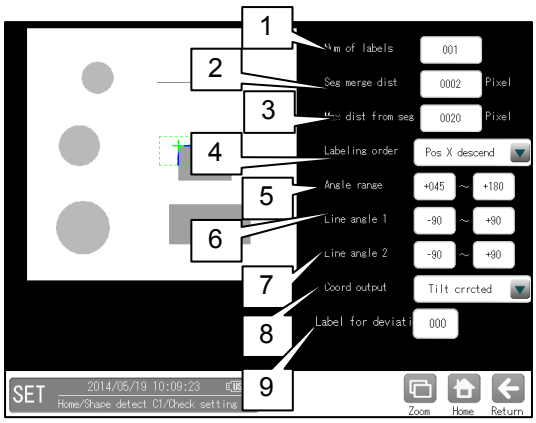
1. [Coordinates output] drop down list
Select "Original" or "Tilt corrected".
(Default setting: Tilt corrected)

- **Original:**
  Outputs the detected coordinates on the captured image.
- **Tilt corrected:**
  Outputs the detected coordinates on the image after the tilt angle correction.

2. [Edge reduce by angle] data input box
Enter the angle to detect a line segment on a candidate circumference. (0 – 90 degree)
The line segment on a circumference having angle larger than the set angle against the center of the circle is not inspected.

3. [Edge reduce by position] data input box
Enter standard deviation for the distribution data of distance from the center of a circle to the edge vs. number of pixels. (0.000 – 9.999)
The edge at the position out of the set standard deviation is not inspected.

(3) When the inspection shape is "Corner":



1. **[Number of labels] data input box**
   Enter the maximum number of corners to detect. (1 – 255)

2. **[Seg merge distance] data input box**
   Enter the number of pixels for the distance between line segments by which the device judges a straight line or not by uniting line segments. (0 – 1000 pixels)

3. **[Max dist from seg] data input box**
   There is a case a corner is having a radius. Meantime, a perfect corner consists of the mating of two line segments.
   Enter the distance between a corner and the perfect corner.
   The corner at out of the set distance is not inspected.

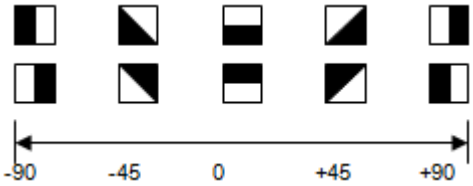
4. **[Labeling order] drop down list**
   Select the labeling order:
   "Pos X ascend", "Pos X descend", "Pos Y ascend", "Pos Y descend","Angle ascend" or "Angle descend".

5. **[Angle range] data input boxes**
   Enter angle range to detect a corner.
   Two lines mate each other and having an angle out of the set range is not judged as a corner.

6. **[Line angle 1] data input boxes**
   Enter angle range to detect a line segment.
   The line segment having an angle out of the range is not inspected.

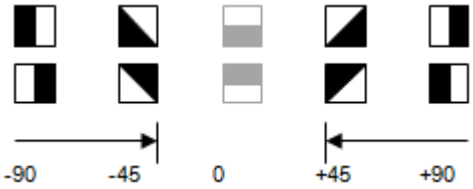
7. **[Line angle 2] data input boxes**
   Enter angle range to detect another line segment.
   The line segment having an angle out of the range is not inspected.

Setting example 1: -90 to +90 (360°)



Setting example 2: -45 to +45

Setting example 3:+45 to -45



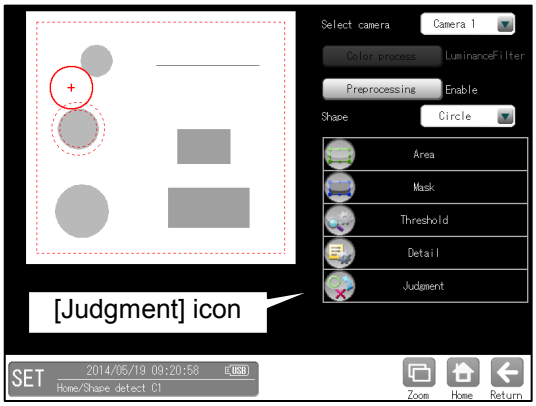
8. **[Coordinates output] drop down list**
   Select "Original" or "Tilt corrected".
   (Default setting: Tilt corrected)
   - **Original:**
     Outputs the detected coordinates on the captured image.
   - **Tilt corrected:**
     Outputs the detected coordinates on the image after the tilt angle correction.

9. **[Labels for deviation] data input box**
   Enter the number of label for deviation inspection. The device outputs the deviation between the positions of reference and captured images with the entered label number.

[5] [Judgment] icon

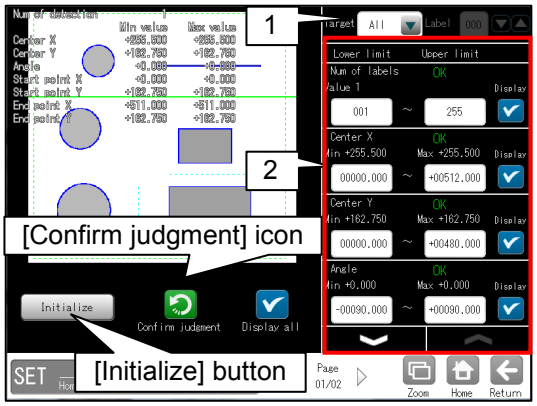
Set the upper and lower limits for OK/NG judgment based on the results of processing the Shape module.
When the inspection result is within the range you set, the device will output an "OK", or "NG" if otherwise.

① Touch the [Judgment] icon on the Shape module setting screen.

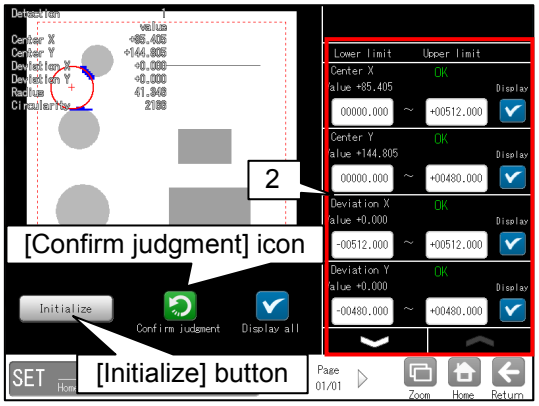


② The Judgment setting screen will appear.

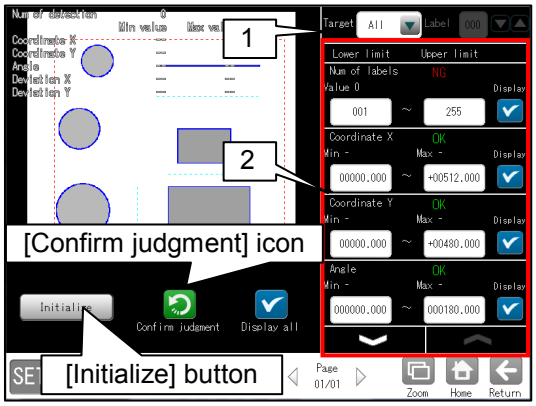
■ **When the inspection shape is "Line"**



■ **When the inspection shape is "Circle"**



■ **When the inspection shape is "Corner"**



1. [Target] drop down list

Select "All" or "Specify" for label to judge.
When "Specify" is selected, enter the label number to use (0 to 254) with the [Label number] data input box and number keypad.

2. Inspection items, upper and lower limits, and judgment data input boxes

Enter judgment criteria (upper and lower limit values) for each inspection item.

[Inspection items]

- **When the inspection Shape is "Line":**
  "Number of labels",
  "Center X", "Center Y",
  "Angle",
  "Start point X", "Start point Y",
  "End point X" and “End point Y”.

- **When the inspection Shape is "Circle":**
  "Center X", "Center Y",
  "Deviation X", “Deviation Y”,
  "Radius", “Circularity" and "Detection".

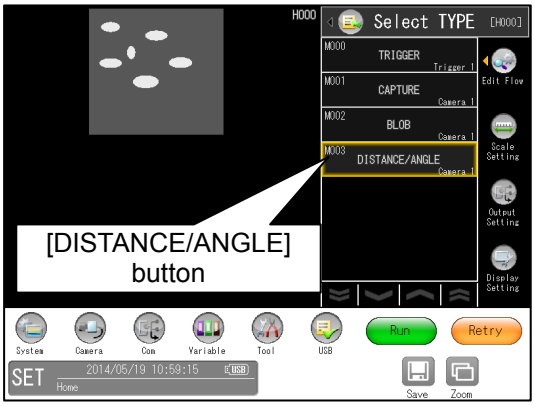
- **When the inspection Shape is "Corner":**
  "Number of labels",
  "Coordinate X", "Coordinate Y",
  "Angle", "Deviation X" and “Deviation Y”.

- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting.
  It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

4-4-16 Distance/Angle module

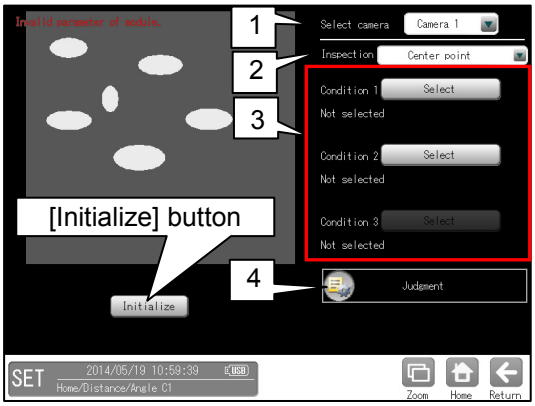
The Distance/Angle module is used to inspect distances between two points and the angles that are made by drawing lines between three points by using specific coordinates detected by the image processing modules ("Center", "Gravity center", "Edge position", etc.).
(The screens shown below are typical example)

① Touch the [DISTANCE/ANGLE] button on the (Home) SET screen.



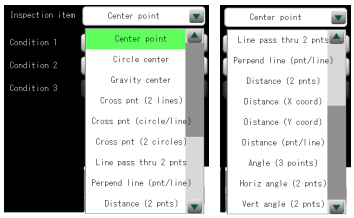
・See page 4-31 for how to edit the module flow.

② The Distance/Angle module setting screen will appear.



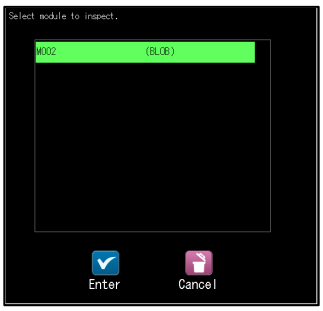
1. [Select Camera] drop down list
Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".
In 2 Trigger mode, select a camera depending on the Object type number.
See page 4-6.

2. [Inspection item] drop down list
Select an item for distance & angle inspection.

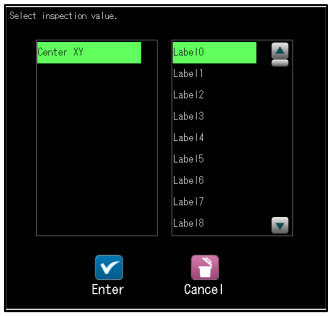


3. [Inspection items for distance & angle]
・See the [Inspection items] on the next page.

4. [Condition 1] to [Condition 3] buttons
・When no conditions have been selected, "Not selected" will be shown on the left of the button.
・Use Condition 3 when you select "Circle center", "Gravity center" or "Angle of 3 points".
・Touch the [Condition n] button, and the window for selecting appropriate inspection modules will appear. (n = 1 to 3)



Select an inspection module and touch the [Enter] icon, and a window for selecting the appropriate inspection item and label number for inspection will appear.



Touch the desired inspection item and label number, and touch the [Enter] icon.
The inspection items displayed vary with the inspection module selected.

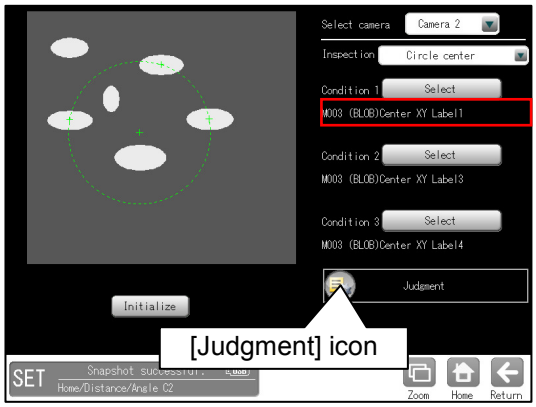
*** SF/Gray/Multiple search or Edge module**
"Coordinates XY"

*** Blob or Defect inspection module**
"Gravity center XY", "Center XY"

*** Shift edge module**
"Coordinates XY", "Start point", "End point"

*** Shape module**
"Start point", "End point", “Center point”

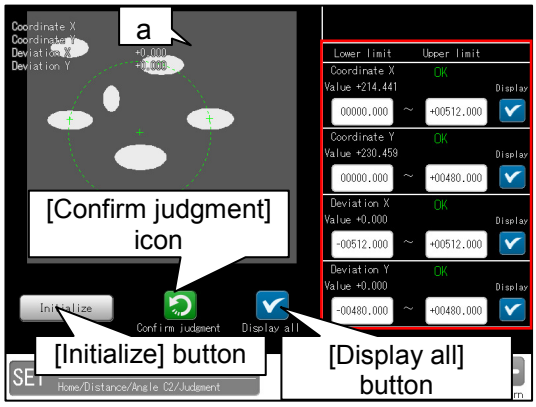
The "Module name", "Inspection item", and "Label number" selected are displayed under each [Condition n] button. (n = 1 to 3)



5. [Judgment] icon

Set the upper and lower limits for OK/NG judgment based on the results of processing the Distance/Angle module

When the inspection result is within the range you set, the device will output an "OK", or "NG" if otherwise.



a. Inspection items, upper and lower limits, buttons and Confirm judgment icon

The judgment items will vary depending on the inspection item selected.

*** When "Center point", "Circle center", "Gravity center" or "Cross point of 2 lines" is selected.**

"Coordinates X/Y" and "Deviation X/Y"

*** When "Line pass thru 2 points", " Perpendicular line of a Point & a Line" is selected**

"Start point X/Y", "End point X/Y", "Start point deviation X/Y" and "End point deviation X/Y"

*** When the "Distance of 2 points", "Distance in X coordinates", "Distance in Y coordinates" and "Distance between a Point & Line" is selected**

"Distance"

*** When "Angle of 3 points", "Horizontal angle of 2 points" or "Vertical angle of 2 points" is selected**

"Angle" and "Relative angle"

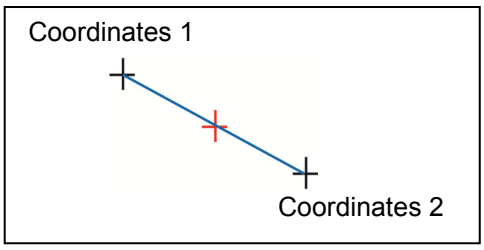
- Touch the [Display] or [Display all] button to display the judgment result.
- Scroll the inspection items display with the buttons under the items.
- Touch the [Confirm judgment] icon to display the judgment result (OK/NG) with the current setting. It is displayed on the right of each inspection item.
- Touch the [Initialize] button to reset all the judgment setting to their initial values.

[Inspection items]

The Distance/Angle module can inspect the following items.

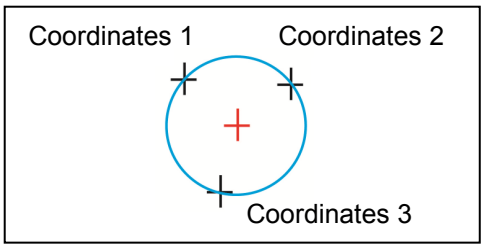
- **Center point**

  Determines the center point coordinates between two points specified.
  It also inspects the deviation of this point from the center point coordinates obtained in the same manner in the reference image.



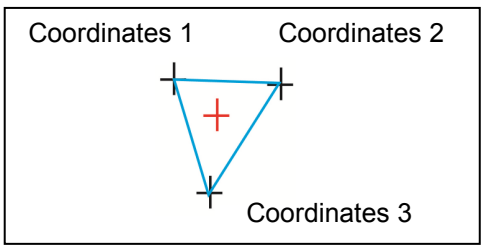
- **Circle center**

  Draws a circle passing through the specified 3 points, and determines the center coordinates of this circle. It also inspects the deviation of this point from the circle center coordinates obtained in the same manner in the reference image.



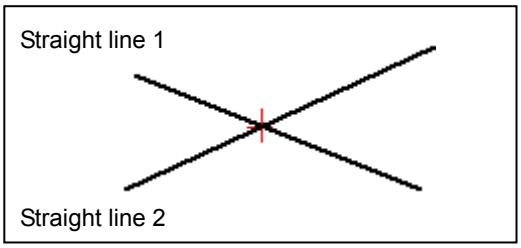
- **Gravity center**

  Draws a triangle by using the specified 3 points, and determines the gravity center coordinates of the triangle. It also inspects the deviation of this point from the gravity center of the coordinates obtained in the same manner in the reference image.



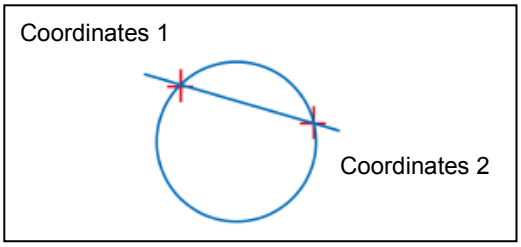
- **Cross point of 2 lines**

  Determines the cross point coordinates of the two straight lines specified.
  It also inspects the deviation of the coordinates from the ones obtained in the same manner in the reference image.



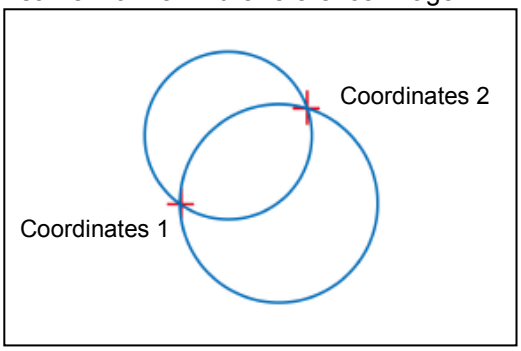
- **Cross point of circle and line**

  Determines the cross point coordinates of the circle and straight line specified.
  It also inspects the deviation of the coordinates from the ones obtained in the same manner in the reference image.



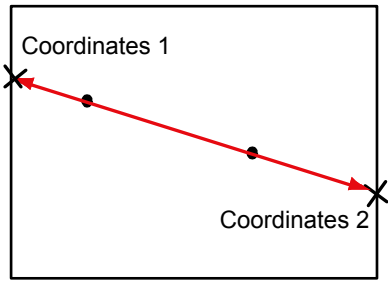
- **Cross point of 2 circles**

  Determines the cross point coordinates of two circles.
  It also inspects the deviation of the coordinates from the ones obtained in the same manner in the reference image.



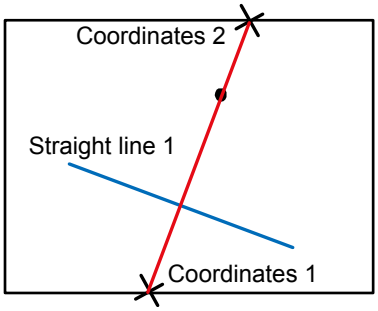
- **Line pass thru 2 points**

  Creates a straight line passing through the two points specified and determines the coordinates of this straight line's start and end points in the image.
  It also inspects the deviation of the coordinates from the ones obtained in the same manner in the reference image.



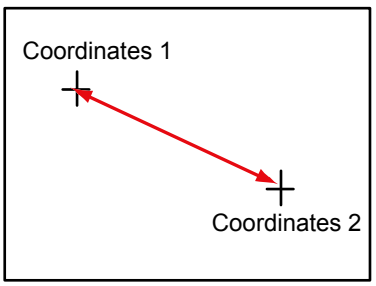
- **Perpendicular line of a Point & a Line**

  Draws a perpendicular line from the specified point to the specified line. Then it determines the coordinates of the start and end points of the straight line in the image.
  It also inspects the deviation of the coordinates from the ones obtained in the same manner in the reference image.

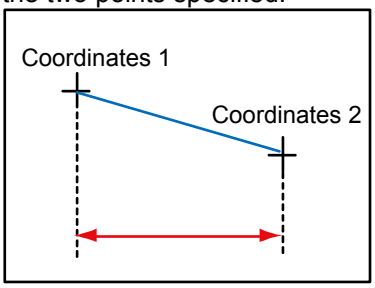


- **Distance of 2 points**

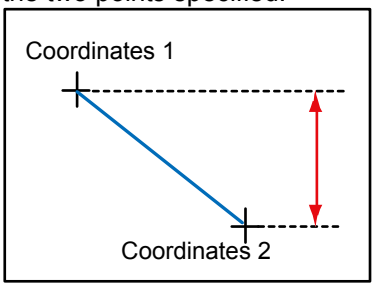
  Inspects the distance between the two points specified.



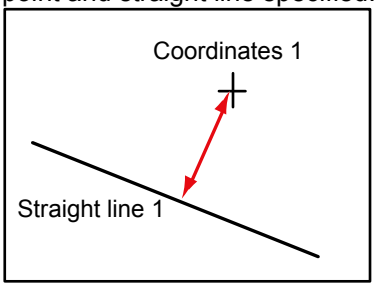
- **Distance in X coordinates**
  Inspects the distance in X coordinate between the two points specified.



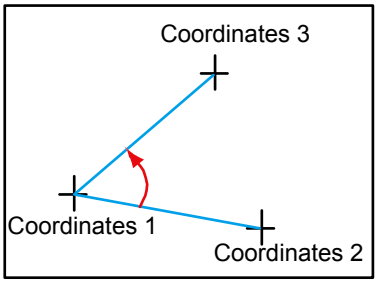
- **Distance in Y coordinates**
  Inspects the distance in Y coordinate between the two points specified.



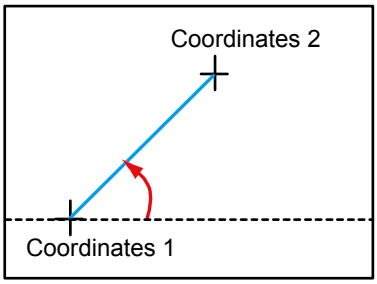
- **Distance between a Point & a Line**
  Inspects the minimum distance between the point and straight line specified.



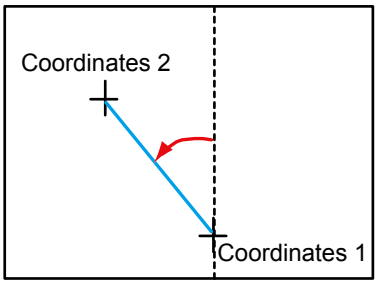
- **Angle of 3 points**
  Inspects the angle between a line from coordinates 1 and 2 and a line between coordinates 1 and 3.
  When coordinate 3 is at CCW to the line between coordinates 1 and 2, the angle will be a positive (+) value.
  When coordinate 3 is at CW to the line between coordinates 1 and 2, the angle will be a negative (-) value.
  This function also inspects the deviation of this angle from the angle obtained in the same manner in the reference image.



- **Horizontal angle of 2 points**
  Inspects the angle between a horizontal line that passes through coordinates 1 and the line drawn between coordinates 1 and 2.
  When coordinate 2 is at CCW to the horizontal line passing through coordinates 1, the angle will be a positive (+) value.
  When coordinate 2 is at CW to the horizontal line, the angle will be a negative (-) value.
  This function also inspects the deviation (relative angle) of this angle from the horizontal angle of 2 points obtained in the same manner in the reference image.



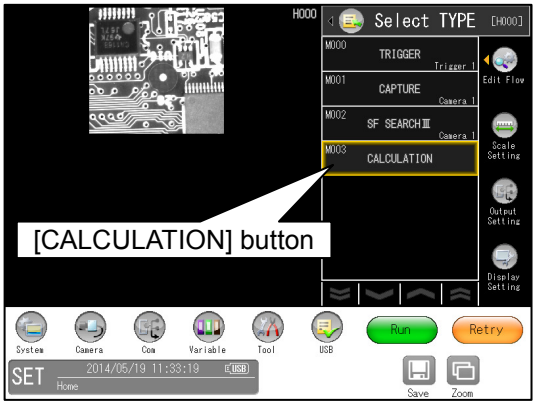
- **Vertical angle of 2 points**
  Inspects the angle made by a vertical line passing through coordinates 1 and the line drawn between coordinates 1 and 2.
  When coordinate 2 is CCW to the vertical line passing through coordinates 1, the angle will be a positive (+) value.
  When coordinates 2 is CW to the vertical line, the angle will be a negative (-) value.
  This function also inspects the deviation (relative angle) of this angle from the vertical angle of 2 points obtained in the same manner in the reference image.



4-4-17 Calculation module

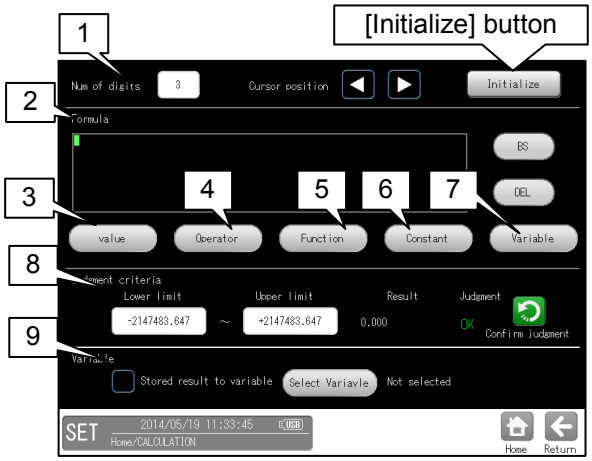
This module is used to calculate various elements including inspected values and inspection results from each module in order to make final OK/NG over all judgments.
(The screens shown below are typical example)

① Touch the [CALCULATION] (Numeric calculation) button on the (Home) SET screen,



・See page 4-31 for how to edit the module flow.

② The Calculation module setting screen will appear.

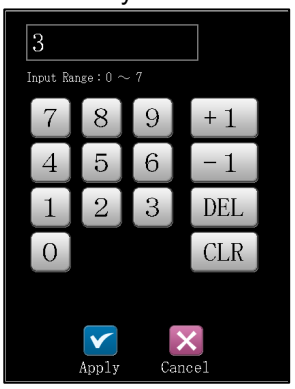


1. Number of digits below decimal => (1)
2. Formula => (2)
3. [Inspect value] button => (3)
4. [Operator] button => (4)
5. [Function] button => (5)
6. [Constant] button => (6)
7. [Variable] button => (7)
8. Judgment criteria => (8)
9. Variable Setting => (9)

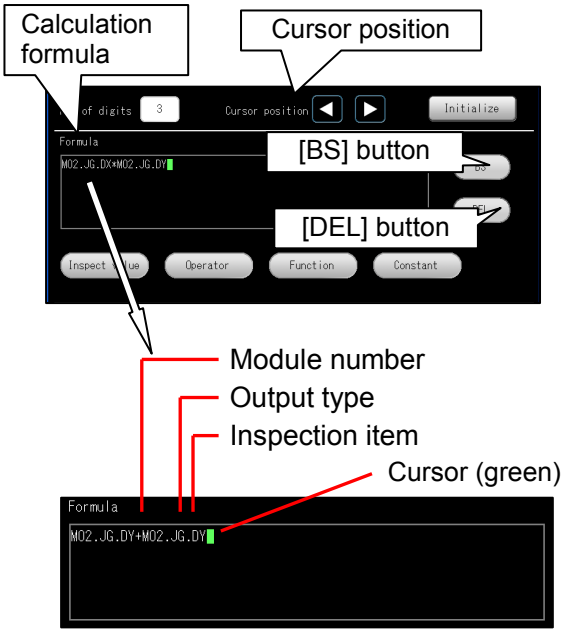
・Touch the [Initialize] button to reset the settings for the numerical calculations to their initial values.

[1] [Number of digits] data input box
Enter the number of digits below the decimal point (0 to 7).

・This setting is applied to the constants in items [6] and [7] below, as well as to the judgment conditions (upper and lower limits).
・A number keypad will appear.
Touch the number you want to enter.



[2] Formula
Enter a calculation formula in the frame with the [(Inspection) value], [Operator], [Function], [Constant] and [Variable] buttons and their windows.
See sections [3] to [7] below.



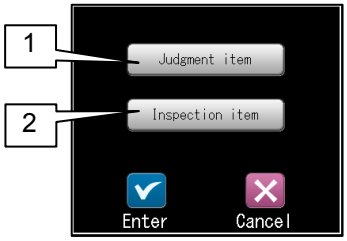
・Touch the left or right "cursor position" button to move the cursor (green).
・Touch the [BS] button to delete the calculation formula item at the left of the cursor position.
・Touch the [DEL] button to delete the calculation formula item at the cursor position.

[3] [Inspection value] button

Use to enter inspection value in the calculation Formula.

① Touch the [Inspection value] button and the module select window will appear.

② Touch a module you want to inspect and then touch the [Enter] icon.
A window to select the output type will appear.



1. Touch the [Judgment Item] button and a judgment item selection window will appear.

Touch the judgment item you want to use and then touch the [Enter] icon.
The selected judgment item will be displayed in the calculation Formula frame.

[Display example of Judgment Item]

- Module judgment: "M02.JG.MD"
- Number of detections: "M02.JG.N"
- Coordinate X: "M02.JG.X", Coordinate Y: M02.JG.Y"
- Angle θ: "M02.JG.AG"
- Matching (Degree of match): "M02.JG.SC"
- Deviation X: "M02.JG.DX"
- Deviation Y: "M02.JG.DY"
- Deviation θ: "M02.JG.RA"

2. Touch the [Inspection Item] button and an inspection item selection window will appear.

Touch an inspection item and then touch the [Enter] icon. The selected inspection item will be displayed in the calculation Formula frame.

[Display example of Inspection Value]

- Number of inspections: "M02.MR.N"

[4] [Operator] button

Use to enter operators (+, -, etc.) in the formula.
Touch the [Operator] button and an operator setting window will appear.

- **Operator**
  +, *, and,
  -, /, or,
  (,), xor

Examples of the "and," "or," and "xor" functions are shown below.

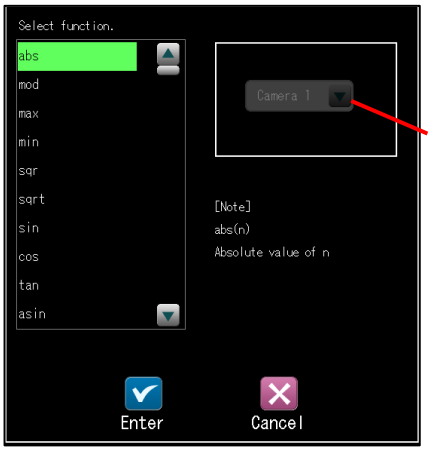
- **and** (logical product)
  In case of setting M08 (Calculation module) to "1" when the judgment results of all of the modules (M05 to M07) are "OK", enter the formula shown below.
  M08 = M05.JG.MD and M06.JG.MD and M07.JG.MD
- **or** (logical sum)
  In case of setting M08 (Calculation module) to "1" when the judgment results of one or more of the modules (M05 to M07) is "OK", enter the formula shown below.
  M08 = M05.JG.MD or M06.JG.MD or M07.JG.MD
- **xor** (exclusive OR logical sum)
  In case of setting M08 (Calculation module) to "1" when the judgment results of modules M05 and M06 are different, enter the formula shown below.
  M08 = M05.JG.MD xor M06.JG.MD

[Note]

The device treats division by zero as an error.

[5] [Function] button

Use to places functions into the calculation formula.
Touch the [Function] button and a function selection window will appear.



Functions in which the [Camera] drop down list becomes effective:

scalex
scaley
unscalex
unscaley

- **Functions**

  The functions available on the device are as follows:

  - **abs**
    (absolute value of "n")
    <Formula> abs (n)
    <Ex.> abs (-64) = 64
  - **mod** (remainder of a÷b)
    <Formula> mod (a, b)
    <Ex.> mod (32,5) = 2
  - **max** (the larger value of "a" and "b")
    <Formula> max (a, b)
    <Ex.> max (5,2) = 5
  - **min** (the smaller value of "a" and "b")
    <Formula> min (a, b)
    <Ex.> min (5,2) = 2
  - **sqr** (square of "n")
    <Formula> sqr (n)
    <Ex.> sqr (3) = 9
  - **sqrt** (square root of "n")
    <Formula> sqrt (n)
    <Ex.> sqrt (64) = 8
    The square root of a negative value cannot be resolved.
  - **sin** (sine value of "n", n = an angle)
    <Formula> sin (n)
    <Ex.> sin (30) = 0.5
  - **cos** (cosine value of "n", n = an angle)
    <Formula> cos (n)
    <Ex.> cos (60) = 0.5
  - **tan** (tangent value of "n", n = an angle)
    <Formula> tan (n)
    <Ex.> tan (45) = 1
  - **asin** (arc sine value of "n", n = an angle)
    <Formula> asin (n)
    <Ex.> asin (0.5) = 30
  - **acos** (arc cosine value of "n", n = an angle)
    <Formula> acos (n)
    <Ex.> acos (0.5) = 60
  - **atan** (arc tangent value of "n", n = an angle)
    <Formula> atan (n)
    <Ex.> atan (45) = 1
  - **scalex**
    Select a camera to use this function.
    Multiply the specified argument (n) by a scale X coefficient.
    <Formula> scale1x (n) or scale2x (n)
  - **scaley**
    Select a camera to use this function.
    Multiply the specified argument (n) by a scale Y coefficient.
    <Formula> scale1y (n) or scale2y (n)
  - **unscalex**
    Select a camera to use this function.
    Divide the specified argument (n) by the scale X coefficient.
    <Formula> unscale1x (n) or unscale2x (n)
  - **unscaley**
    Divide the specified argument (n) by a scale Y coefficient.
    <Formula> unscale1y (n) or unscale2y (n)
  - **not**
    When V < 1.0: Returns "1".
    When V >= 1.0: Returns "0".
    <Formula> not (V)
    <Ex.> not (0) = 1
  - **gt** (Greater than)
    When V0 > V1: Returns "1".
    When V0 <= V1: Returns "0".
    <Formula> gt (V0, V1)
    <Ex.> gt (12,11) = 1
  - **lt** (Lower than)
    When V0 < V1: Returns "1".
    When V0 >= V1: Returns "0".
    <Formula> lt (V0, V1)
    <Ex.> lt (5,12) = 1
  - **ge** (Greater than or equal)
    When V0 >= V1: Returns "1".
    When V0 < V1: Returns "0".
    <Formula> ge (V0, V1)
    <Ex.> ge (12,11) = 1, ge (12,12) = 1

- **le** (Less than or equal)
  When V0 <= V1: Returns "1".
  When V0 > V1: Returns "0".
  <Formula> le (V0, V1)
  <Ex.> le (5, 12) = 1, le (5,5) = 1
- **eq** (Equal)
  When V0= V1: Returns "1".
  When V0 ≠ V1: Returns "0".
  <Formula> eq (V0, V1)
  <Ex.> eq (3, 3) = 1
- **pow** (Power)
  Returns V1th power of V0.
  <Formula> pow (V0, V1)
  <Ex.> pow (4, 3) = 64
- **floor** (Foor)
  Returns largest integer not greater than V.
  <Formula> floor (V)
  <Ex.> floor (3.7) = 3, floor (-3.7) = -4
- **ceil** (Ceiling)
  Returns smallest integer not less than V.
  <Formula> ceil (V)
  <Ex.> ceil (3.7) = 4, ceil (-3.7) = -3
- **truncate** (truncate)
  Converts V to a whole number.
  <Formula> truncate (V)
  <Ex.> truncate (3.7) = 3
  truncate (-3.7) = -3
- **round** (round function)
  Round up/down V and returns a whole number.
  <Round> round (V)
  <Ex.> round (3.4) = 3
  round (3.5) = 4
  round (-3.4) = -3
  round (-3.5) = -4
- **ave** (average)
  Returns the average value of V0 to Vn (maximum 15 values).
  <Formula> ave (V0,V1,…,Vn)
  <Ex.> ave (2,4,6,8) = 5
- **aver** (average within a range)
  Returns the average value of V0 to Vn (up to 13) within a range between the specified minimum and maximum values.
  <Formula> aver (MIN, MAX, V0, V1,…,Vn)
  <Ex.> aver (20,25,23,18,25,30) = 24
  When none of V0 to Vn are within the range, returns "0".
- **maxr** (Maximum value within a range)
  Returns the maximum value of V0 to Vn (up to 13) within the range between the specified minimum and maximum values.
  <Formula> maxr (MIN, MAX, V0, V1,…,Vn)
  <Ex.> maxr (20,25,23,18,25,30) = 25
  When none of V0 to Vn are within the range, returns "0".
- **minr** (Minimum value within a range)
  Returns the minimum value of V0 to Vn (up to 13) within the range between the specified minimum and maximum values.
  <Formula> minr (MIN, MAX, V0, V1,…,Vn)
  <Ex.> minr (20, 25, 23, 18, 25, 30) = 23
  When none of V0 to Vn are within the range, returns "0".
- **maxn** (Maximum index)
  Returns an index number (0 to n) having the largest value within V0 and Vn (up to 15).
  <Formula> maxn (V0, V1,…,Vn)
  <Ex.> maxn (8, 9, 13, 7, 14) = 4
  (14 is the largest value)
  When maltiple Vn with the same largest argument exist, returns the smaller index number.
- **minn** (Minimum index)
  Returns an index number (0 to n) having the smallest value within V0 and Vn (up to 15).
  <Formula> minn (V0, V1,…,Vn)
  <Ex.> minn (8, 9, 13, 7, 14) = 3
  (7 is the smallest value)
  When maltiple Vn with the same smallest argument exist, returns the smaller index number.

[6] [Constant] button

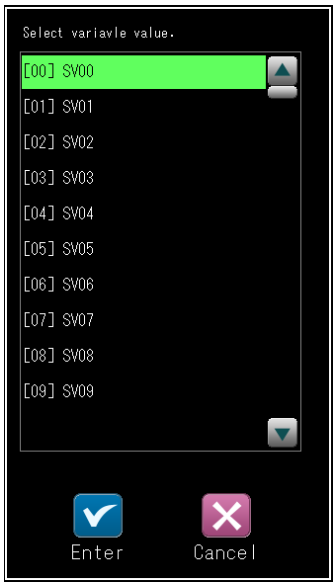
Use to enter constants. Touch the [Constant] button and enter a value with the number keypads.

[Constant setting range]
-2147483.647 to 2147483.647

・See page 4-154 for setting the decimal point.

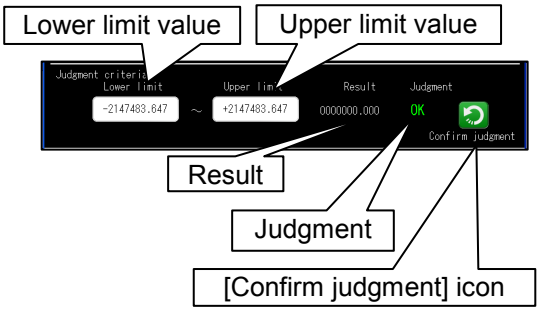
[7] [Variable] button

Select the variable number, [SVnn].



[8] [Judgment] data input boxes

Enter the "Upper limit value" and "Lower limit value" used to determine an OK/NG for the calculation result.



- Touch the [Confirm judgment] icon to check the judgment result with the entered values. A judgment result (OK/NG) will be displayed at the right of each inspection item.
- Touch the [Initialize] button to reset the setting to their initial values.

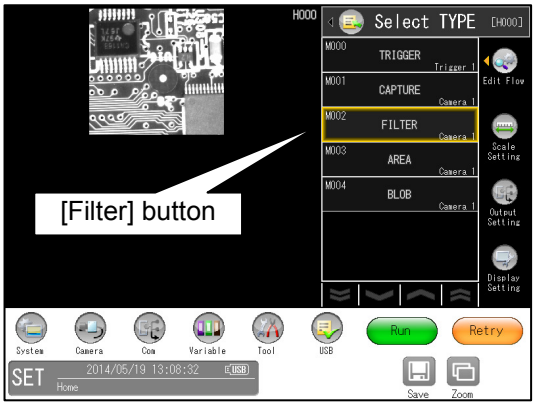
[9] Variable Setting

When storing a result as a variable, check the “Store result as a variable” check box and select a variable number to store with the “Select Variable” button.

4-4-18 Filter module

This module is for improving image quality.
The image processed by this module can be used throughout the modules that follow this module.
Therefore, you do not need to set the "Quality Improvement" available for certain modules that follow this module if the filter to be used is the same as that has been used in this module.

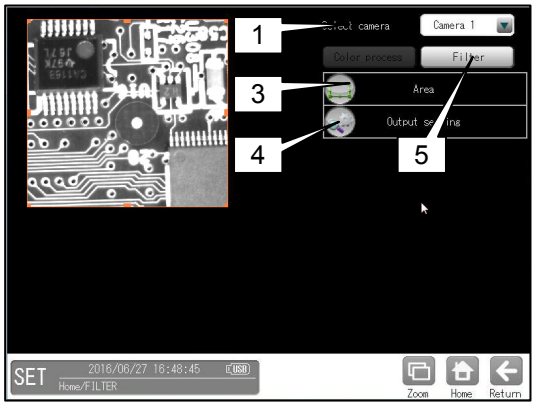
① Touch the [Filter] button on the (Home) SET screen.



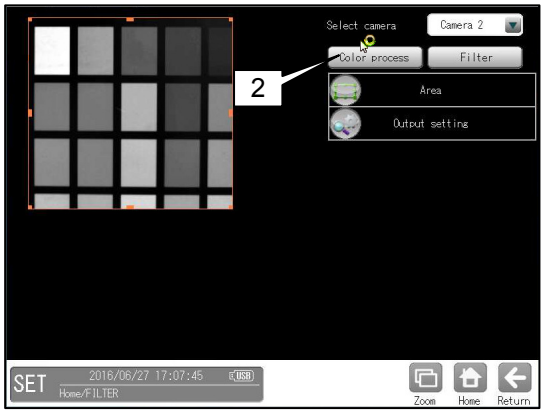
・See page 4-31 for how to edit the module flow.

② The filter setting screen will appear.

[When a monochrome camera is used]



[When a color camera is used]



1. [Select Camera] drop down list

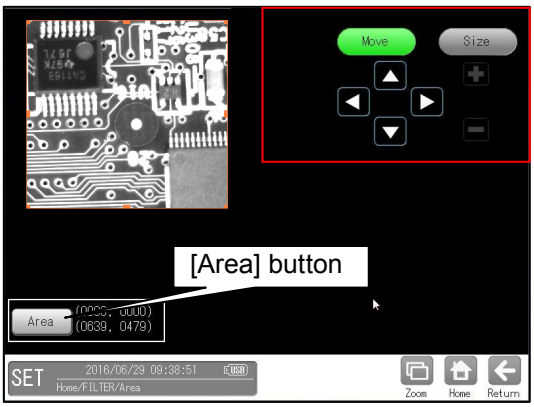
Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".
In 2 Trigger mode, select a camera depending on the Object type number.
See page 4-6.

2. [Color preprocess] button (When a color camera is used)

When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)
See page 4-68 for the function and setting procedures.

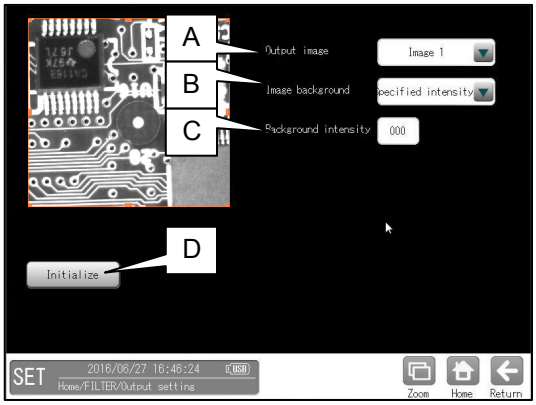
3. [Area] buttons

Define the inspection area using the [Move], [Size], [Direction] and [+] [-] buttons.
・See page 3-6 for setting the inspection area.



4. [Output setting] button

Set the "Output image", "Image background" and "Background intensity".



A. [Output image] drop down list

Select "Image n" to store the processed image in the internal memory. (n = 1 to 4) "Image 1" to "Image 4".

- When 2 Trigger mode is set, the output images are limited as follows depending on the Object TYPE:

  0 to 99 (1 Triiger): Images 1 & 2

  100 to 199 (2 Trigger): Images 3 & 4
- Images 1 to 4 can be used in the preprocessing of each module.

B. [Image background] drop down list

(When “Image 1” to “Image 4” is selected)
Select “Specified intensity” or “Capture image” for the image background.

C. [Background intensity] data input box

(When “Specified intensity” is selected)
Set the intensity. (0 to 255)

D. [Initialize] button

Touch the [Initialize] button to reset the setting to their initial values.

5. [Filter] button

There are 2 types of filters as follows:

- **Simple filter**

  Apply a simple filtering process to captured images or filtered output images (1 to 4) in the modules before this module.
  The processed image can be stored as an improved quality image for use in the modules that follow this module. => (1)

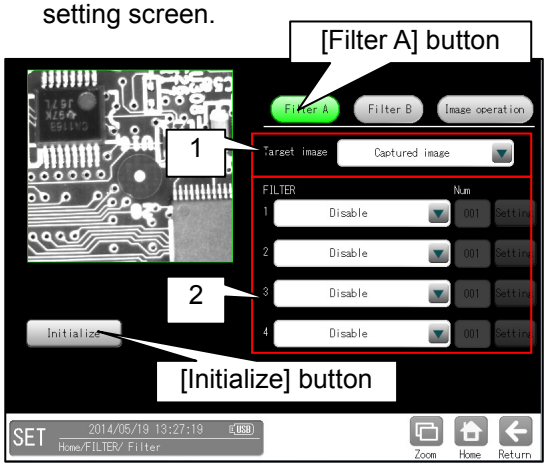
- **Filtering operation of 2 images**

  Take two images out of captured images, Filter A images, Filter B images and filtered output images (1 to 4) in the modules before this module and apply a subtraction process, etc. to such two images.
  The created image can be stored as an improved quality image for use in the modules that follow this module. => (2)

[1] Setting procedure for Simple Filter

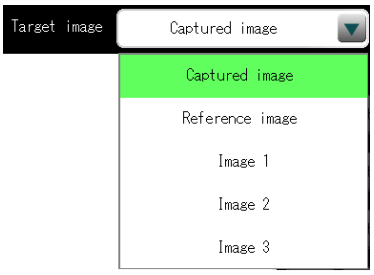
Set Filter A and Image Operation (without calculation) according to the following steps (Setting of “Filter B” is not required).

① Touch the [Filter A] button on the filter setting screen.



1. [Target image] drop down list

Select one from "Captured image", "Reference image" or “Image n (1 – 4)” for Target image.

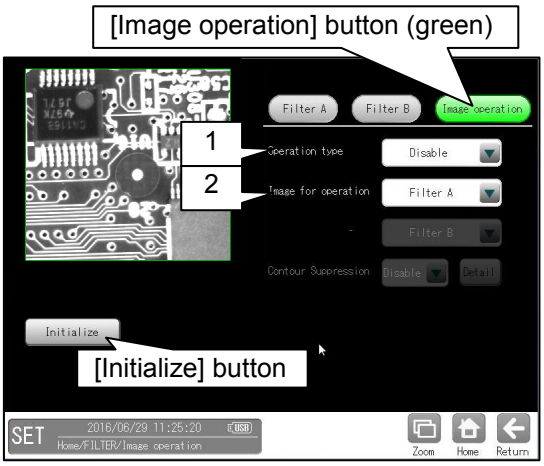


- Output Image (1 to 4) are not displayed if they have not been set by the Filter module in upstream of the flow.
- In 2 Trigger mode, the output images (1 to 4) have restrictions as follows depending on the Object TYPE:
  0 to 99 (1 Triiger): Images 1 & 2
  100 to 199 (2 Trigger): Images 3 & 4

2. [Filter 1] to [Filter 4] drop down lists

Select one of 28 kinds of filters
See page 4-57.

② Touch the [Image Operation] button on the filter setting screen.



1. [Operation type] drop down list

Select "Disable".

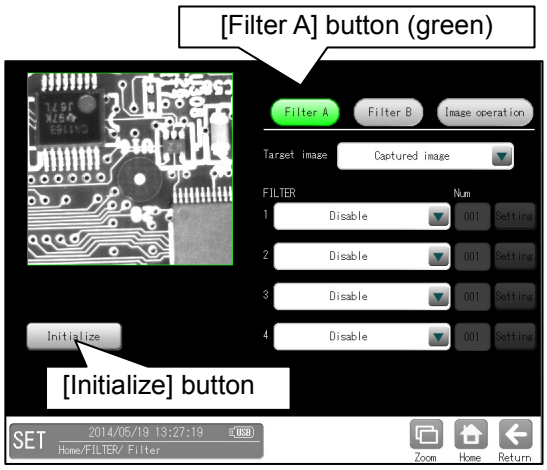
2. [Image for operation] drop down list

Select "Filter A".

- Touch the [Initialize] button to reset the setting to their initial values.

[2] Setting procedure for the filtering operation of 2 images

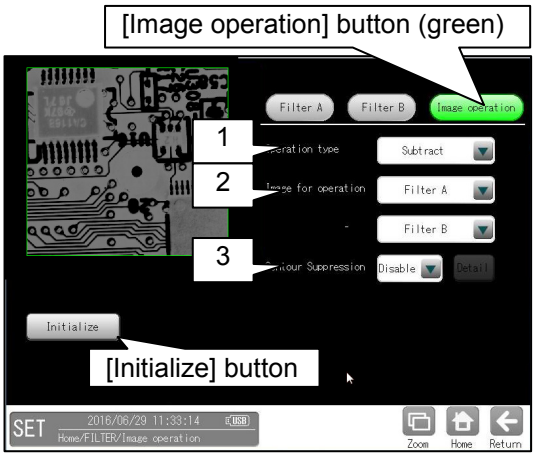
① Display the filter setting screen.



- When using a filtered image for the image operation, touch the [Filter A] button and select the image for Filter A from the drop down list.
- When making calculations between two images that have different filtering operation applied, touch the [Filter B] button and select an image for Filter B from the drop down list.

The procedure for setting the filter is the same as that for the "Setting procedures for the Simple filter" section in the previous page.

② Touch the [Image operation] button.



1. [Operation type] drop down list

Select an operation type (12 types).

[Operation types]

"Disable", "Addition", "Subtract", "Absolute difference", "Max intensity", "Min intensity", "Avg", "AND", "OR", "XOR", "XNOR", "NAND" and "NOR".

・See page 4-58 for the Operation types.

2. [Image for operation] drop down list

Select two images to process from the drop down list.

[Process image type]

"Captured image", “Reference image”, "Filter A", "Filter B" and "Image 1 to 4"

- Output Image (1 to 4) are not displayed if they have not been set by the Filter module in upstream of the flow.
- In 2 Trigger mode, the output images (1 to 4) have restrictions as follows depending on the Object TYPE:

  0 to 99 (1 Triiger): Images 1 & 2
  100 to 199 (2 Trigger): Images 3 & 4

3. [Contour Suppression] drop down list

When the operation type is “Subtract” or “Absolute difference”, set either “Disable” or “Enable” for the contour suppression.

See page 4-59 for the details about the principles used in making calculations between images.

- Touch the [Initialize] button to reset the setting to their initial values.

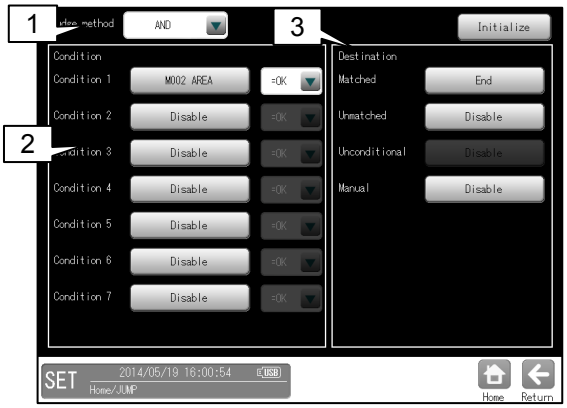
4-4-19 Jump module

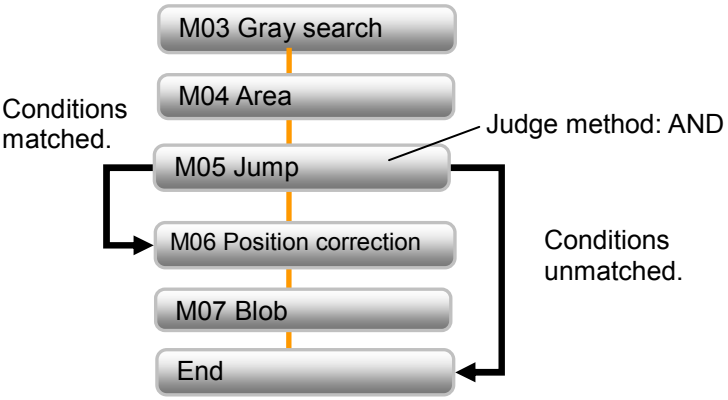
The device processes the modules in the order of the module flow (top to bottom) displayed on the module setting screen. However, if a Jump module is inserted, the device will logically judge the results of the modules that come before the Jump module and jump to any module that follows this module according to the inspection result.

[1] Principle of the Jump module

The jump module consists of three elements:

1. Judgment method,
2. Jump condition (maximum 7) and
3. Jump destination
   (When conditions are matched / conditions are unmatched / unconditionally / manually).





● Example of jump
AND of the following:
Condition 1: Result of M03 = OK
Condition 2: Result of M04 = OK
Destination when conditions are matched = M06
Destination when conditions are unmatched = End

1. Judgment method

When more than one jump conditions are used, specify a logical AND or OR for the conditions.
When AND is selected, the device will jump to the Matched destination only when all the conditions are matched.
When either one of the conditions is unmatched, the device will jump to the Unmatched destination.
When OR is selected, the device will jump to the Matched destination when one of the conditions is met. When none of the conditions are matched, the device will jump to the Unmatched destination.

2. Jump Conditions

Conditions 1 to 7 can be used.
Enter a module name and select OK/NG for the result of each module.

3. Jump Destination

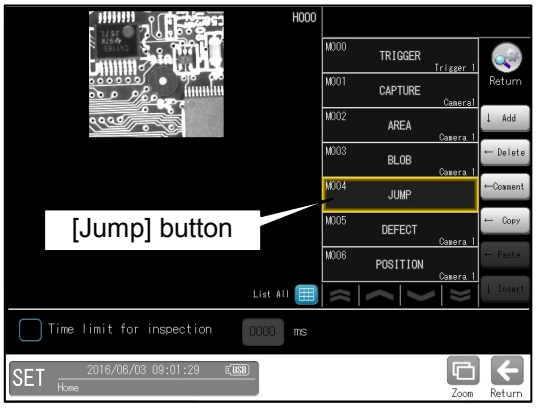
- **Matched or Unmatched**
  Specify the destinations to jump to when the result of the specified conditions and judgment method are matched or unmatched.

- **Unconditional**
  The Unconditional function automatically jumps to the specified module.
  Unconditional jump is enabled only when nothing are set for Conditions 1 to 7.

- **Manual**
  The Manual function enables a jump to a destination manually.
  When a destination module is not "Enable" after jump, the device cannot continue the module flow.
  In such a case, use this Manual function to complete the module flow manually.

[2] Operation procedures

① On the (Home) SET screen, touch the [Jump] button.



・See page 4-31 for how to edit the module flow.

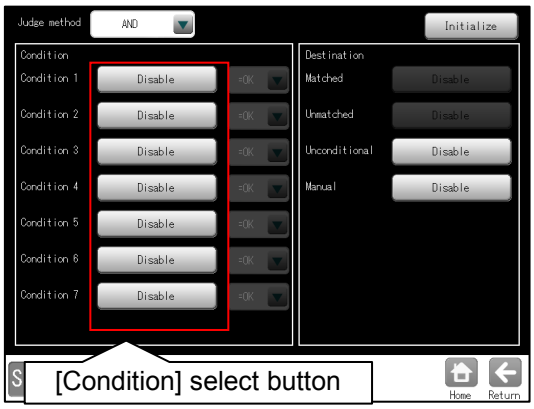
② The Jump module setting screen will appear.

・In case of Unconditional or Manual jump, do not set the "Judge method" or "Conditions."

(1) To specify the jump method

③ Select a judgment method (AND / OR) from the [Judge method] drop down list.

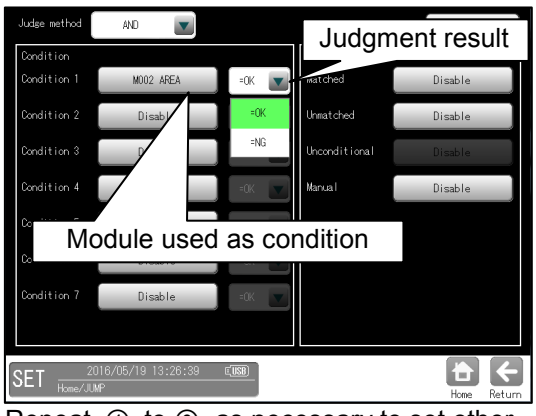
④ Touch a condition selection button to set the conditions (1 to 7).



⑤ The screen for selecting a module/folder for jump condition will appear.

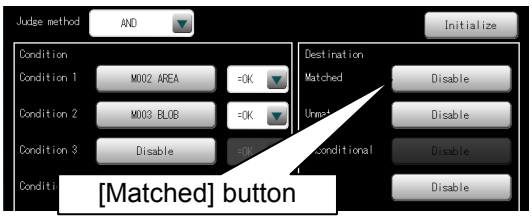
・Select the module that jump condition is applied to and then touch the [Enter] icon.

⑥ Select "=OK" or "=NG" for the judgment result of the module with the ▼ button.



Repeat ④ to ⑥, as necessary to set other conditions.

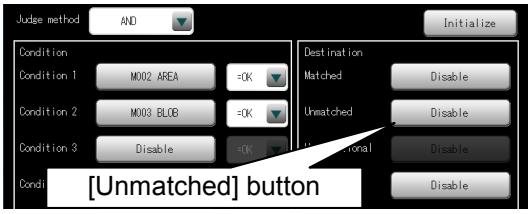
⑦ Touch the [Matched] button to set the destination for matched.



⑧ Jump destination selection screen will appear.

・Select jump destination when the set condition for matched is met, and touch the [Enter] icon.

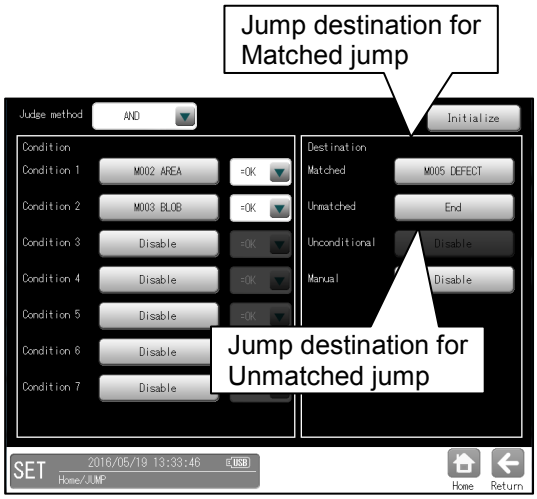
⑨ Touch the [Unmatched] button to set the destination for unmatched.



⑩ Jump destination selection screen will appear.

・Select jump destination when the set condition for unmatched is met, and touch the [Enter] icon.

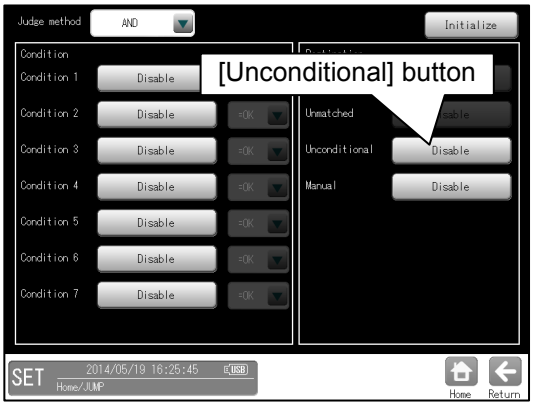
⑪ The selected jump destination (module) will be displayed on the [Matched] and [Unmatched] buttons.



(2) To set Unconditional jump

・The button is effective only when all of the Conditions 1 to 7 are set to "Disable".

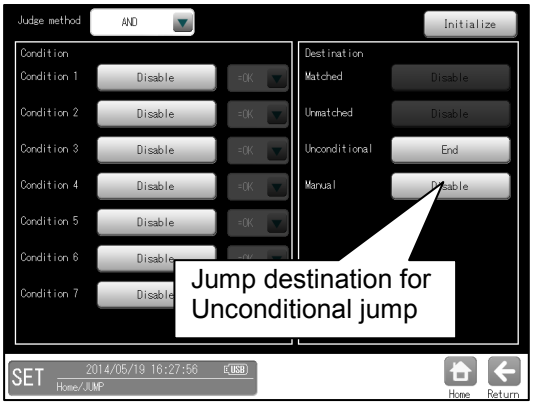
① Touch the [Unconditional] button to set the jump destination.



② Jump destination selection screen will appear.

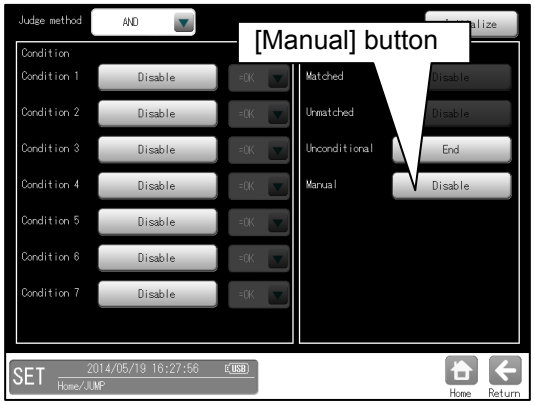
・Select jump destination and touch the [Enter] icon.

③ The selected jump destination (module) for unconditional jump will be displayed on the button.



(3) To set Manual jump

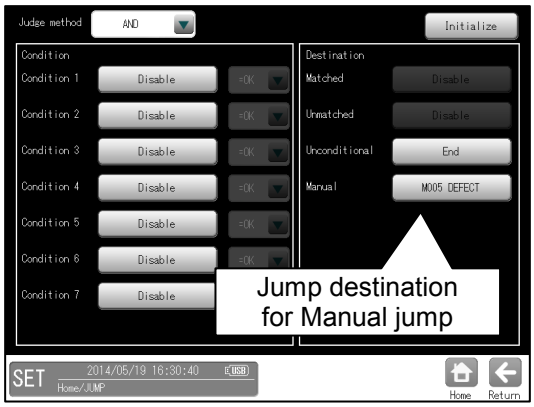
① Touch the [Manual] button to set the jump destination.



② Jump destination selection screen will appear.

・Select the Manual jump destination and touch the [Enter] icon.

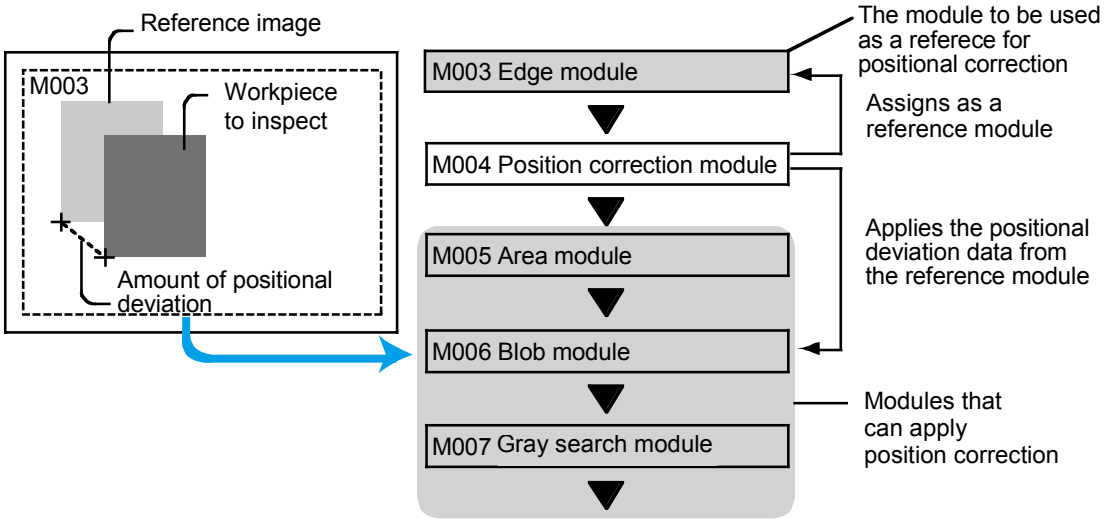
③ The selected destination (module) for the manual jump will be displayed on the button.



4-4-20 Position Correction module

Depending on the inspection method, as well as the situation, the position of an object to be inspected may deviate on the X or Y-axis, or be tilted from the pre-registered reference image position.
In such a case, the device can inspect the amount of positional deviation of the object from the pre-registered reference image and apply that to other inspection modules that follow this module.

The module used as a reference locates at upper stream of the "Position correction module" in the module flow and can be selected from modules that output positional corrections (the Edge module, SF search module, etc.). (See the table shown below)
The data which position is corrected by this "Position correction module" will be applied to the modules that follow this module.



- Modules that can be used as a reference for position correction

Correction Mode	Module	Data Output
Correction X/Y	Blob Edge SF Search III Gray Search Multi Search Shape Defect	Deviation
	Calculation	Calculation result
Image Rotation Area Rotation	Edge	Relative angle
	SF Search Gray Search Multi Search Distance/Angle	Angle Relative angle
	Blog Defect	Main axis angle
	Calculation	Calculation result

- Modules that can apply the position correction

Correction Mode	Module	Data Output
Correction X/Y Image Rotation	Area	Rectangle, Circle, Ellipse,
	Blob	Polygon, Arc, Rotated rectangle
	Edge	Rectangle, Projected rectangle, Line, Circle, Ellipse, Arc, Rotated rectangle and Rotated projected rectangle
	Defect	Rectangle, Circle, Ellipse, Polygon, Arc, Rotated rectangle
	Shift Edge Pitch	Rectangle, Rotated rectangle, Arc
	Shape	Rectangle, Double circle
	Point, Color	Rectangle
	SF Search III Gray Search Multi Search	Rectangle (search area)
	OCV	Rectangle, Circle, Ellipse, Polygon, Arc, Point
	Code Reader	Rectangle
Area Rotation	Area Blog	Rectangle, Circle, Polygon,
		Arc, Rotated rectangle
	Edge	Rectangle, Projected rectangle, Line, Circle, Ellipse, Arc, Rotated Rectangle and Rotated projected rectangle
	Defect	Rectangle, Circle, Ellipse, Polygon,
		Arc, Rotated rectangle
	Shift Edge Pitch	Rectangle , Arc, Rotated rectangle
	Shape	Rectangle, Double circle
	Point, Color	Rectangle
	SF Search III Gray Search Multi Search	Rectangle (search area)

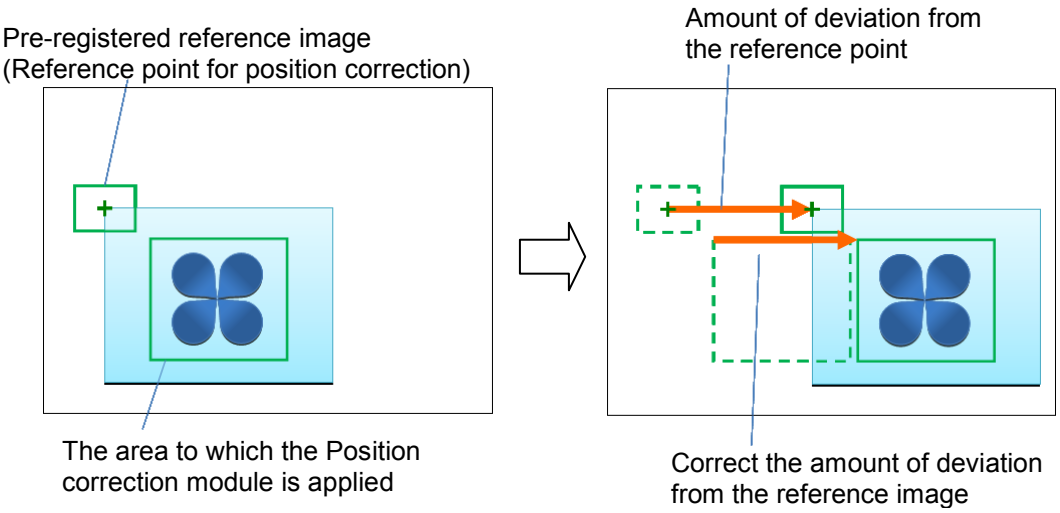
[1] Position correction types

There are 4 types of position corrections:

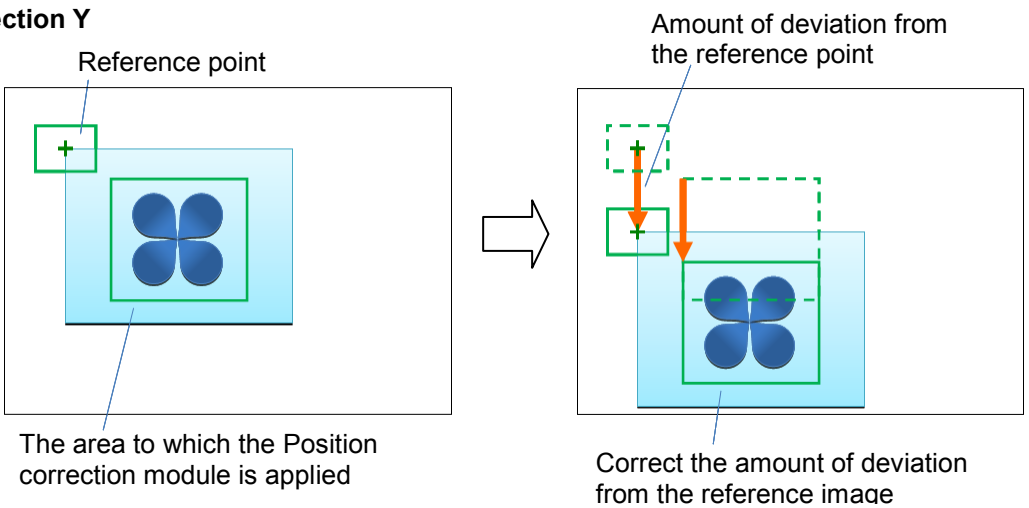
Correction X:	Correct deviation in the X direction,
Correction Y:	Correct deviation in the Y direction,
Area rotate:	Correct rotated image.
Image rotate:	Correct entire rotated images.

By combining these, various position corrections as follows can be done.

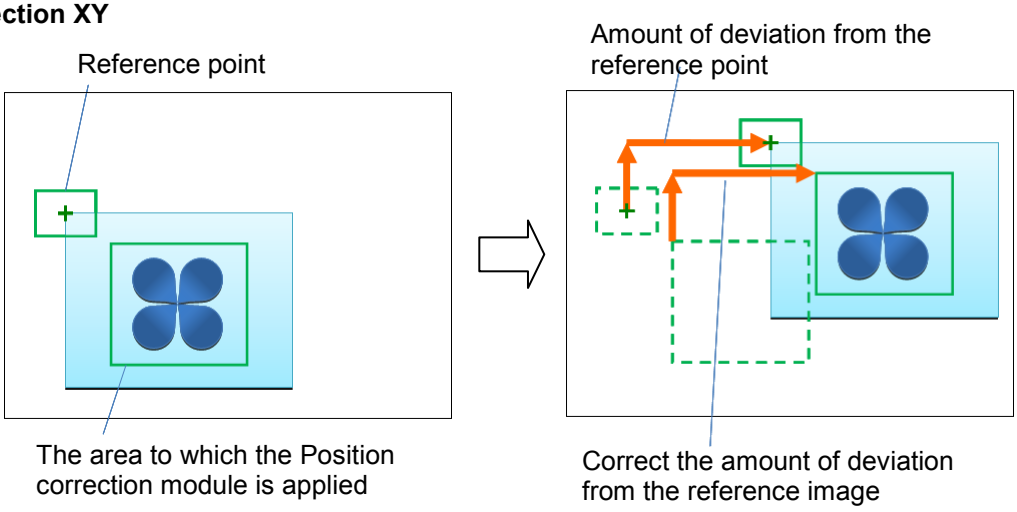
● **Correction X**



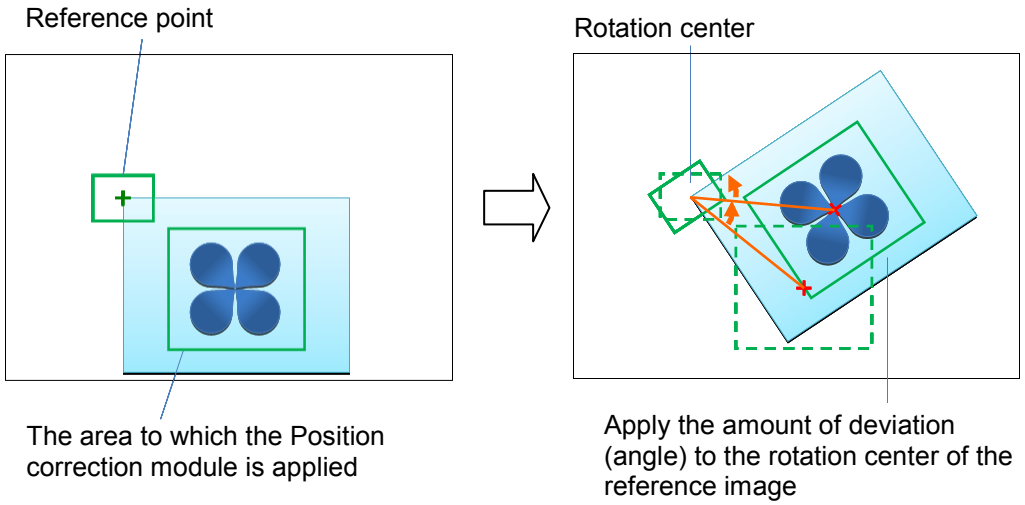
● **Correction Y**



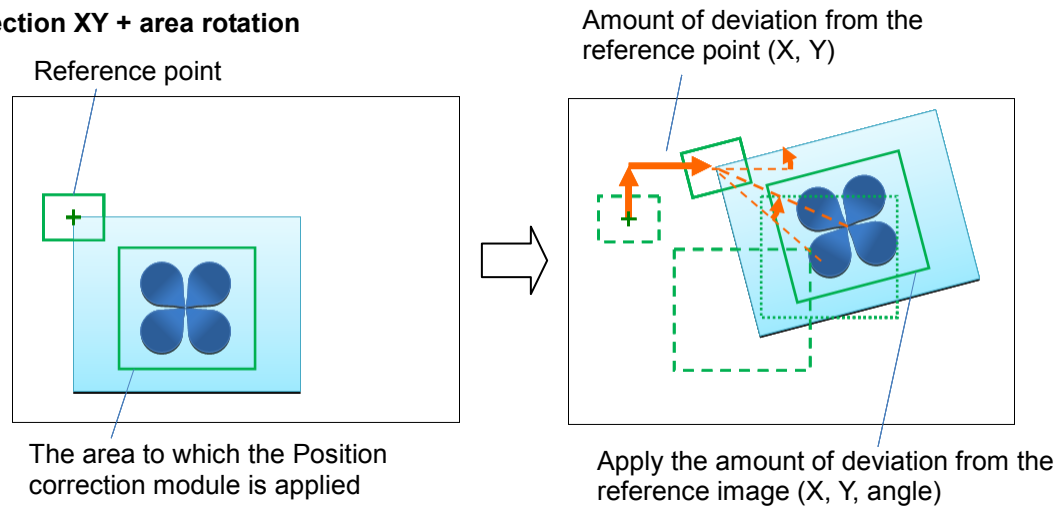
● **Correction XY**



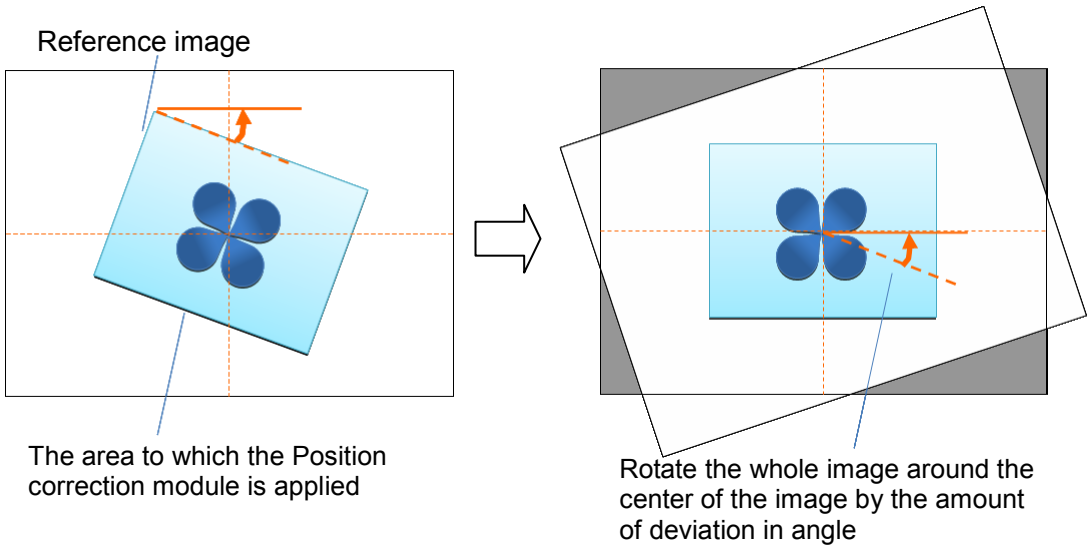
● **Area rotation**



●**Correction XY + area rotation**



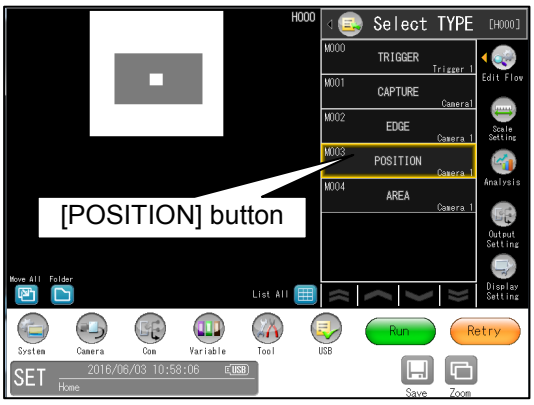
● **Image rotation**



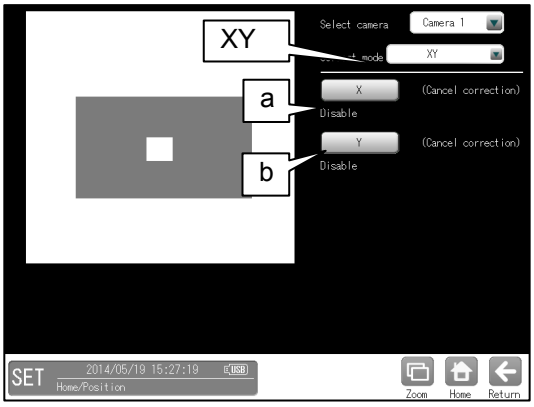
[2] Operation procedures

(The screens shown below are typical example)

① Touch the [POSITION (correction)] button on the (Home) SET screen.



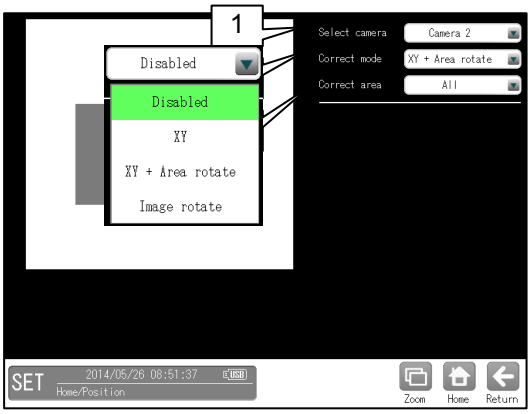
・When the "XY" correction mode is selected



a. [X] button
b. [Y] button

・See page 4-31 for how to edit the module flow.

② The Position correction module setting screen will appear.



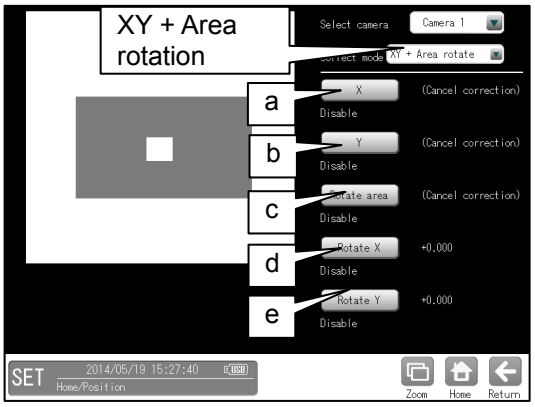
1. [Select Camera] drop down list

Select a "Camera number to use" when enabled this module:
"Camera 1" or "Camera 2".

2. [Correct mode] drop down list

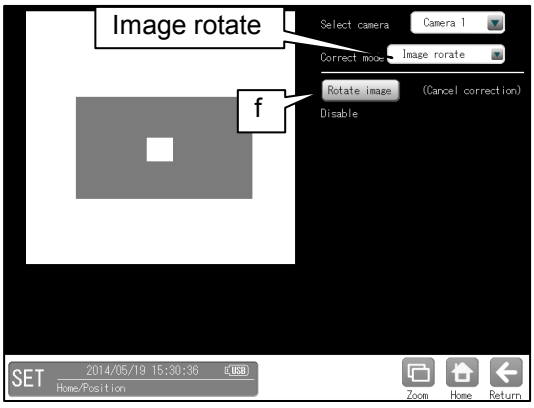
Select one from “Disable”, “XY”, “XY+Area rotate” and “Image rotate”.

・ When the "XY + Area rotation" correction mode is selected



a. [X] button
b. [Y] button
c. [Rotate area] button
d. [Rotate X] button
e. [Rotate Y] button

・When the "Image rotate" mode is selected



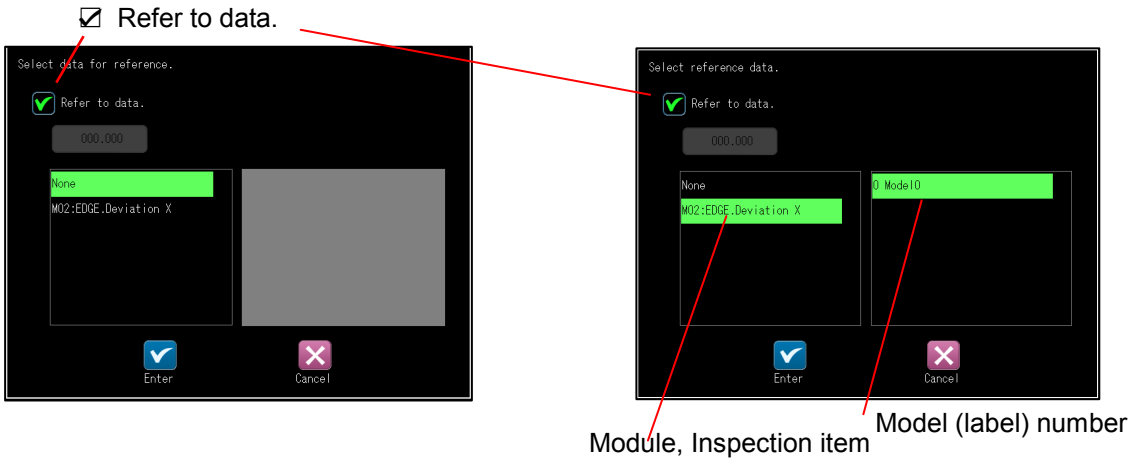
f. [Rotate image] button

3. [Correct area] drop down list

Select one from “All”, “Area” and “Mask”.

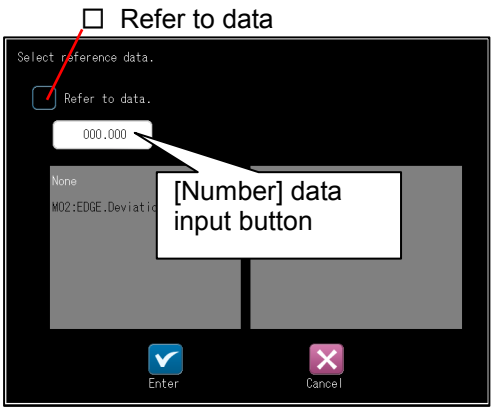
③ Touch buttons [a] to [f] on the screens shown above for each correction mode.
A data selection screen will appear.

・When the "Refer to data" is checked ☑



Select the data to use for the position correction (Module, Inspection item, etc.) and then touch the [Enter] icon.

・When the " Refer to data" is unchecked ☐.

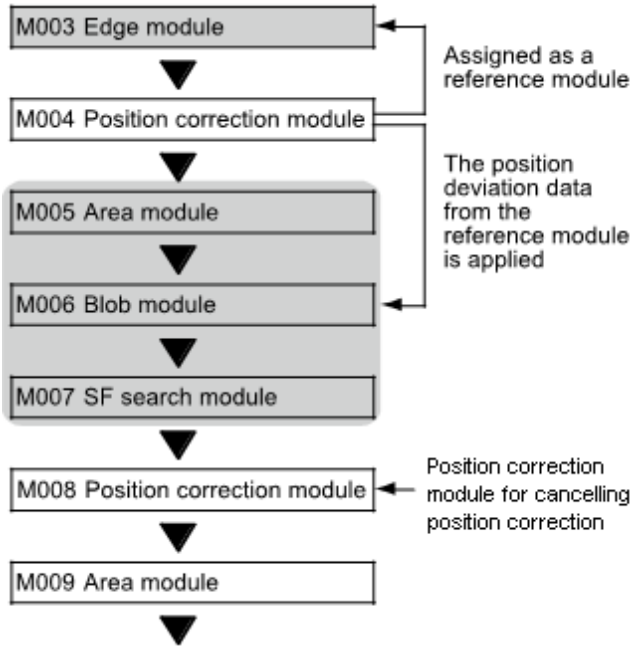


Enter coordinates, and/or an angle with the data input box and number keypad.
Then touch the [Enter] icon.

The selected set data (numeric value) is displayed right next to the setting button.

[3] To cancel the positional correction

After processing the "Position correction module", the position correction will be applied to the modules that follow this module.
To cancel applying this correction in the middle of the module flow, insert a "Position correction module" without any setting.
Then the modules which follow after such Position correction module will not be position corrected.
(The position correction condition is cancelled.)



In this flow example, "Position correction module" without any setting is set at step M008.

The "Position correction module" called in step M004 will be applied to steps M005 to M007.

The position correction is disabled for the modules M009 and after.

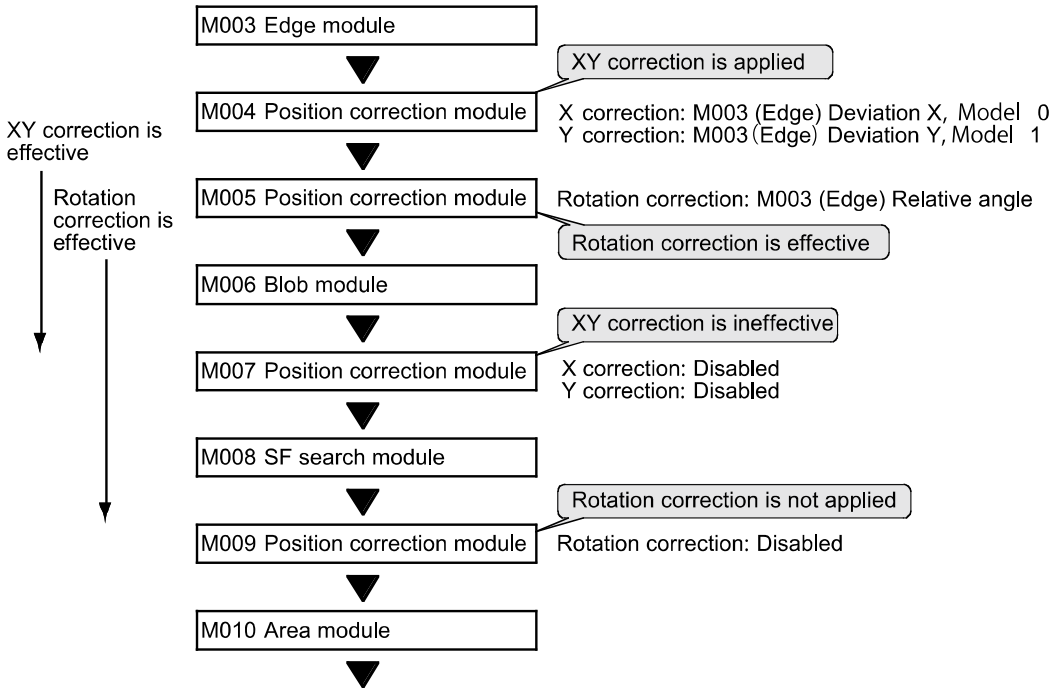
■ **Position correction module for cancelling positional correction**

To cancel a particular positional correction, select the correction mode you want to cancel and disable the inspection items on the "Position correction module".

Details	Position correction module setting	
	Correction mode	Inspection item settings
To cancel XY correction	XY correction	X correction: None, Y correction: None
To cancel X correction	XY correction	X correction: None, Y correction: Inspection items to execute Y correction
To cancel Y correction	XY correction	X correction: Inspection items to execute X correction, Y correction: None
To cancel Image rotation	Image rotation	Rotate correction: None
To cancel Area rotation	Area rotation	Rotate correction: None

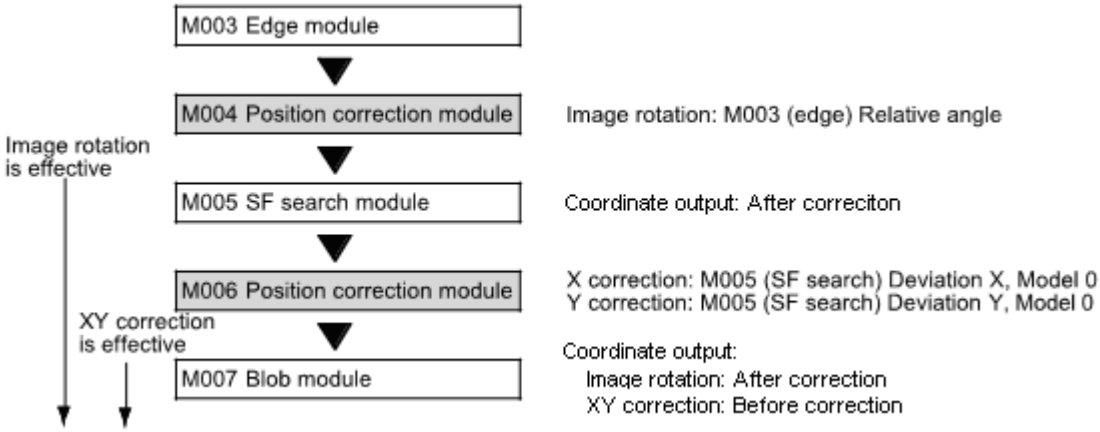
Position corrections that were not cancelled are applied to the modules that follow this module.

[Example]



[4] Two step flow of Image rotation + XY correction

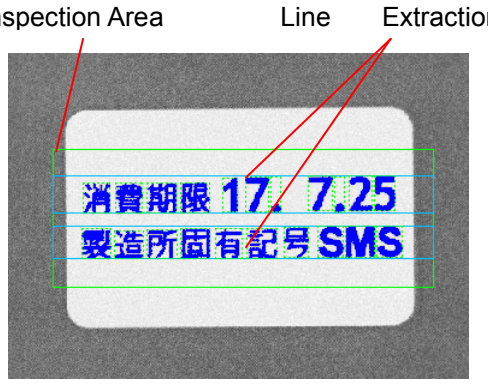
Shown below is a module flow example of positional correction by combining the Image rotation and XY corrections.

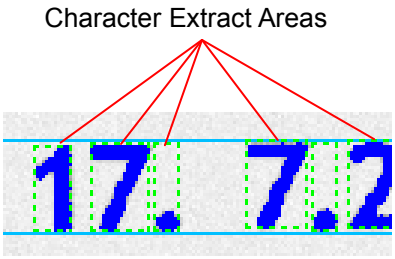


・ M007 blob module outputs the "Gravity center" and "Center" coordinates of the image captured by the camera (=before the image rotation) for XY correction.

4-4-21 OCV Module
(Optical Character Verification)

The OCV module is an image processing module to check and judge an image against preset characters for match or unmatch, inspect the character quality and recognize characters.





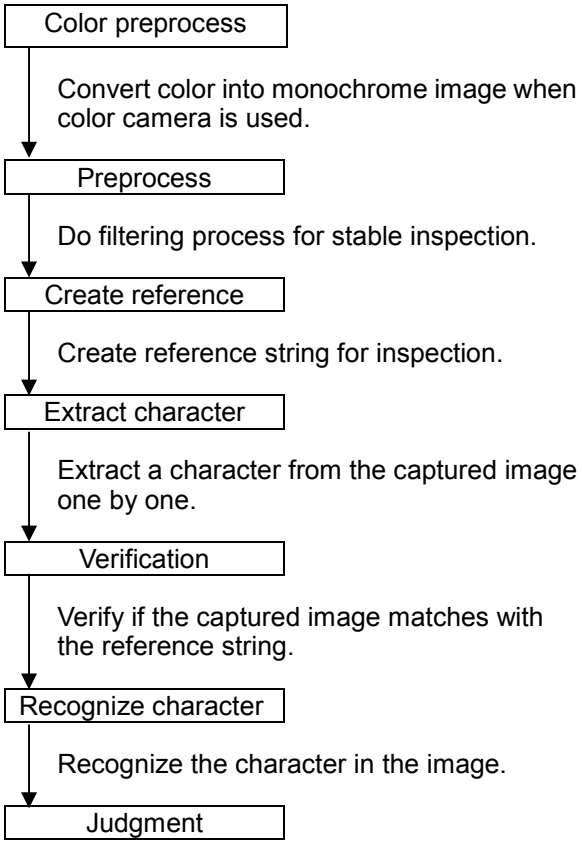
■ **Output details**

The following inspection results are output.

- **Set string**
  The set string used as the reference for the inspection.
- **Recognized string**
  The string recognized.
- **Number of characters**
  The number of characters extracted.
  A space is not included as a character.
- **Matching score of a character**
  The character matching score of each searched character against reference characters.
  (Expressed by a number: 0 to 99).
  (Max Value, Min Value and Recognized Character)
- **Matching result of a string**
  The matching result of each recognized string against the preset string.
  (Expressed by 0 = Match or 1= Unmatch).
  (Max Value, Min Value and Recognized Character)
- **Recognition score (Candidate 1)**
  The recognition score of each recognized character against candidate 1 character.
  (Expressed by a number: 0 to 99)
  (Max Value, Min Value and Recognized Character)
- **Recognition score (Candidate 2)**
  The recognition score of each recognized character against candidate 2 character.
  (Expressed by a number: 0 to 99).
  (Max Value, Min Value and Recognized Character)
- **Stability**
  The difference between the recognition scores of candidates 1 and 2.
  (Expressed by a number: 0 to 99).
  (Max Value, Min Value and Recognized Character)
- **Recognized character (Candidate 1)**
  The candidate 1 for the recognized character.
  (Shift JIS code)
  (Max Value, Min Value and Recognized Character)
- **Recognized character (Candidate 2)**
  The candidate 2 for the recognized character.
  (Shift JIS code)
  (Max Value, Min Value and Recognized Character)
- **OK/NG judgment**
  The upper and lower limits of each of the above inspection item are set and used as the criteria for "OK" and "NG" judgment.
  OK: All the inspection results are within the criteria
  NG: One or more of the inspection results are out of the criteria.

[1] Process flow of OCV module

The process flow of the OCV module is as follows:



[2] Extract a character

Extract a character one by one for inspection.
When the extraction is successful, a frame is displayed around the character.
Two methods are available for the extraction:

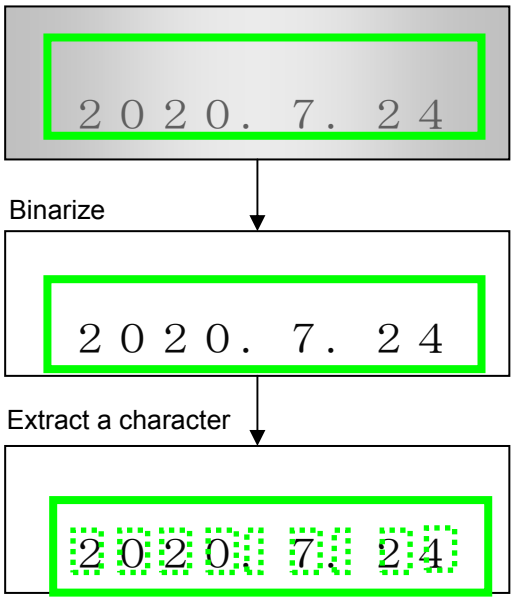
① Binarization
Extraction is possible even if the position and size of the characters vary.

② Gray Search
Extraction is possible even when the extraction by binarization is not stable due to the effect of background, etc.

(1) Extraction by Binarization

Set the inspection area such that it surrounds the string for inspection.
Binarize the area and do labeling.
Extract a character based on the labeling information.

Setting of inspection area
(The area must be set to rectangle, circle, ellipse or polygon)



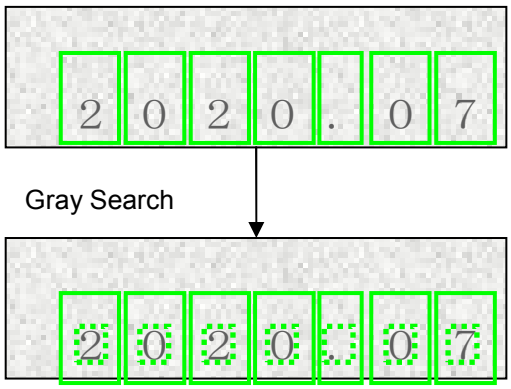
(2) Extraction by Gray Search

Set the inspection area such that it surrounds a character for inspection.
Process Gray Search on the inspection area by using a dictionary image (gray).

Note:

1. Set the inspection area shape to “Point”.
2. Set the dictionary to use to “Gray mode”.

Setting of inspection area
(The area shape must be set to Point)



[3] Verification

Two verification methods are available for the OCV module:

① Binarization
Obtain matching score by combining "Broken/Dirty inspection" and "Shape Edge inspection", Verification is possible even if the character size varies thanks to the normalization function of the character size.

② Gray Search
Obtain matching score by Gray Search. Size for dictionary must be selected. (See [5] Registration of dictionary for detail)

Note:

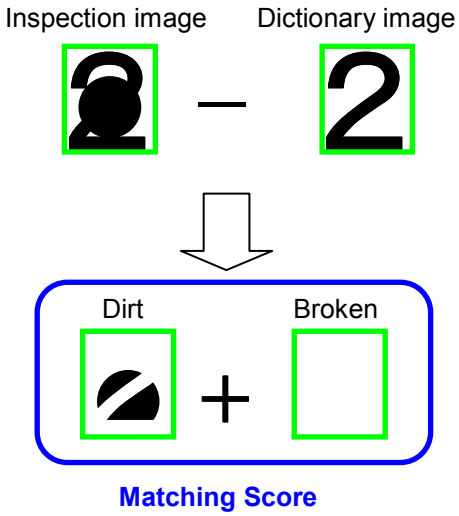
1. Selection of the size for dictionary registration is required.
   See [5] [Dictionary] icon in page 4-190.
2. The number of dictionary that can be registered depends on the selected size.

(1) Verification by Binarization

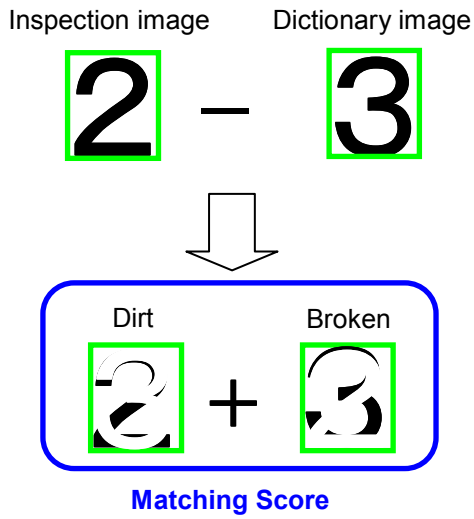
Obtain matching score by comparing the inspection image and dictionary image and inspecting broken and dirt.

As optional functions, Shape Edge inspection, Width inspection and Feature inspection are available.

Quality (Broken/Dirty)



Different character



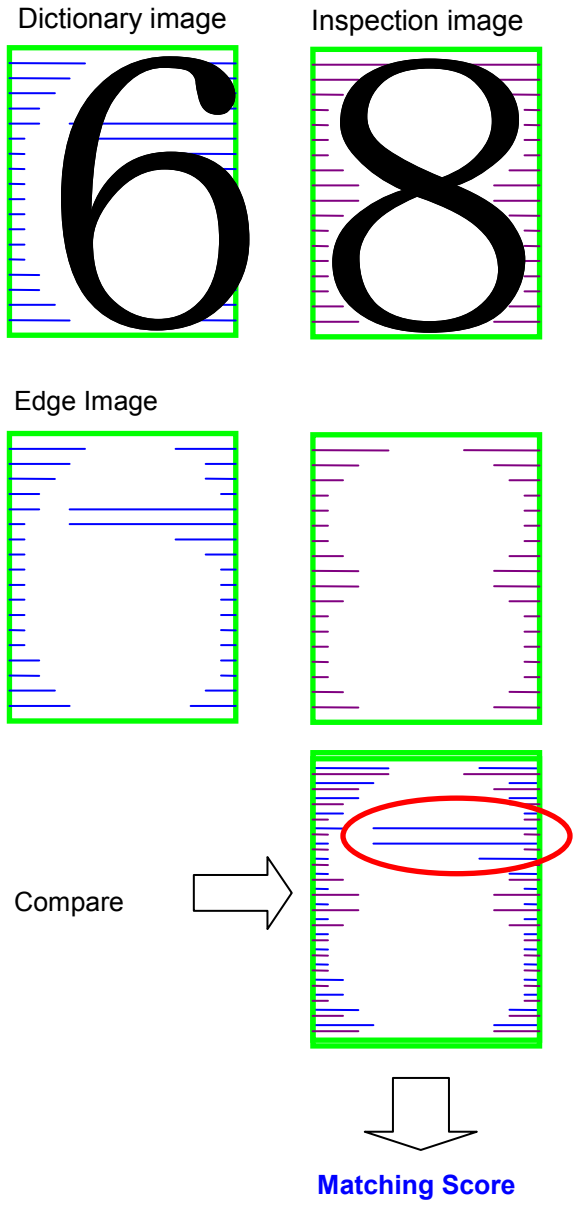
(2) Verification by Binarization
(Shape Edge inspection)

Do Shape Edge inspection, detect contour of the character and obtain matching score.

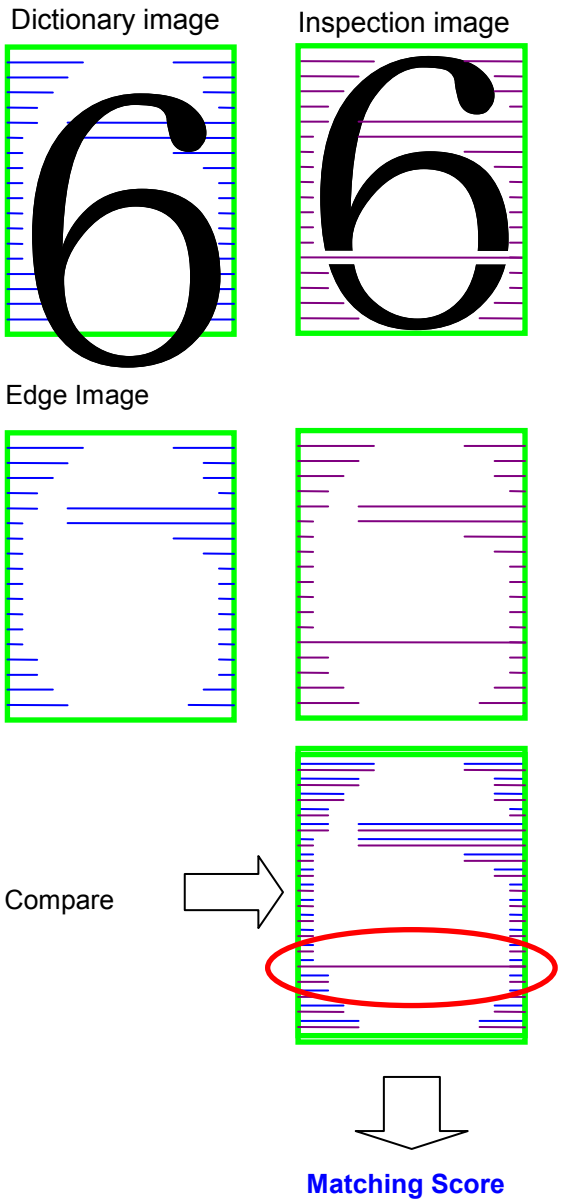
Determine the matching score of the character by combining the score obtained by Broken/Dirty inspection.

The execution of Shape Edge inspection is selectable.

Different Character



Missing Line



(3) Gray Search

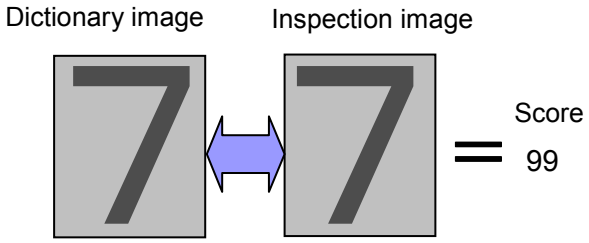
Does Gray Search and obtain matching score.

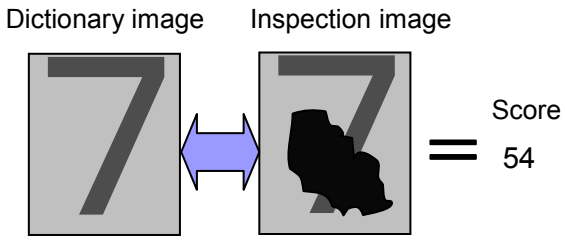
The Gray Search uses a kind of information processing technique called Normalized Correlation that calculates the relationship between two data for obtaining a matching score.

[Factors that determines Correlation Value]

- Judges as similar if the intensity of the 2 images is in the same tendency (positive correlation) and as different if the intensity is in the opposite tendency (negative correlation).

That is, the portion of inspection image and dictionary image becomes positive if they are both light or dark, or becomes negative if one is bright and the other is dark.





[4] Setting Flow of OCV module

The setting flow of the OCV module is as follows:

Select Camera

Select the camera to capture image.

Color Preprocess

Set when a color camera is used.

Preprocess

Set to make extraction of a character easy.

Set Inspection Area

Set the inspection area.

Set Mask Area

Set the mask area within the inspection area.

Set String

Set the reference string for inspection.

Set Extraction

Set the process to extract a character one by one.

Register Dictionary

Register the dictionary image for reference.

Set Inspection

Set the inspection.

Set Detail

Set the detail items of the inspection.

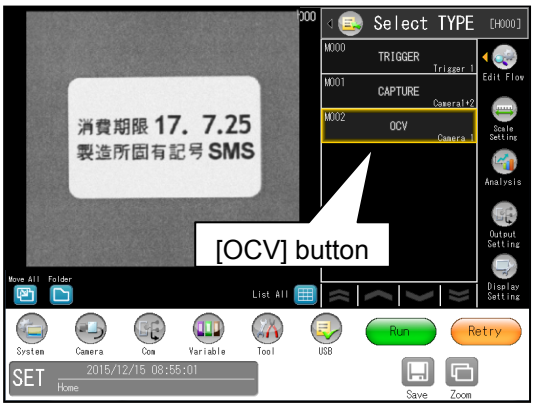
Set Judgment

Set the judgment conditions

Operation Procedure

Following is the procedure for setting the "OCV module" as an example.

① Touch the [OCV] button on (Home) SET screen.



・See page 4-31 for how to edit the module flow.

② The OCV module setting screen will appear.

[When monochrome camera is used]

[When color camera is used]

1. [Select Camera] drop down list

Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".
In 2 Trigger mode, select a camera depending on the Object type number.
See page 4-6.

2. [Preprocessing] button

Preprocessing will make the captured image easy for inspection.
See page 4-56 for the functions and setting procedures.

3. Setting buttons

- Area => [1]
- Mask => [2]
- String => [3]
- Extraction => [4]
- Dictionary => [5]
- Inspection => [6]
- Detail => [7]
- Judgment => [8]

4. [Color preprocess] button

(When a color camera is used)

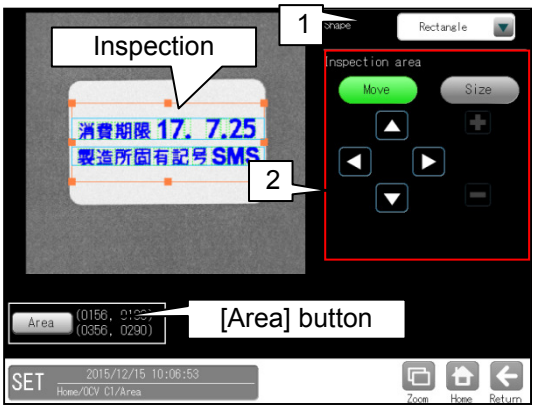
When a color camera is used, set the "Color processing". (IV-S300C3/C8, IV-C250C3/C8)
See page 4-68 for the function and setting procedures.

[1] [Area] icon

Set the inspection area.

① Touch the [Area] icon on the OCV module setting screen.

② The Area setting screen will appear.
See page 3-6 for setting the inspection area.



1. [Shape] drop down list

Select the inspection area shape:

"Rectangle", "Circle", "Ellipse", "Polygon", “Arc” or “Point”..

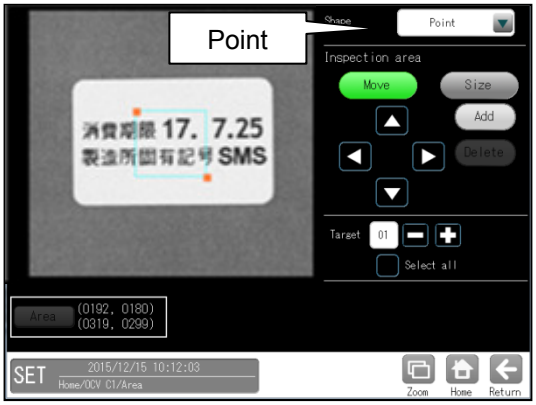
2. Area setting buttons

Set the inspection area with the [Area], [Move], [Size], [Directions] and [+], [-] buttons.

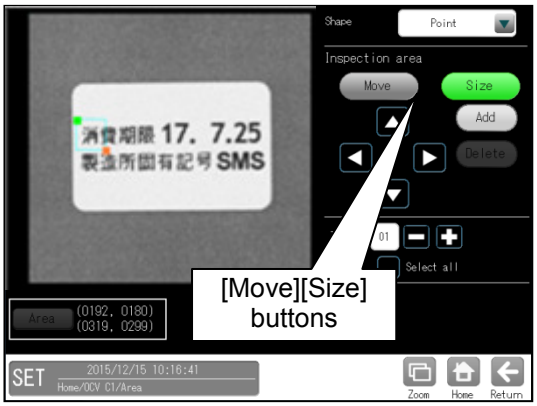
- Setting procedure for Point.
  The “Point” means the inspection area for each character extraction.
  - Set the point area larger than the size of the character to inspect.
  - The point area may overlap with next character and next point area.

Setting Example:

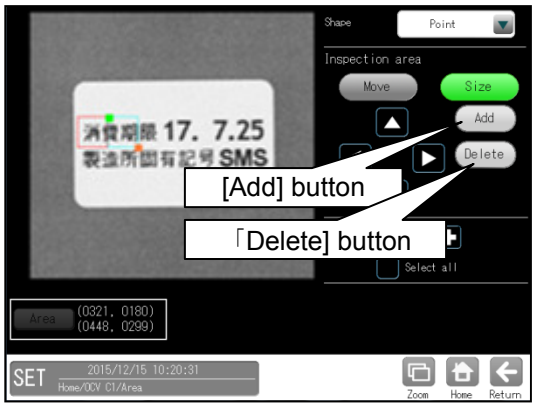
① Select “Point” from the Shape drop down list.



② Set the inspection area with [Move] and [Size] buttons.

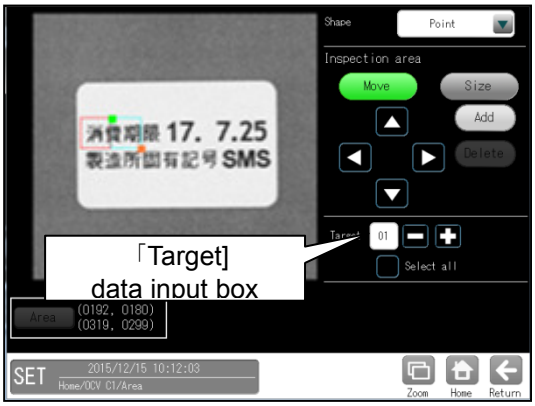


③ To add a Point, select a point and touch the [Add] button.
Exactly the same point is added on the right of the selected point.



④ To delete a Point, select it and touch the [Delete] button.

⑤ To change the Point size or move a point, enter the target point number in the data input box and change the Point with [Move] or [Size] button.
Note:
[-] [+] buttons can be used to select a Point.



⑥ To select all Points, check the [Select all] check box.

[2] [Mask] icon

When you want to avoid inspecting one or more areas within the inspection area, you can create up to four mask areas.

① Touch the [Mask] icon on the OCV module setting screen.

The screens below are when “Rectangle” is selected for the Shape.

1. **[Mask 1] to [Mask 4] buttons**
   Touch one of the mask buttons: [Mask 1] to [Mask 4].
2. **[Shape] drop down list**
   Select a shape for the mask area: "Disable", "Rectangle", "Circle", "Ellipse" or "Polygon".
3. **[Mask area] buttons**
   Set the mask area with the [Mask], [Move], [Size], [Directions] and [+] [-] buttons.

・ See page 3-6 for setting the Mask areas.

[3] [String] icon

OCV module requires a string for judgment reference.
Eight blocks are available for entering a string
The string connected the string in each Block 0 to Block 7 is defined as “Set String” in this manual.
The “Set String” can be set up to 5 rows and 64 characters.

There are 5 kinds for the string.
Select one from the drop down list.

Kind	String
Fixed	Entered string
Pattern	Word selected from the drop down list
Date	Entered date with offset
Time	Current time
Variable	Entered string The same as “Fixed” but becomes the object of assigning a string by communication command.

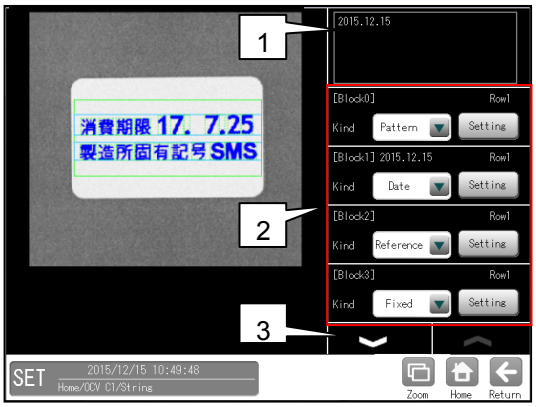
Setting Example:
1st line: ”賞味期限 17. 7. 25”
2nd line: “製造所固有記号 S M S”
To set the above, set as follows:

String	Block	Kind	Row
賞味期限	0	Pattern	1
17. 7. 25	1	Date	1
製造所固有記号	2	Pattern	2
S M S	3	Fixed	2

Note:
The blocks are connected from left to right.

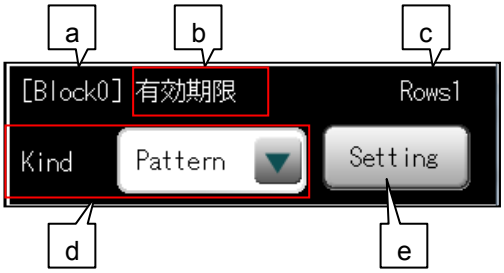
① Touch the [String] icon on OCV module setting screen.

② String Setting screen will appear.



1. String Display
   Displays current Set String.

2. Setting of String



   a. Block Number: 0 to 7
   Displays the Block Number.
   b. Set String
   Displays current string of the block.
   c. Rows: 1 to 5
   Displays the number of rows of the block. The setting of Rows to be done by the data input box that appears when the [Setting] button is touched.
   d. [Kind] drop down list
   Select the string kind from the drop down list.
   e. [Setting] button
   The setting screen of the selected string kind will appear.

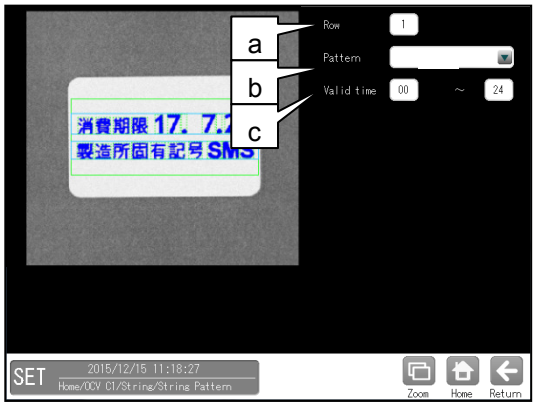
3. Page Change
   Scroll a page with the [⌄] and [⌃] buttons under the block setting data input boxes.
   1 page: Block 0 to Block 3
   2 page: Block 4 to Block 7

(1) Setting of “Fixed” and “Variable”

Both “Fixed” and “Variable” use the entered string as Set String.

Fixed

Variable



1. **[Row] data input box**
   Set the row of the block:
   Row: 1 to 5
   Default: 1

2. **[String] data input box**
   Enter the string.
   Maximum 16 characters

3. **[Valid Time] data input boxes**
   Enter the time period to include the block in the Set string.
   Time: 00 to 24
   Default: 00 to 24

   Setting Example:
   String: “AM”
   Valid Time: 00 to 12

Valid Time Setting	Set String
00:00 ~ 11:59	“AM”
12:00 ~ 23:59	None

(2) Setting of “Pattern”

The Pattern uses the word selected from the drop down list

Pattern

1. **[Row] data input box**
   Set the row of the block:
   Row: 1 to 5
   Default: 1

2. **[Pattern] drop down list**
   Select one from the drop down list.
   Default: None

   Selectable options
   (All in Chinese character)

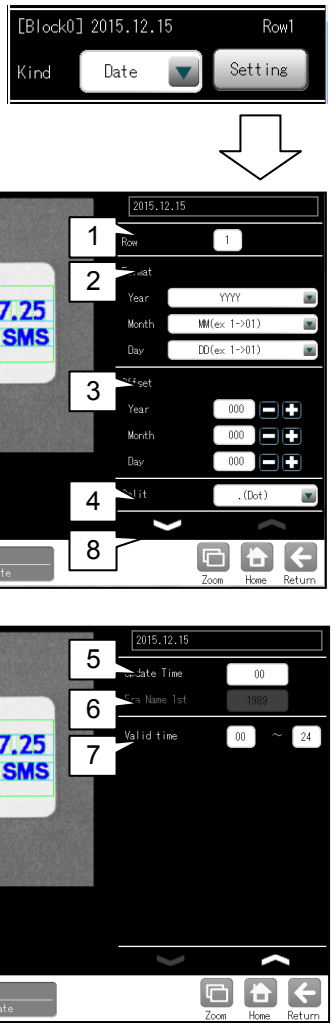
0	None	6	製造記号
1	消費期限	7	固有記号
2	賞味期限	8	製造年月日
3	有効期限	9	製造年月
4	製造所固有記号	10	精米年月日
5	製造番号	11	使用期限

3. **[Valid Time] data input boxes**
   Enter the time period to include the block in the Set string.
   Time: 00 to 24
   Default: 00 to 24
   See left of this page for the example.

(3) Setting of “Date”

The date and time are created automatically by the internal calendar and used as Set String.

Date



1. **[Row] data input box**
   Set the row of the block:
   Row: 1 to 5
   Default: 1

2. **[Format] drop down lists**
   Select one from the drop down list.

Year

Option	Current Year	String
Disable	2015	
YYYY		2015
YY		15
Y		5
Era Name		27 ※1
Code 1 / 2		※2

※1： When set 1st year of Era as 1989.
※2： See page 4-11.

Month

Option	Current Month	String
Disable	1 - 12	
MM (2 digits) (example: 1->01)	1 - 9	01 - 09
	10 - 12	10 - 12
MM (w/o space) (example: 1->1)	1 - 9	1 - 9
	10 - 12	10 - 12
MM (w. space) (example: 1-> 1)	1 - 9	1 - 9
	10 - 12	10 - 12
Code 1 / 2		※2

Day

Option	Current Day	String
Disable	1 - 31	
DD (2 digits) (example: 1->01)	1 - 9	01 - 09
	10 - 31	10 - 31
DD (w/o space) (example: 1->1)	1 - 9	1 - 9
	10 - 31	10 - 31
DD (w. space) (example: 1-> 1)	1 - 9	1 - 9
	10 - 31	10 - 31
001 - 365		001 - 365
1 - 365		1 - 365
Code 1 / 2		※2

3. **[Offset] data input boxes**
   Enter the offset value against the date set by the Format Setting.

   The date calculated by the offset becomes as the Set String.
   Offset Range for each [Year], [Month] and [Day]: -999 to 999
   Default: 0

4. [Split] drop down list
   Select one from the drop down list as to how to display the date.

(When the Set String is 2017/1/1)

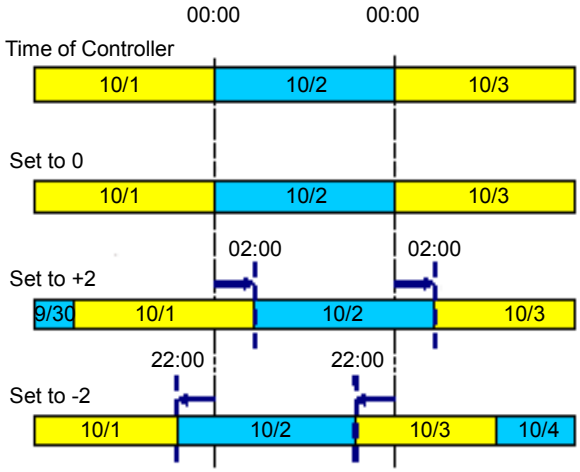
Option	String
Disable	201711
.(Dot)	2017.1.1
/(Slash)	2017/1/1
(Space)	2017 1 1
Kanji (年月日)	2017 年 1 月 1 日

5. [Update Time] data input box

Enter the time to update the date.
Entering a positive/negative number updates the time after/before 0:00, respectively.

Range: -23 to 23
Default: 00

Update Timing



6. [Era Name] data input box

When era name is selected, touch " ﹀ " key and enter the 1st year of the Era in the [Era Name 1st] data input box.
[Year]: 0 to 9999
Default : 1989

(Example)

Set Year	Current year	String
1989	2015	27

7. [Valid Time] data input boxes

Enter the time period to include the block in the Set string.
Time: 00 to 24
Default: 00 and 24

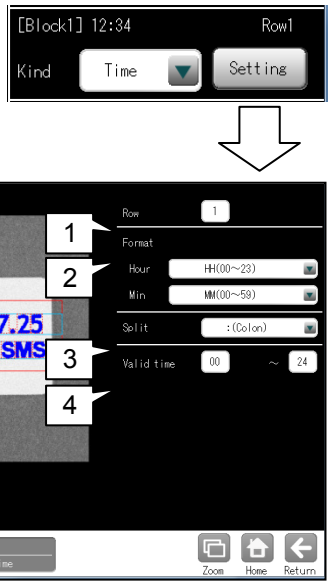
8. Page Change

Scroll a page with the [﹀] and [﹀] buttons under the block setting data input boxes.

(4) Setting of "Time"

The time is created automatically by the internal calendar of the device and used as Set String.

Time



1. [Row] data input box

Set the row of the block:
Row: 1 to 5
Default: 1

2. [Format] drop down lists

Select one from the drop down list.

Hour

Option	Current Year	String
Disable	2015	
HH (2 digits) (Example: 00 ~ 23)	0 ~ 9	00 ~ 09
	10 ~ 23	10 ~ 23
H (Example: 0 ~ 23)	0 ~ 9	0 ~ 9
	10 ~ 23	10 ~ 23

3. [Split] drop down list

Select one from the drop down list as to how to display the time.

(When the Set String is 12:15)

Option	String
Disable	1 2 1 5
: (Colon)	1 2 : 1 5

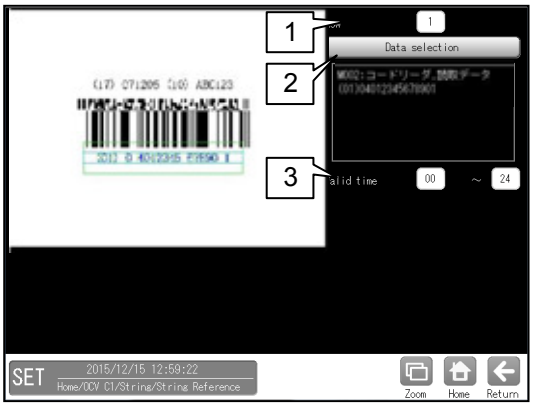
4. [Valid Time] data input boxes

Enter the time period to include the block in the Set string.
[Time]: 00 to 24
Default: 00 to 24

(5) Referencing String Data

Text data (string) of a Text, Code Reader or OCV module before OCV module can be referenced and set as the set string.

Reference



1. [Row] data input box

Set the row of the block:

Row: 1 to 5

Default: 1

2. [Data selection] button

Select one from the drop down list.

The number, item and string of the referenced string is displayed at the top right.

3. [Valid Time] data input boxes

Enter the time period to include the block in the Set string.

[Hour]: 00 to 24

Default: 00 to 24

[4] [Extraction] icon

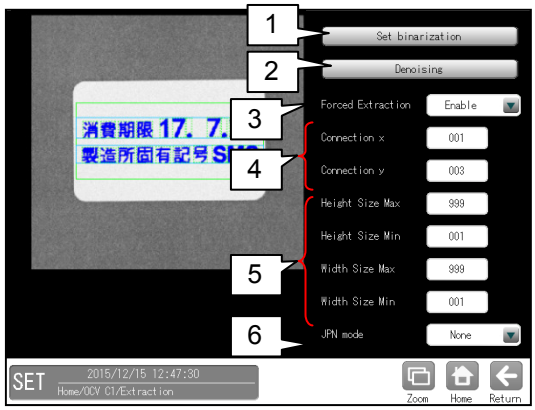
When you want to inspect each character one by one, you can extract a character from a string.

Note:

When the “Area” is “Point”, you do not need to extract a character.

① Touch the [Extraction] icon on the OCV module setting screen.

② Extraction setting screen will appear.



Flow of Extraction process

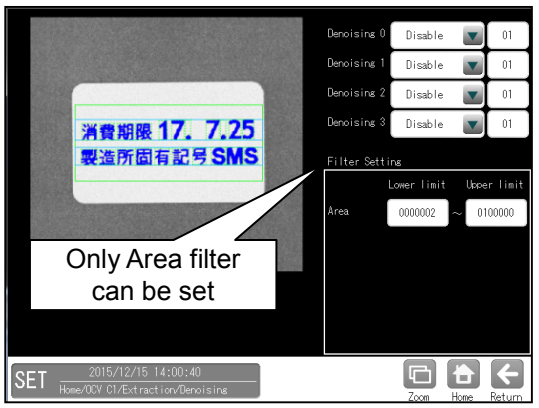
- **Binarization**
  Do binarization (black and white) on the image to separate characters from the background.
  Setting item: Set Binarization
- **Labeling**
  Separate the binarized image by block.
  Setting item: Denoising
- **Connect parts of a character**
  Connect parts of the character so that it can be inspected as a character (label) when a part of the character is chipped or separated from others.
  Setting item: Connect in x and y.
- **Elimination of a character by its size**
  Eliminate a label which size is larger than the set label size.
  Setting item: Character width and height size (Max and Min)
  Note:
  When eliminating by character size, although the image has been binarized, frame for extraction will not appear.
- **Extraction of a row**
  Do projection process toward horizontal direction and extract and display each row by a frame.
- **Extraction of a character**
  Extract each character from a row and display it by a frame.
- **Forced Extraction**
  When the number of characters in a row is smaller than that of a set string, separate a character until the said numbers become the same assuming that the characters are touching each other.
  Note:
  There is a case where the character cannot be separated.
  Setting item: Forced Extraction

1. **[Set Binarization] button**

   - Touch the [Set binarization] button and the following screen will appear.
     See page 4-93 for the setting.

2. **[Denoising] button**

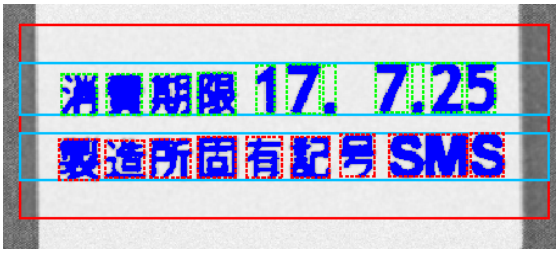
   - Touch the [Set binarization] button and the following screen will appear.
     See page 4-96 for the setting.
     Note: Only Area filter can be set.



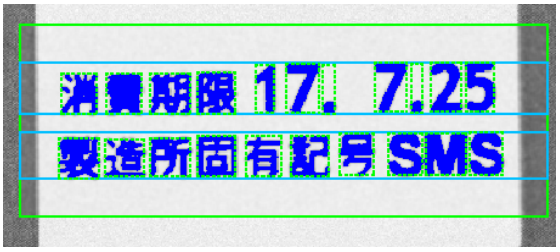
3. **[Forced Extraction] drop down list**
   This process extracts each character based on the dictionary image when 2 characters are touching each other as the result of binarization.

Option	Description
None	Do not do Forced Extraction even if characters are touching each other.
Enable	Do Forced Extraction when the number of characters of a string is less than that of the set string.

Example: Forced Extraction was not performed



Example: Performed Forced Extraction



4. **[Connection x/Connection y] data input boxes**
   Enter the distances (numbers of pixels) to connect part of a character when a part of the character is chipped.
   The labels close each other within the set distance are connected as a character.

   This setting is useful for dot character, Chinese character, etc.
   Distance: 1 to 999
   Default: Width = 1, Height = 3

5. **[Height Size Max/Height Size Min/Width Size Max/Width Size Min] data input boxes**
   Enter the size (number of pixels) for cutting out a character.

   Size: 1 to 999
   Default: Max = 999, Min = 1

6. **[JPN mode] drop down list**
   This mode is useful for inspecting a 2-byte character in which the labels may be separated
   The system tries to make the extraction frame shape to square.

Option	Description
None	Do not do JPN mode.
Enable	Do JPN mode.

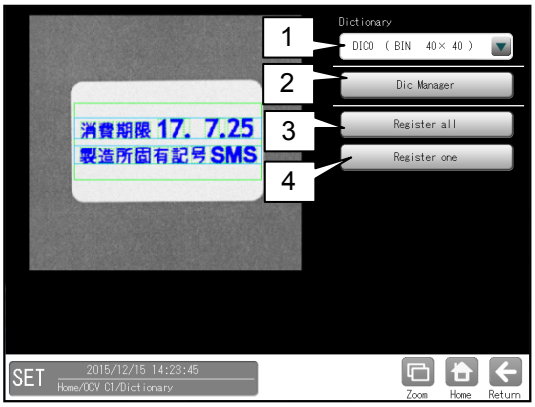
[5] [Dictionary] icon

Touch this icon to register a dictionary image to be used for the inspection (verification and OCR).

What is a “Dictionary”?
In this manual, the reference image of a character is called Dictionary Image and the group of the images is called as a Dictionary.
Maximum 4 Dictionaries can be registered per system and 1,000 dictionary images can be registered in a Dictionary.
There are 200 kinds of characters and 20 different types for a character that can be registered

① Touch the [Dictionary] icon on the OCV module setting screen.

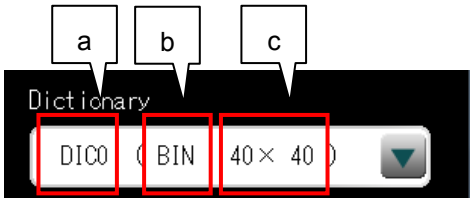
② Dictionary registration setting screen will appear.



1. [Dictionary] drop down list

Select the dictionary to use.

a. Dictionary Number: DIC0 to DIC3
b. Dictionary Mode: Binary or Gray
c. Dictionary Size: 40×40, 60×60, etc.



2. [Dictionary Manager] button

Touch this button to open a Dictionary. Management screen to check or edit. ⇒ (1)

3. [Register all] button

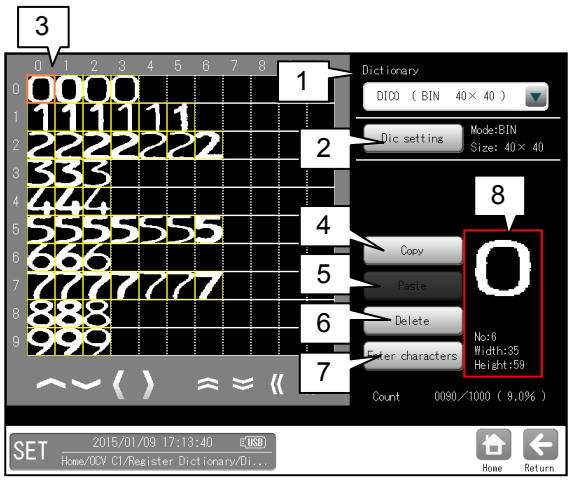
Touch this button to open Register all character screen. ⇒ (2)

4. [Register one] button

Touch this button to open Register one character screen. ⇒ (3)

(1) [Dictionary Manager] button

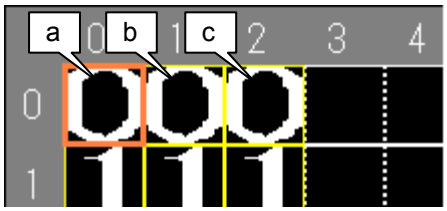
The screen to check or edit dictionary image will appear.



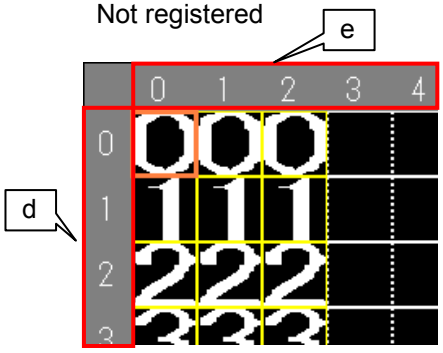
1. [Dictionary] drop down list
Select the dictionary to use.

2. [Dictionary Setting] button
Touch this button to edit (copy or delete) a dictionary. ⇒(1)-1

3. Dictionary image display
Displays the enlarged dictionary image.



a. Orange frame: Cursor
b. Dictionary image (yellow framed): Registered
c. Dictionary image (white framed): Not registered



d. Registered character
Displays the registered character.
e. Pattern number of registered character: 0 ~ 19

f. Arrow buttons
Buttons to move cursor.
g. Page jump buttons
Buttons to move cursor by one page.

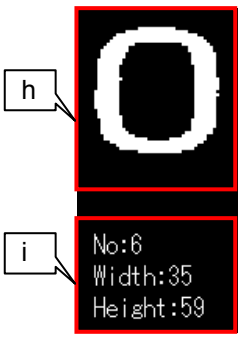
4. [Copy] button
Touch this button to copy the image selected by the cursor.

5. [Paste] button
Touch this button to paste the image copied.

6. [Delete] button
Touch this button to delete the image selected by the cursor.

7. [Enter characters] button
Touch this button to enter a character.
A keyboard will appear.

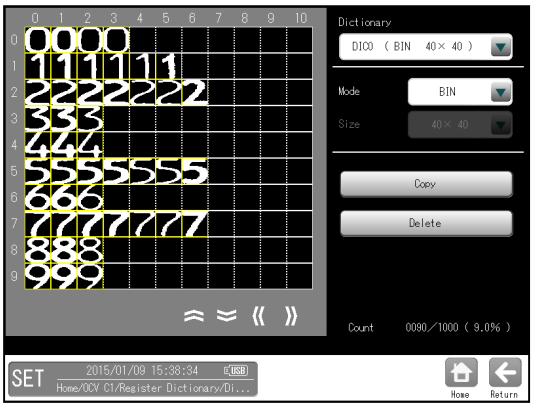
8. Dictionary Image display
Enlarged dictionary image is displayed.



h. Dictionary image
i. No:
Registered number of the dictionary image.
Width: Width of the dictionary image
Height: Height of the dictionary image

(1)-1 [Dictionary Setting] button

Touch this button to edit (copy or delete) a dictionary.



1. [Dictionary] drop down list

Select the dictionary to edit.

2. [Mode] drop down list

Select the mode of the dictionary.
The inspection of a character is determined based on the mode selected.
Once the mode is changed, the dictionary is initialized.

When the Area is set to “Point”, be sure to set the mode to “Gray”.

Mode	Description
Binary	Set Binary to the dictionary.
Gray	Set Gray to the dictionary.

3. [Size] drop down list

Select the maximum size of the dictionary image.

Note 1: This setting can be done only for Gray mode.

Note 2: Once the size is changed, the dictionary is initialized.

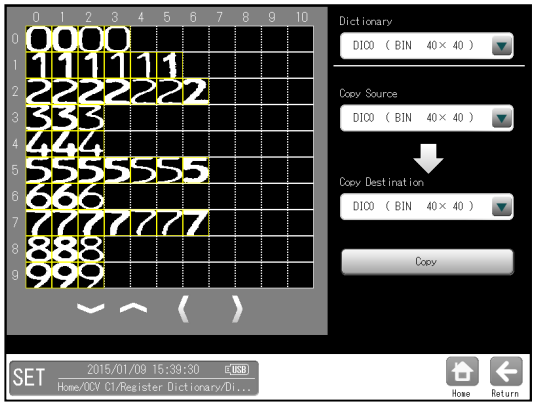
Note 3: The number of dictionary images that can be registered depends on the selected size.

Set Size	Maximum number of dictionary images
40 × 40	1000
40 × 60	666
60 × 60	444
80 × 80	250
80 ×120	166
100 × 100	160

Note 4: When an image larger than the set size is registered, the area of the image within the size is registered.

4. [Copy] button

Touch the button to copy a dictionary.



a. [Dictionary] drop down list

Select the dictionary to display.

b. [Copy from] drop down list

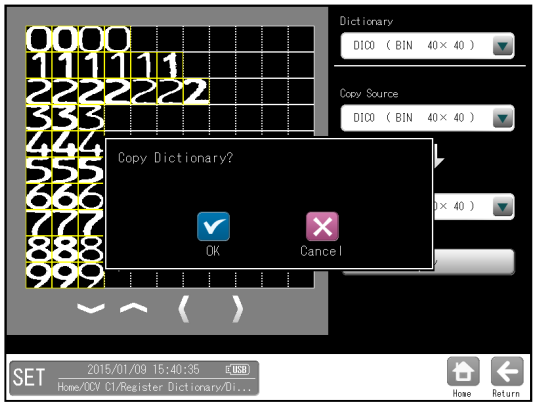
Select the dictionary to copy.

c. [Copy to] drop down list

Select the dictionary to paste.

d. [Copy] button

Touch this button to copy and paste the dictionary.
A pop up window will be displayed to confirm the copy operation.
OK: Copy the dictionary.
Cancel: Return to the previous screen.



5. [Delete] button

Touch the button to delete a dictionary.
A pop up window will be displayed to confirm the delete operation.

OK: Delete the dictionary.
Cancel: Return to the previous screen.

(2) [Register all] button

Touch this button to register a character image to the dictionary.

Already set string will be displayed on the screen.

With this “Register all”, all the characters for a line of a dictionary are registered.

Note:

When same characters are included in the line, only the first one from the left of the line is registered. The second and on same characters must be registered by “Register one”, as necessary.

1. [Line No.] drop down list

Select the line number to register a dictionary.

Line Number: 1 to max. 5

Note: Only the number of extracted lines is displayed.

[+/-] buttons

These can be used to select a line instead of the drop down list.

2. [String] data input box

Enter the string to register as a dictionary.

A keyboard will appear.

Registration of a dictionary is possible only when the number of characters of the registered string and that of the extracted are the same.

3. [Register] button

Each character at extracted areas is registered as the character at the corresponding position of a string to be registered.

A pop up window with a message will appear when this button is touched.

Message	Description
Registration completed.	The dictionary was registered successfully.
String is invalid.	String for registration is invalid. Check and enter correct string.
Number of characters is 0.	Number of characters is 0. Check the setting for extraction.
Number of characters is short.	Number of characters is short. Check the registered string and the setting for extraction.
Too many characters/line.	Too many characters/line. Check the registered string and the setting for extraction.

4. [Adjust extraction area] check box

Check this check box when you want to register a dictionary in the area different from the current extraction area.

Note 1: You do not need to check this check box when a character is extracted correctly.

Note 2: Check this check box when characters are touching each other.

a. [Target] data input box

Enter the character number to extract.

[+/-] buttons

These can be used to select the character to extract instead of the data input box.

b. [Move/Size] buttons

Touch this button to Move or change Size of the cut area.

c. [▲] [▼] [◀] [▶] keys ([Direction] keys)

Use these direction keys to move or change size.

(3) [Register one] button

Touch this button to register a character image to the dictionary.

With this “Register one”, only the selected character is registered.

1. [Character No.] data input box

Enter the character number that is going to be registered

The selected character is displayed by orange frame.

Character No.: 0 to 64 (max)

[+/-] buttons

These can be used to select a character instead of the data input box.

2. [Character] data input box

Enter the character to register as a dictionary.

A keyboard will be displayed.

Note: Once the character is changed, the set string will be set automatically.

3. [Register] button

The selected character is registered as the character at the corresponding position of a string to be registered.

A pop up window with a message will be displayed when this button is touched.

Message	Description
Registration completed.	The dictionary was registered successfully.
String is invalid.	No strings are registered. Check and enter correct string.

4. [Adjust extraction area] check box

Check this check box when you want to register the selected character in the area different from the current extraction area.

Note 1: You do not need to check this check box when the character is extracted correctly.

Note 2: Check this check box when characters are touching each other.

a. [Move/Size] buttons

Touch this button to Move or change Size of the cut area.

b. [▲] [▼] [◀] [▶] keys ([Direction] keys)

Use these direction keys to move or change size.

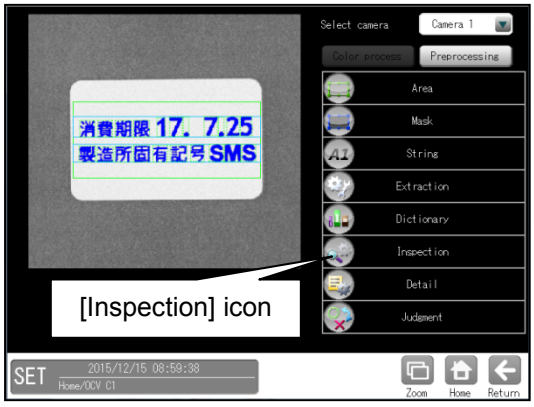
[6] [Inspection] icon

Touch this icon to set inspection item (Verification or Recognition).
It is possible to do inspection on block that is set by set string.

- Verification
  Check if the extracted character is the same as the registered dictionary or not and output matching score.
  “NG” is output when the number of characters extracted is different from the number of the registered character.
  (Output)
  Number of characters
  Matching score

- Recognition
  For an extraction character, output the closest registered character.
  (Output)
  Number of characters
  Recognized character (1st):
  Closest registered character
  Recognized character (2nd):
  Second closest registered character
  Recognition Score:
  The recognition score of the 1st
  Stability:
  The recognition score difference between the 1st and 2nd characters

① Touch the [Inspection] icon on the OCV module setting screen.



② The Inspection setting screen will appear.

1. [Target] drop down list
Select an inspection target:

Option	Description
All	Makes all blocks as the inspection target.
Specify	Makes the specified block as the inspection target.

2. [Block] data input box
Enter the block number when set “Target” as “Specify”.
[+/-] buttons:
These can be used to select a block instead of the data input box.

3. [Verification] drop down list

Select “Enable” or “Disable” the verification. When “Enable” is selected, touch the [Setting] button and set the following:

Note:
The [Setting] button is enabled when the Dictionary mode is “Binary” and the Inspection Area is not “Point”.

Option	Description
Disable	Verification is not done.
Enable	Verification is done.

a. [Symbol inspection] drop down list

Select “None” or “Enable” to include symbols (like “.”, “/”, etc.) in the verification.

Option	Description
None	Verification is not done. Matching score output becomes”99”.
Enable	Verification is done.

b. [Kanji inspection] drop down list

Select “None” or “Enable” to include double byte characters in the verification.

Option	Description
None	Verification is not done. Matching score output becomes”99”.
Enable	Verification is done.

c. [Edge inspection] drop down list

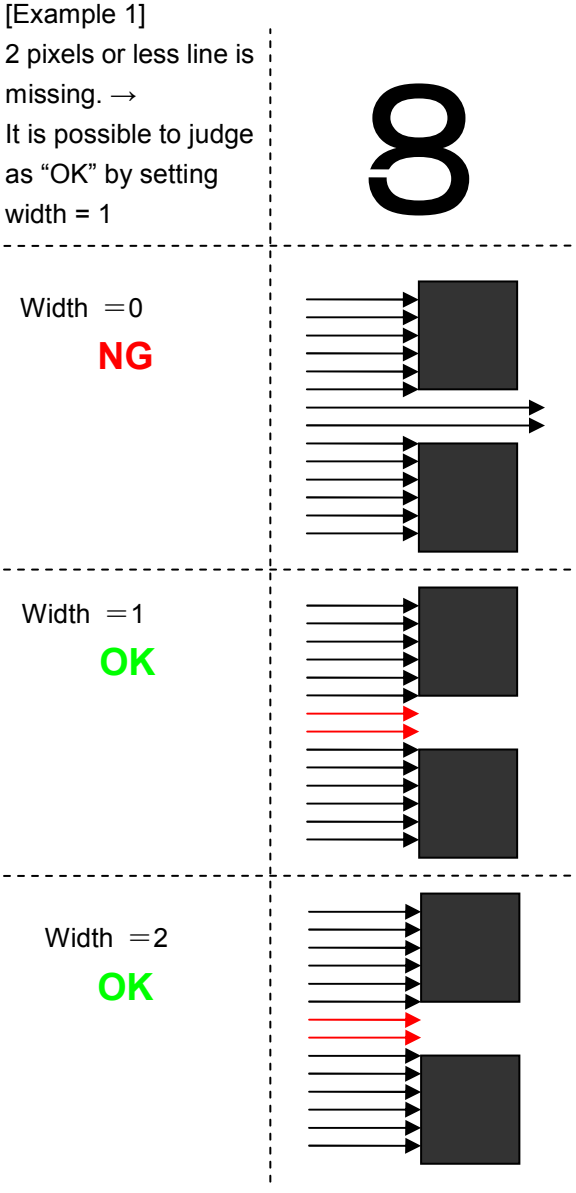
Select “None” or “Enable” to include shape edge in the verification.

Option	Description
None	Shape edge is not inspected.
Enable	Shape edge is inspected.

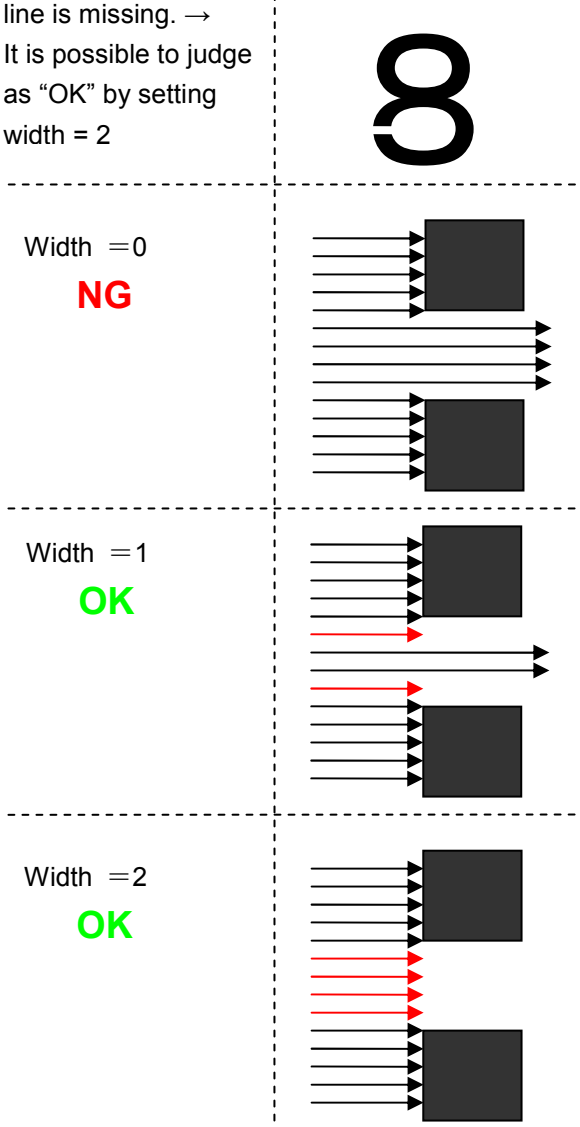
d. [Edge scan width] data input box

Enter the width for scanning edge in the shape edge inspection.
Setting a larger value will help in disregarding chipped character.
On the other hand, too large scan width will disable recognition of a different character.
Width: 0 to 99
Default: 1

[Example 1]
2 pixels or less line is missing. →
It is possible to judge as “OK” by setting width = 1



[Example 2]
4 pixels or less line is missing. →
It is possible to judge as “OK” by setting width = 2



Option	Description
None	Character width check is not done.
±10%	The matching score becomes “0” when ±10% or more change.
±20%	The matching score becomes “0” when ±20% or more change.
±30%	The matching score becomes “0” when ±30% or more change.
±40%	The matching score becomes “0” when ±40% or more change.
±50%	The matching score becomes “0” when ±50% or more change.
±60%	The matching score becomes “0” when ±60% or more change.
±70%	The matching score becomes “0” when ±70% or more change.
±80%	The matching score becomes “0” when ±80% or more change.
±90%	The matching score becomes “0” when ±90% or more change.

Default: ±30% or less

e. [Width check] drop down list

Select an option for width check:
Whether or not check the change in the height and width ration.
When it is checked, matching score becomes 0 if the change in the height and width ratio is bigger than the set value.
When the change is within the set value, it does not affect on the matching score.

f. [Edge inspection mask] data input box

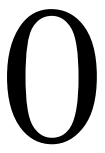
If you want to make certain line missed or dot missed character as OK, set the acceptable limit in this input box.
The system will mask the shaped edge based on the setting.

Note: Because the system will do the edge inspection mask after normalizing extracted character into 40 x 40 pixel size, the setting is made by 1/40 unit.
Mask Width: 0 to 39
Default: 0

Edge inspection mask setting = 0

NG

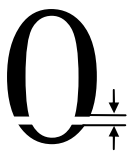
Outputs NG if a line is missed.



Edge inspection mask setting > Missing line

OK

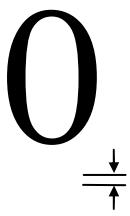
Outputs OK



Edge inspection mask setting < Missing line

NG

Outputs NG.



(Setting Example)

Acceptable Limit	Set Value
NG if a line is missing	0
OK up to missing line with width 5% of the character height	2
OK up to missing line with width 10% of the character height	4
OK up to missing line with width 20% of the character height	8
OK up to missing line with width 30% of the character height	12
OK up to missing line with width 40% of the character height	16
OK up to missing line with width 50% of the character height	20

g. [Verify precision] drop down list

Select “Standard” or “H-accuracy” for the precision of the verification.

Note:
Setting to “H-accuracy” makes the verification more precise and enables detection of defective characters such as chipped, etc.
It, however, may reject ones within the acceptable criteria.
Therefore, the setting must be done by considering the variation within OK goods and the requirement for detection.

Option	Description
Standard	Normal verification is done.
H-accuracy	Verification with high accuracy is done.

h. [Feature mesh inspection] drop down list

Select “None” or “Enable” for the feature mesh inspection.

Note:
Setting to “Enable” makes the verification more precise by doing feature mesh inspection and enables detection of defective characters such as chipped, etc.
It, however, may reject ones within the acceptable criteria.
Therefore, the setting must be done by considering the variation within OK goods and the requirement for detection.

Option	Description
None	Feature mesh inspection is not done.
Enable	Feature mesh inspection is done.

4. [OCR] drop down list

OCR (optical character recognition) reads the target character.

When “Enable” is selected, touch the [Setting] button and set the following:

Note:

The recognition score is calculated based on the verification process, therefore, the “Verify” must be set to “Enable” and the “setting” must be done, accordingly.

Option	Description
Disable	Recognition is not done.
Enable	Recognition is done.

a. [OCR Target] drop down list

Select one from the drop down list.

Option	Description
Numeral, English, Kanji, Symbol	Do the recognition by making all the character kinds registered in the dictionary as target.
Numeral, English, |Kanji|, Symbol	Do the recognition by making character kinds set by the set string as target. When the set string is Numeral and English, make both as target, though.
Numeral, |English|Kanji|, Symbol	Do the recognition by making character kinds set by the set string as target.
Numeral, English, Symbol	Do the recognition by making the listed character kinds as target.
Numeral, English	== ditto ==
Kanji	== ditto ==
Numeral, English (Upper), Symbol	== ditto ==
Numeral, English (Upper)	== ditto ==
Numeral, Kanji	== ditto ==
Numeral, Symbol	== ditto ==
Numeral	== ditto ==
English (Upper), Symbol	== ditto ==
English, Symbol	== ditto ==
English (Upper)	== ditto ==
English	== ditto ==
English (Upper), Kanji	== ditto ==
English, Kanji	== ditto ==
English (Upper), Kanji, Symbol	== ditto ==
English, Kanji, Symbol	== ditto ==
Kanji, Symbol	== ditto ==

Default: Numeral, English, Kanji, Symbol

Character kinds

Character Kind	Description
Numeral	0123456789
English	ABCDEFGHIJKLM NOPQRSTUVWXYZ abcdefghijklm nopqrstuvwxyz
Kanji	Kanji, カタカナ, ひらがな, etc
Symbol	./-()<> etc

[7] [Details] icon

Touch this icon to set detail inspection item.

① Touch the [Detail] icon on the OCV module setting screen.

② Detail setting screen will appear.

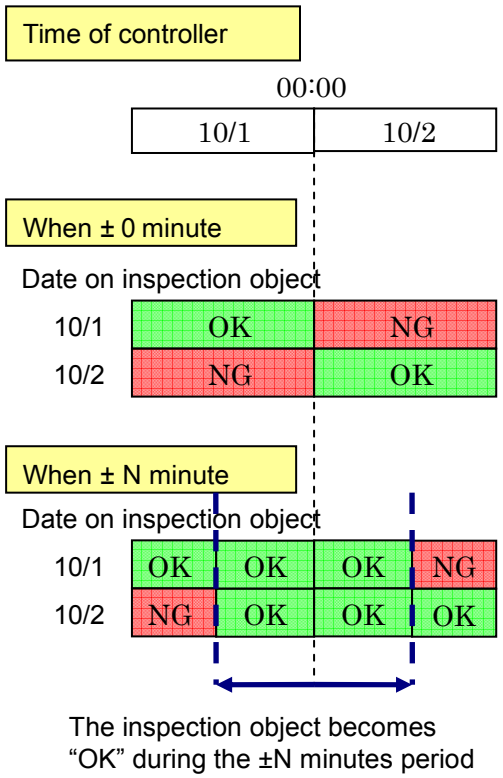
1. [Time concern] data input box

Set the time to concern in ± minutes:

Time to concern means time difference between the clock of the controller and time information written on the inspection object.

Time difference: 0 to 100

Default: 0



The inspection object becomes "OK" during the ±N minutes period

2. [Verify Retry] drop down list

Retry means the process to repeat verification until the verification score set by the verify retry condition is exceeded.

Meantime, the upper limit of number of retries is set by the system.

If the retry does not finish until the limit, the highest score among the retries is output.

Note:

The retry process makes the inspection time longer.

Option	Description
None	Do not do verification retry.
Enable	Do verification retry.

3. [Verify Retry Condition] data input box

Enter the verification score.

The verification is retried until the score exceeds the set value.

Number of Retry: 0 to 99

Default: 80

4. **[Verify Denoising number] drop down list**

Verify Denoising means to do denoising process (Dilate and Erode) after cutting out a character and before verification and recognition process.

By enabling this, it is possible to inspect fine tipped and dirty printing.

Note 1:

There is a case redo of dictionary registration is necessary when changed this setting.

Note 2:

Carefully do the setting so that fine tipped and dirty printing within acceptable limit is not rejected.

Option	Description
None	Do not do denoising.
Dilate	Effective for hiding fine tipping and holes of printing. The thickness of a line becomes thicker.
Erode	Effective for hiding dirt and noises of printing. The thickness of a line becomes thinner.
Dilate → Erode	Effective for hiding fine tipping and holes of printing. The thickness of a line is unchanged.
Erode → Dilate	Effective for hiding dirt and noises of printing. The thickness of a line is unchanged.

Default: None

(Effect of Denoising)

None

Dilate -> Erode x 1 time

5. **[Verify Denoising number] data input box**

Enter the number of repeating Denoising.

Number of repeating: 0 to 10

Default: 0

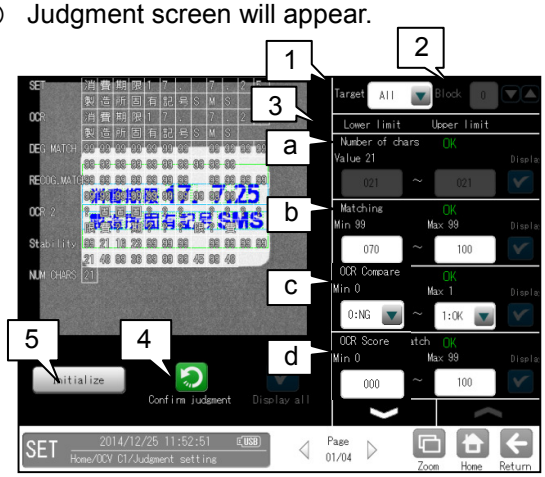
[8] [Judgment] icon

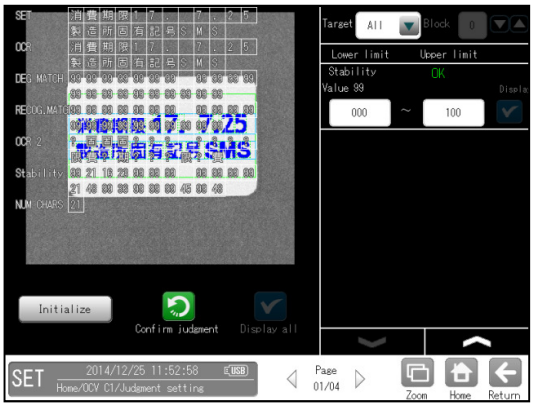
Set the upper and lower limits for OK/NG judgment based on the results of processing the OCV module.

When the inspection result is within the range you set, the device will output an "OK", or "NG" if otherwise.

① Touch the [Judgment] icon on the OCV module setting screen.

③ Judgment screen will appear.





1. **[Target] data input box**
   Select “All” or “Specify” regarding the judgment.

Option	Description
All	Judgment is made on all the blocks of the string.
Specify	Judgment is made on the specified block.

2. **[Block] data input box**
   Enter the block number when set “Target” as “Specify”.
   [Arrow] buttons
   These can be used to select a block instead of the data input box.

   Block Number: 0 to 7
   Default: 0

3. **Inspection items Lower/Upper limits**
   You can set the minimum and maximum of the following inspection items:

   Scroll a page with the [ ] and [ ] buttons under the block setting data input boxes.

   [Inspection items]
   - Number of characters
   - Matching score
   - OCR Compare
   - OCR score
   - Stability

   Touch [Confirm judgment] icon to confirm the judgment conditions you have set.
   A judgment result (OK/NG) will be displayed on the right of each inspection item.

   a. Number of characters
   Set the number of characters for judgment. The numbers can be set when “Verification” is set to “Disable” on Inspection Setting screen.
   When “Verification” is set to “Enable” on Inspection Setting screen, judgment result will be “OK” when the number of set string and that of extracted strings are the same.
   Number of characters: 0 to 64
   Default: 0 and 64

   b. Matching score
   Set the matching score for judgment when “Verification” is set to “Enable” on Inspection Setting screen.
   Matching score: 0 to 100
   Default: 70 and 100

   c. OCR compare
   Set the judgment condition for the comparison between recognized character and set character when “OCR” is set to “Enable” on Inspection Setting screen.
   Options: 0(NG) or 1(OK)
   Default: 0(NG) and 1(OK)

   d. OCR score
   Set the OCR score for judgment when “OCR” is set to “Enable” on Inspection Setting screen.
   OCR score: 0 to 100
   Default: 0 and 100

   e. Stability
   Set the stability for judgment when “Recognition” is set to “Enable” on Inspection Setting screen.
   Stability means the difference between the recognition scores of candidates 1 and 2.
   Stability: 0 to 100
   Default: 0 and 100

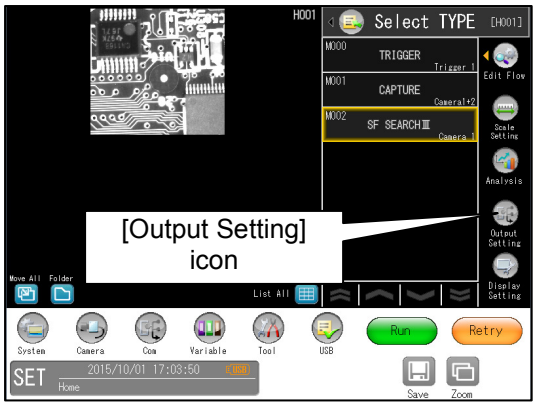
4. [Confirm judgment] icon
   Touch this icon to confirm the judgment conditions you have set.
   A judgment result (OK/NG) will be displayed on the right of each inspection item.

5. [Initialize] button
   Touch this button to set all the settings to their default values.

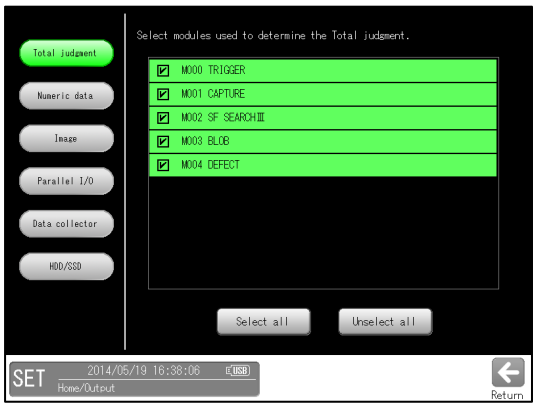
4-4-22 Output setting

This function set outputs of the device.
(The screens shown below are typical example)

① Touch the [Output Setting] icon on the (Home) SET screen.



② The Output setting screen will appear.

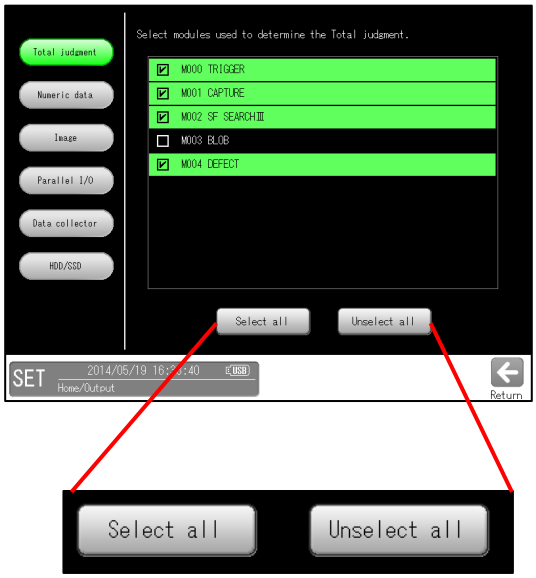


Touch each button for setting output.
The currently selected item button is displayed in green.

- Total judgment => [1]
- Numeric data => [2]
- Image => [3]
- Data collector => [4]
- Parallel I/O => [5]
- HDD/USB => [6]

[1] [Total judgment] button

On the Output setting screen, touch and select the modules to be used for determining total judgment.



You can use the following buttons to select or unselect all.

1. [Select all] button
All the modules shown on the screen will be selected.

2. [Unselect all] button
All the modules shown on the screen will be unselected.

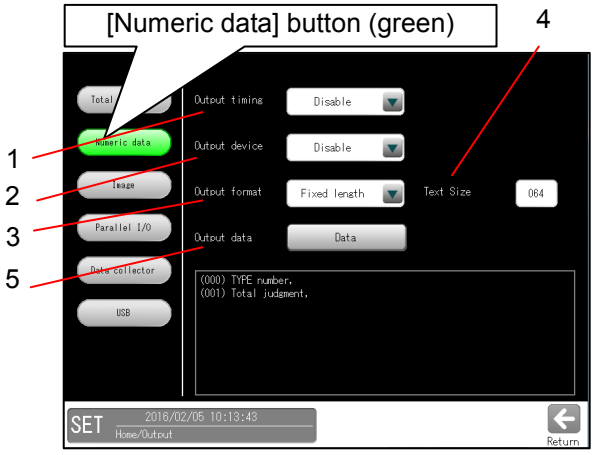
Green highlighted: Selected module
Black highlighted: Unselected module

The total judgment becomes “OK” when all of the selected modules are “OK”.

The Serial/Ethernet output of Total judgment is as follows:
OK = 1, NG = 0, ER = 2

[2] [Numeric data] button

Set the output related numeric data for "Output timing", "Output device (destination)", "Output format", and "Output data".
Touch one of the buttons on the Output setting screen, and enter each item.



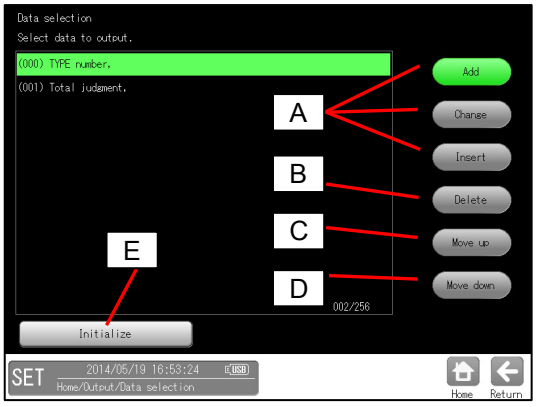
1. **[Output timing] drop down list**
   Select output timing: "Disable", "Each trigger", "All OK", or "All NG".

2. **[Output device] drop down list**
   Select output device:
   "Disable", "Serial", "Ethernet" or “CC-Link”.

3. **[Output format] drop down list**
   Select "Fixed length" or "Variable length".

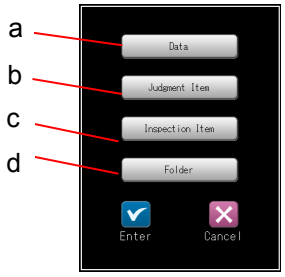
4. **[Text size] data input box**
   (When set to “Fixed length”)
   Enter the size of “Character string” data.
   When data size is smaller than the set size, spaces(0x20) are filled up to the set size.
   When data size is larger than the set size, the data up to the set size is output.
   “Character string” denotes the output of OCV, Code Reader and Text modules.

5. **[Output data] button**
   Touch the button and a data selection screen will appear.



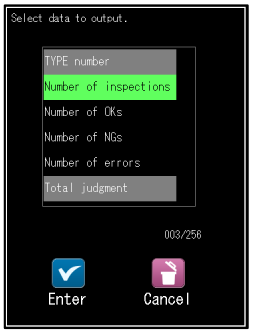
By touching a button (A to E), select and enter the data you want to output.

A. [Add] / [Change] / [Insert] button
The window shown below will appear when one of the three buttons is touched.
・In case of [Change], an output data must be selected before touching the button.



Touch one of the above buttons (a to c), then touch the [Enter] icon.

a. [Data] button
The data selection window will appear.



Touch the data you want to output, and then touch the [Enter] icon.

[Data options]
"Object TYPE number",
"Number of inspections",
"Number of OKs", "Number of NGs",
"Number of errors" and "Total judgment".

Return to the Data selection screen, and the selected item will have been added, changed or inserted and shown on the screen.

b. [Judgment Item] button

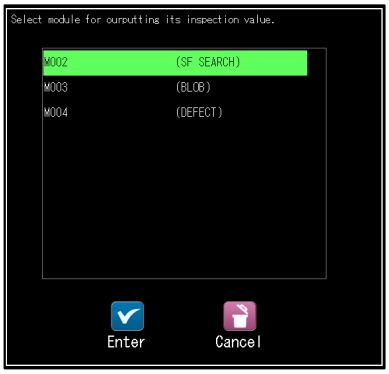
The module selection window for outputting its judgment criteria will appear.

Touch the item (module number/name) you want to output its judgment criteria and touch the [Enter] icon.

Return to the Data selection screen by touching the [Enter] icon, and the selected item will have been added, changed or inserted and shown on the screen.

c. [Inspection item] button

The module selection window for outputting inspection item will appear.



Touch the item (module number / name) you want to output and touch the [Enter] icon.

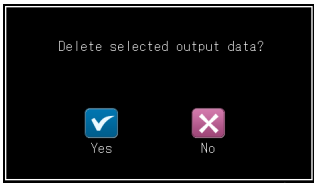
The screen shown below will appear.
(When SF search is selected)

Touch the item and the option, if shown on right of the item, and touch the [Enter] icon.

Return to the Data selection screen by touching the [Enter] icon, and the selected item will have been added, changed or inserted and shown on the screen.

B. [Delete] button

Select the data to delete from the output and touch the button and the window shown below will be displayed.



Touch the [Yes] icon and the currently selected output data will be deleted.

C. [Move up] button

The currently selected output data will move up by one line.

D. [Move down] button

The currently selected output data will move down by one line.

E. [Initialize] button

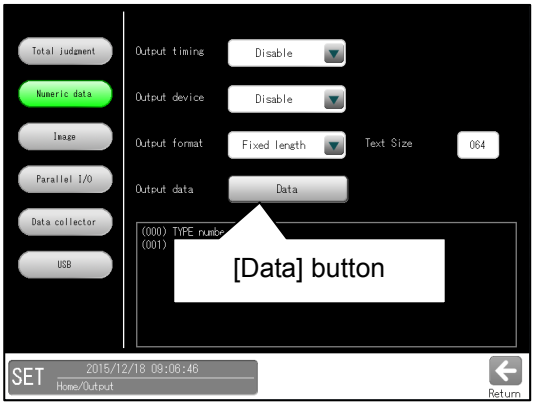
Initialize confirmation window will appear. Touch the [Yes] icon and the data output settings will be initialized.

(1) Output data order

The data is output in the order set by the following steps.
(Home) SET screen -> [Output Setting] icon -> [Numeric Data] button -> [Data] button.

[Data selection] screen will appear.
The selected items on the screen will be output from top to bottom, one at a time, in the selected order:

1 Object TYPE number
2. Number of inspections
3. Number of OKs
4. Number of NGs
5. Number of errors
6. Total judgment
7. Judgment result
8. Inspection value



(2) Data output size and display example

(2)-1 For other than inspection data

1	Object type number	0 to 99	2 bytes
2	Number of inspection	0 to FFFFFFFF$_{(H)}$	4 bytes
3	Number of OKs	0 to FFFFFFFF$_{(H)}$	4 bytes
4	Number of NGs	0 to FFFFFFFF$_{(H)}$	4 bytes
5	Number of errors	0 to FFFFFFFF$_{(H)}$	4 bytes
6	Total judgment	NG=0 OK=1 ERROR=2 Not executed =3	2 bytes
7	Judgment result	NG=0 OK=1 ERROR=2 Not executed =3	2 bytes

(Example)
When the system writes 2 bytes and 4 bytes data to a Sharp PLC, storage address 9000:
When 2 bytes = 12AB$_{(H)}$

9000 AB
9001 12

When 4 bytes = 1234ABCD$_{(H)}$

9000 CD
9001 AB
9002 34
9003 12

Note:
For character data, 1 byte of text needs a 2 bytes area for storing.
As an example, the text data "ABC" is shown on the right.

0	00	41
2	00	42
4	00	43
6		

(2)-2 For inspection data

[Area]

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD
		Area	AR	2	M000.JG.AR
Inspection value	MR	Area	AR	4	M000.MR.AR

[Blob]
[Defect inspection]

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD
		Number of labels	N	2	M000.JG.N
		Area	AR	2	M000.JG.AR
		Perimeter	PE	2	M000.JG.PE
		Fillet dia. X	FX	2	M000.JG.FX
		Fillet dia. Y	FY	2	M000.JG.FY
		Gravity center X	GX	2	M000.JG.GX
		Gravity center Y	GY	2	M000.JG.GY
		Center X	CX	2	M000.JG.CX
		Center Y	CY	2	M000.JG.CY
		Axis angle	AG	2	M000.JG.AG
		Deviation on X axis	DX	2	M000.JG.DX
		Deviation on Y axis	DY	2	M000.JG.DY

[Blob]

[Defect inspection]

Output type	Symbol	Inspection item	Symbol	Label	Output size (bytes)	Display example
Inspection value	MR	Number of labels	N	—	2	M000.MR.N
		Total area	TA	—	4	M000.MR.TA
		Area	AR	0 to 254	4	M000.MR.AR000
		Area (Max)	ARMAX	—	4	M000.MR.ARMAX
		Area (Min)	ARMIN	—	4	M000.MR.ARMIN
		Perimeter	PE	0 to 254	4	M000.MR.PE000
		Perimeter (Max)	PEMAX	—	4	M000.MR.PEMAX
		Perimeter (Min)	PEMIN	—	4	M000.MR.PEMIN
		Fillet dia. X	FX	0 to 254	4 (1000x)	M000.MR.FX000
		Fillet dia. X (Max)	FXMAX	—	4 (1000x)	M000.MR.FXMAX
		Fillet dia. X (Min)	FXMIN	—	4 (1000x)	M000.MR.FXMIN
		Fillet dia. Y	FY	0 to 254	4 (1000x)	M000.MR.FY000
		Fillet dia. Y (Max)	FYMAX	—	4 (1000x)	M000.MR.FYMAX
		Fillet dia. Y (Min)	FYMIN	—	4 (1000x)	M000.MR.FYMIN
		Gravity center X	GX	0 to 254	4 (1000x)	M000.MR.GX000
		Gravity center X (Max)	GXMAX	—	4 (1000x)	M000.MR.GXMAX
		Gravity center X (Min)	GXMIN	—	4 (1000x)	M000.MR.GXMIN
		Gravity center Y	GY	0 to 254	4 (1000x)	M000.MR.GY000
		Gravity center Y (Max)	GYMAX	—	4 (1000x)	M000.MR.GYMAX
		Gravity center Y (Min)	GYMIN	—	4 (1000x)	M000.MR.GYMIN
		Gravity center coordinate	GXY	0 to 254	No output	M000.MR.GXY000
		Center X	CX	0 to 254	4 (1000x)	M000.MR.CX000
		Center X (Max)	CXMAX	—	4 (1000x)	M000.MR.CXMAX
		Center X (Min)	CXMIN	—	4 (1000x)	M000.MR.CXMIN
		Center Y	CY	0 to 254	4 (1000x)	M000.MR.CY000
		Center Y (Max)	CYMAX	—	4 (1000x)	M000.MR.CYMAX
		Center Y (Min)	CYMIN	—	4 (1000x)	M000.MR.CYMIN
		Center coordinate	CXY	0 to 254	None	M000.MR.CXY000
		Axis angle	AG	0 to 254	4 (1000x)	M000.MR.AG000
		Axis angle (Max)	AGMAX	—	4 (1000x)	M000.MR.AGMAX
		Axis angle (Min)	AGMIN	—	4 (1000x)	M000.MR.AGMIN
		Deviation on X axis	DX	—	4 (1000x)	M000.MR.DX
		Deviation on Y axis	DY	—	4 (1000x)	M000.MR.DY

Note: (1000x) denotes a value multiplied by 1000.

[Edge]

Output type	Symbol	Inspection item	Symbol	Model	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	—	2	M000.JG.MD
		Coordinate X	X	0/1	2	M000.JG.X0
		Coordinate Y	Y	0/1	2	M000.JG.Y0
		Coordinate XY	XY	0/1	—	M000.JG.XY0
		Deviation on X axis	DX	0/1	2	M000.JG.DX0
		Deviation on Y axis	DY	0/1	2	M000.JG.DY0
		Detection	DT	0/1	2	M000.JG.DT0
		Relative angle	RA	—	2	M000.JG.RA
Inspection value	MR	Coordinate X	X	0/1	4 (1000x)	M000.MR.X0
		Coordinate Y	Y	0/1	4 (1000x)	M000.MR.Y0
		Coordinate XY	XY	0/1	—	M000.MR.XY0
		Deviation on X axis	DX	0/1	4 (1000x)	M000.MR.DX0
		Deviation on Y axis	DY	0/1	4 (1000x)	M000.MR.DY0
		Detection	DT	0/1	2	M000.MR.DT0
		Relative angle	RA	—	4 (1000x)	M000.MR.RA

Note: (1000x) denotes a value multiplied by 1000.

[Shift Edge]
Position inspection mode

Output type	Symbol	Inspection item	Symbol	Cell	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	—	2	M000.JG.MD
		Coordinate X	X	—	2	M000.JG.X
		Coordinate Y	Y	—	2	M000.JG.Y
		Angle	AG	—	2	M000.JG.AG
		Distance	DS	—	2	M000.JG.DS
		Detection	DT	—	2	M000.JG.DT
Inspection value	MR	Coordinate X	X	0 to 254	4 (1000x)	M000.MR.X000
		Coordinate Y	Y	0 to 254	4 (1000x)	M000.MR.Y000
		Coordinate X (Max)	XMAX	—	4 (1000x)	M000.MR.XMAX
		Coordinate X (Min)	XMIN	—	4 (1000x)	M000.MR.XMIN
		Coordinate Y (Max)	YMAX	—	4 (1000x)	M000.MR.YMAX
		Coordinate Y (Min)	YMIN	—	4 (1000x)	M000.MR.YMIN
		Angle	AG	0 to 254	4 (1000x)	M000.MR.AG000
		Angle (Max)	AGMAX	—	4 (1000x)	M000.MR.AGMAX
		Angle (Min)	AGMIN	—	4 (1000x)	M000.MR.AGMIN
		Distance	DS	0 to 254	4 (1000x)	M000.MR.DS000
		Distance (Max)	DSMAX	—	4 (1000x)	M000.MR.DSMAX
		Distance (Min)	DSMIN	—	4 (1000x)	M000.MR.DSMIN
		Detection	DT	0 to 254	16	M000.MR.DT000

Note: (1000x) denotes a value multiplied by 1000.

[Shift Edge]

Width inspection mode

Output type	Symbol	Inspection item	Symbol	Cell	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	—	2	M000.JG.MD
		Width	LEN	—	2	M000.JG.LEN
		Start point X	SX	—	2	M000.JG.SX
		Start point Y	SY	—	2	M000.JG.SY
		End point X	EX	—	2	M000.JG.EX
		End point Y	EY	—	2	M000.JG.EY
		Start distance	SD	—	2	M000.JG.SD
		End distance	ED	—	2	M000.JG.ED
		Angle	AG	—	2	M000.JG.AG
		Detection	DT	—	2	M000.JG.DT
Inspection value	MR	Width	LEN	0 to 254	4 (1000x)	M000.MR.LEN000
		Width (Max)	LENMAX	—	4 (1000x)	M000.MR.LENMAX
		Width (Min)	LENMIN	—	4 (1000x)	M000.MR.LENMIN
		Start point X	SX	0 to 254	4 (1000x)	M000.MR.SX000
		Start point Y	SY	0 to 254	4 (1000x)	M000.MR.SY000
		Start point X (Max)	SXMAX	—	4 (1000x)	M000.MR.SXMAX
		Start point X (Min)	SXMIN	—	4 (1000x)	M000.MR.SXMIN
		Start point Y (Max)	SYMAX	—	4 (1000x)	M000.MR.SYMAX
		Start point Y (Min)	SYMIN	—	4 (1000x)	M000.MR.SYMIN
		End point X	EX	0 to 254	4 (1000x)	M000.MR.EX000
		End point Y	EY	0 to 254	4 (1000x)	M000.MR.EY000
		End point X (Max)	EXMAX	—	4 (1000x)	M000.MR.EXMAX
		End point X (Min)	EXMIN	—	4 (1000x)	M000.MR.EXMIN
		End point Y (Max)	EYMAX	—	4 (1000x)	M000.MR.EYMAX
		End point Y (Min)	EYMIN	—	4 (1000x)	M000.MR.EYMIN
		Start distance	SD	0 to 254	4 (1000x)	M000.MR.SD000
		End distance	ED	0 to 254	4 (1000x)	M000.MR.ED000
		Start distance (Max)	SDMAX	—	4 (1000x)	M000.MR.SDMAX
		Start distance (Min)	SDMIN	—	4 (1000x)	M000.MR.SDMIN
		End distance (Max)	EDMAX	—	4 (1000x)	M000.MR.EDMAX
		End distance (Min)	EDMIN	—	4 (1000x)	M000.MR.EDMIN
		Angle	AG	0 to 254	4 (1000x)	M000.MR.AG000
		Angle (Max)	AGMAX	—	4 (1000x)	M000.MR.AGMAX
		Angle (Min)	AGMIN	—	4 (1000x)	M000.MR.AGMIN
		Detection	DT	0 to 254	2	M000.MR.DT000

[Shift Edge]

Defect inspection mode

Output type	Symbol	Inspection item	Symbol	Cell	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	—	2	M000.JG.MD
		Number of defects	N	—	2	M000.JG.N
		Defect position X	DPX	—	2	M000.JG.DPX
		Defect position Y	DPY	—	2	M000.JG.DPY
		Defect height	DH	—	2	M000.JG.DH
		Defect width	DW	—	2	M000.JG.DW
		Defect area	DAR	—	2	M000.JG.DAR
		Start point X	SX	—	2	M000.JG.SX
		Start point Y	SY	—	2	M000.JG.SY
		End point X	EX	—	2	M000.JG.EX
		End point Y	EY	—	2	M000.JG.EY
		Circle center X	CCX	—	2	M000.JG.CCX
		Circle center Y	CCY	—	2	M000.JG.CCY
		Radius	R	—	2	M000.JG.R
		Ellipse center X	ECX	—	2	M000.JG.ECX
		Ellipse center Y	ECY	—	2	M000.JG.ECY
		Long radius	ELR	—	2	M000.JG.ELR
		Short radius	ESR	—	2	M000.JG.ESR
		Angle	AG	—	2	M000.JG.AG
Inspection value	MR	Number of defects	N	0 to 254	4 (1000x)	M000.MR.N000
		Defect position X	DPX	0 to 254	4 (1000x)	M000.MR.DPX000
		Defect position Y	DPY	0 to 254	4 (1000x)	M000.MR.DPY000
		Defect position X (Max)	DPXMAX	—	4 (1000x)	M000.MR.DPXMAX
		Defect position X (Min)	DPYMIN	—	4 (1000x)	M000.MR.DPYMIN
		Defect position Y (Max)	DPYMAX	—	4 (1000x)	M000.MR.DPYMAX
		Defect position Y (Min)	DPYMIN	—	4 (1000x)	M000.MR.DPYMIN
		Defect height	DH	0 to 254	4 (1000x)	M000.MR.DH000
		Defect height (Max)	DHMAX	—	4 (1000x)	M000.MR.DHMAX
		Defect height (Min)	DHMIN	—	4 (1000x)	M000.MR.DHMIN
		Defect width	DW	0 to 254	4 (1000x)	M000.MR.DW000
		Defect width (Max)	DWMAX	—	4 (1000x)	M000.MR.DWMAX
		Defect width (Min)	DWMIN	—	4 (1000x)	M000.MR.DWMIN
		Defect area	DAR	0 to 254	4 (1000x)	M000.MR.DAR000
		Defect area (Max)	DARMAX	—	4 (1000x)	M000.MR.DARMAX
		Defect area (Min)	DARMIN	—	4 (1000x)	M000.MR.DARMIN
		Start point X	SX	0 to 254	4 (1000x)	M000.MR.SX000
		Start point Y	SY	0 to 254	4 (1000x)	M000.MR.SY000
		End point X	EX	0 to 254	4 (1000x)	M000.MR.EX000
		End point Y	EY	0 to 254	4 (1000x)	M000.MR.EY000
		Circle center X	CCX	0 to 254	4 (1000x)	M000.MR.CCX000
		Circle center Y	CCY	0 to 254	4 (1000x)	M000.MR.CCY000
		Radius	R	0 to 254	4 (1000x)	M000.MR.R000
		Ellipse center X	ECX	0 to 254	4 (1000x)	M000.MR.ECX000
		Ellipse center Y	ECY	0 to 254	4 (1000x)	M000.MR.ECY000
		Long radius	ELR	0 to 254	4 (1000x)	M000.MR.ELR000
		Short radius	ESR	0 to 254	4 (1000x)	M000.MR.ESR000
		Angle	AG	0 to 254	4 (1000x)	M000.MR.AG000

Note: (1000x) denotes a value multiplied by 1000.

[SF Search]

Output type	Symbol	Inspection item	Symbol	Label	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD		2	M000.JG.MD
		Number of detection	N		2	M000.JG.N
		Coordinate X	X		2	M000.JG.X
		Coordinate Y	Y		2	M000.JG.Y
		Coordinate XY	XY		2	M000.JG.XY
		Deviation X	DX		2	M000.JG.DX
		Deviation Y	DY		2	M000.JG.DY
		Degree of match	SC		2	M000.JG.SC
		Angle	AG		2	M000.JG.AG
		Deviation θ	RA		2	M000.JG.RA
Inspection value	MR	Number of detection	N		4 (1000x)	M000.MR.N
		Coordinate X	X	0 to 127	4 (1000x)	M000.MR.X000
		Coordinate Y	Y	0 to 127	4 (1000x)	M000.MR.Y000
		Deviation X	DX	0 to 127	4 (1000x)	M000.MR.DX000
		Deviation Y	DY	0 to 127	4 (1000x)	M000.MR.DY000
		Degree of match	SC	0 to 127	4 (1000x)	M000.MR.SC000
		Angle	AG	0 to 127	4 (1000x)	M000.MR.AG000
		Deviation θ	RA	0 to 127	4 (1000x)	M000.MR.RA000

Note: (1000x) denotes a value multiplied by 1000.

[Distance and Angle]

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD
		Coordinate X	X	2	M000.JG.X
		Coordinate Y	Y	2	M000.JG.Y
		Deviation X	DX	2	M000.JG.DX
		Deviation Y	DY	2	M000.JG.DY
		Distance	DS	2	M000.JG.DS
		Angle	AG	2	M000.JG.AG
		Relative angle	AR	2	M000.JG.AR
		Start point X	SX	2	M000.JG.SX
		Start point Y	SY	2	M000.JG.SY
		End point X	EX	2	M000.JG.EX
		End point Y	EY	2	M000.JG.EY
		Start P. deviation X	DSX	2	M000.JG.DSX
		Start P. deviation Y	DSY	2	M000.JG.DSY
		End P. deviation X	DEX	2	M000.JG.DEX
		End P. deviation Y	DEY	2	M000.JG.DEY
		Coordinate 1X	X1	2	M000.JG.X1
		Coordinate 1Y	Y1	2	M000.JG.Y1
		Coordinate 2X	X2	2	M000.JG.X2
		Coordinate 2Y	Y2	2	M000.JG.Y2
		Deviation 1X	DX1	2	M000.JG.DX1
		Deviation 1Y	DY1	2	M000.JG.DY1
		Deviation 2X	DX2	2	M000.JG.DX2
		Deviation 2Y	DY2	2	M000.JG.DY2
Inspection value	MR	Coordinate X	X	4 (1000x)	M000.MR.X
		Coordinate Y	Y	4 (1000x)	M000.MR.Y
		Deviation on X axis	DX	4 (1000x)	M000.MR.DX
		Deviation on Y axis	DY	4 (1000x)	M000.MR.DY
		Distance	DS	4 (1000x)	M000.MR.DS
		Angle	AG	4 (1000x)	M000.MR.AG
		Relative angle	AR	4 (1000x)	M000.MR.AR
		Start point X	SX	4 (1000x)	M000.MR.SX
		Start point Y	SY	4 (1000x)	M000.MR.SY
		End point X	EX	4 (1000x)	M000.MR.EX
		End point Y	EY	4 (1000x)	M000.MR.EY
		Start P. deviation X	DSX	4 (1000x)	M000.MR.DSX
		Start P. deviation Y	DSY	4 (1000x)	M000.MR.DSY
		End P. deviation X	DEX	4 (1000x)	M000.MR.DEX
		End P. deviation Y	DEY	4 (1000x)	M000.MR.DEY
		Coordinate 1X	X1	4 (1000x)	M000.MR.X1
		Coordinate 1Y	Y1	4 (1000x)	M000.MR.Y1
		Coordinate 2X	X2	4 (1000x)	M000.MR.X2
		Coordinate 2Y	Y2	4 (1000x)	M000.MR.Y2
		Deviation 1X	DX1	4 (1000x)	M000.MR.DX1
		Deviation 1Y	DY1	4 (1000x)	M000.MR.DY1
		Deviation 2X	DX2	4 (1000x)	M000.MR.DX2
		Deviation 2Y	DY2	4 (1000x)	M000.MR.DY2

Note: (1000x) denotes a value multiplied by 1000.

[Calculation]

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD
		Calculation result	CC	2	M000.JG.CC
Inspection value	MR	Calculation result	CC	4 (1000x)	M000.MR.CC

Note: (1000x) denotes a value multiplied by 1000.

[Filter]

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD

[Position]

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD
Inspection value	MR	Correction X	AX	4 (1000x)	M000.MR.AX
		Correction Y	AY	4 (1000x)	M000.MR.AY
		Correction θ	AT	4 (1000x)	M000.MR.AT

Note: (1000x) denotes a value multiplied by 1000.

[Jump]

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD

[Point]

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD
		Effective points	PTN	2	M000.JG.PTN
Inspection criteria	MR	Effective points	PTN	2	M000.MR.PTN

[Gray Search]

Output type	Symbol	Inspection item	Symbol	Label	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	—	2	M000.JG.MD
		Number of detection	N	—	2	M000.JG.N
		Coordinate X	X	—	2	M000.JG.X
		Coordinate Y	Y	—	2	M000.JG.Y
		Angle	AG	—	2	M000.JG.AG
		Deviation X	DX	—	2	M000.JG.DX
		Deviation Y	DY	—	2	M000.JG.DY
		Deviation θ	RA	—	2	M000.JG.RA
		Degree of match	SC	—	2	M000.JG.SC
Inspection value	MR	Number of detection	N	—	4 (1000x)	M000.MR.N
		Coordinate X	X	0 to 254	4 (1000x)	M000.MR.X000
		Coordinate X (Max)	XMAX	—	4 (1000x)	M000.MR.XMAX
		Coordinate X (Min)	XMIN	—	4 (1000x)	M000.MR.XMIN
		Coordinate Y	Y	0 to 254	4 (1000x)	M000.MR.Y000
		Coordinate Y (Max)	YMAX	—	4 (1000x)	M000.MR.YMAX
		Coordinate Y (Min)	YMIN	—	4 (1000x)	M000.MR.YMIN
		Angle	AG	0 to 254	4 (1000x)	M000.MR.AG000
		Angle (Max)	AGMAX	—	4 (1000x)	M000.MR.AGMAX
		Angle (Min)	AGMIN	—	4 (1000x)	M000.MR.AGMIN
		Deviation X	DX	0 to 254	4 (1000x)	M000.MR.DX000
		Deviation X (Max)	DXMAX	—	4 (1000x)	M000.MR.DXMAX
		Deviation X (Min)	DXMIN	—	4 (1000x)	M000.MR.DXMIN
		Deviation Y	DY	0 to 254	4 (1000x)	M000.MR.DY000
		Deviation Y (Max)	DYMAX	—	4 (1000x)	M000.MR.DYMAX
		Deviation Y (Min)	DYMIN	—	4 (1000x)	M000.MR.DYMIN
		Deviation θ	RA	0 to 254	4 (1000x)	M000.MR.RA000
		Deviation θ (Max)	RAMAX	—	4 (1000x)	M000.MR.RAMAX
		Deviation θ (Min)	RAMIN	—	4 (1000x)	M000.MR.RAMIN
		Degree of match	SC	0 to 254	4	M000.MR.SC000
		Degree of match (Max)	SCMAX	—	4	M000.MR.SCMAX
		Degree of match (Min)	SCMIN	—	4	M000.MR.SCMIN

Note: (1000x) denotes a value multiplied by 1000.

[Pitch]

Output type	Symbol	Inspection item	Symbol	Cell	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	—	2	M000.JG.MD
		Number of detection	N	—	2	M000.JG.N
		Light width	WW	—	2	M000.JG.WW
		Dark width	DW	—	2	M000.JG.DW
		Pitch height	PH	—	2	M000.JG.PH
		Start point X	SX	—	2	M000.JG.SX
		Start point Y	SY	—	2	M000.JG.SY
		End point X	EX	—	2	M000.JG.EX
		End point Y	EY	—	2	M000.JG.EY
Inspection value	MR	Number of detection	N	—	4 (1000x)	M000.MR.N
		Light width	WW	0 to 254	4 (1000x)	M000.MR.WW000
		Light width (Max)	WWMAX	—	4 (1000x)	M000.MR.WWMAX
		Light width (Min)	WWMIN	—	4 (1000x)	M000.MR.WWMIN
		Light distance	WD	0 to 254	4 (1000x)	M000.MR.WD000
		Light distance (Max)	WDMAX	—	4 (1000x)	M000.MR.WDMAX
		Light distance (Min)	WDMIN	—	4 (1000x)	M000.MR.WDMIN
		Dark width	DW	0 to 254	4 (1000x)	M000.MR.DW000
		Dark width (Max)	DWMAX	—	4 (1000x)	M000.MR.DWMAX
		Dark width (Min)	DWMIN	—	4 (1000x)	M000.MR.DWMIN
		Dark distance	DD	0 to 254	4 (1000x)	M000.MR.DD000
		Dark distance (Max)	DDMAX	—	4 (1000x)	M000.MR.DDMAX
		Dark distance (Min)	DDMIN	—	4 (1000x)	M000.MR.DDMIN
		Pitch height	PH	0 to 254	4 (1000x)	M000.MR.PH000
		Pitch height (Max)	PHMAX	—	4 (1000x)	M000.MR.PHMAX
		Pitch height (Min)	PHMIN	—	4 (1000x)	M000.MR.PHMIN
		Start point X	SX	0 to 254	4 (1000x)	M000.MR.SX000
		Start point X (Max)	SXMAX	—	4 (1000x)	M000.MR.SXMAX
		Start point X (Min)	SXMIN	—	4 (1000x)	M000.MR.SXMIN
		Start point Y	SY	0 to 254	4 (1000x)	M000.MR.SY000
		Start point Y (Max)	SYMAX	—	4 (1000x)	M000.MR.SYMAX
		Start point Y (Min)	SYMIN	—	4 (1000x)	M000.MR.SYMIN
		End point X	EX	0 to 254	4 (1000x)	M000.MR.EX000
		End point X (Max)	EXMAX	—	4 (1000x)	M000.MR.EXMAX
		End point X (Min)	EXMIN	—	4 (1000x)	M000.MR.EXMIN
		End point Y	EY	0 to 254	4 (1000x)	M000.MR.EY000
		End point Y (Max)	EYMAX	—	4 (1000x)	M000.MR.EYMAX
		End point Y (Min)	EYMIN	—	4 (1000x)	M000.MR.EYMIN

Note: (1000x) denotes a value multiplied by 1000.

[Shape]
(Line)

Output type	Symbol	Inspection item	Symbol	Label	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	—	2	M000.JG.MD
		Number of detection	N	—	2	M000.JG.N
		Center X	CX	—	2	M000.JG.CX
		Center Y	CY	—	2	M000.JG.CY
		Angle	AG	—	2	M000.JG.AG
		Start point X	SX	—	2	M000.JG.SX
		Start point Y	SY	—	2	M000.JG.SY
		End point X	EX	—	2	M000.JG.EX
		End point Y	EY	—	2	M000.JG.EY
Inspection value	MR	Number of detection	N	—	2	M000.MR.N
		Center X	CX	0 to 254	4 (1000x)	M000.MR.CX000
		Center (Max)	CXMAX	—	4 (1000x)	M000.MR.CXMAX
		Center (Min)	CXMIN	—	4 (1000x)	M000.MR.CXMIN
		Center Y	CY	0 to 254	4 (1000x)	M000.MR.CY000
		Center (MAX)	CYMAX	—	4 (1000x)	M000.MR.CYMAX
		Center (Min)	CYMIN	—	4 (1000x)	M000.MR.CYMIN
		Angle	AG	0 to 254	2	M000.MR.AG000
		Angle (Max)	AGMAX	—	2	M000.MR.AGMAX
		Angle (Min)	AGMIN	—	2	M000.MR.AGMIN
		Start point X	SX	0 to 254	4 (1000x)	M000.MR.SX000
		Start point X (Max)	SXMAX		4 (1000x)	M000.MR.SXMAX
		Start point X (Min)	SXMIN		4 (1000x)	M000.MR.SXMIN
		Start point Y	SY	0 to 254	4 (1000x)	M000.MR.SY000
		Start point Y (Max)	SYMAX		4 (1000x)	M000.MR.SYMAX
		Start point Y (Min)	SYMIN		4 (1000x)	M000.MR.SYMIN
		End point X	EX	0 to 254	4 (1000x)	M000.MR.EX000
		End point X (Max)	EXMAX	—	4 (1000x)	M000.MR.EXMAX
		End point X (Min)	EXMIN	—	4 (1000x)	M000.MR.EXMIN
		End point Y	EY	0 to 254	4 (1000x)	M000.MR.EY000
		End point Y (Max)	EYMAX	—	4 (1000x)	M000.MR.EYMAX
		End point Y (Min)	EYMIN	—	4 (1000x)	M000.MR.EYMIN

Note: (1000x) denotes a value multiplied by 1000.

[Shape]
(Circle)

Output type	Symbol	Inspection item	Symbol	Label	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	—	2	M000.JG.MD
		Center X	CX	—	2	M000.JG.CX
		Center Y	CY	—	2	M000.JG.CY
		Deviation X	DX	—	2	M000.JG.DX
		Deviation Y	DY	—	2	M000.JG.DY
		Radius	R	—	2	M000.JG.R
		Circularity	CD	—	2	M000.JG.CD
		Detection	DT	—	2	M000.JG.DT
Inspection value	MR	Center X	CX	0 to 254	4 (1000x)	M000.MR.CX000
		Center (Max)	CXMAX	—	4 (1000x)	M000.MR.CXMAX
		Center (Min)	CXMIN	—	4 (1000x)	M000.MR.CXMIN
		Center Y	CY	0 to 254	4 (1000x)	M000.MR.CY000
		Center (MAX)	CYMAX	—	4 (1000x)	M000.MR.CYMAX
		Center (Min)	CYMIN	—	4 (1000x)	M000.MR.CYMIN
		Deviation X	DX	0 to 254	4 (1000x)	M000.MR.DX000
		Deviation X (Max)	DXMAX	—	4 (1000x)	M000.MR.DXMAX
		Deviation X (Min)	DXMIN	—	4 (1000x)	M000.MR.DXMIN
		Deviation Y	DY	0 to 254	4 (1000x)	M000.MR.DY000
		Deviation Y (Max)	DYMAX	—	4 (1000x)	M000.MR.DYMAX
		Deviation Y (Min)	DYMIN	—	4 (1000x)	M000.MR.DYMIN
		Radius	R	0 to 254	4 (1000x)	M000.MR.R000
		Radius (Max)	RMAX	—	4 (1000x)	M000.MR.RMAX
		Radius (Min)	RMIN	—	4 (1000x)	M000.MR.RMIN
		Circularity	CD	0 to 254	4 (1000x)	M000.MR.CD000
		Circularity (Max)	CDMAX	—	4 (1000x)	M000.MR.CDMAX
		Circularity (Min)	CDMIN	—	4 (1000x)	M000.MR.CDMIN
		Detection	DT	0 to 254	2	M000.MR.DT000
		Detection (Max)	DTMAX	—	2	M000.MR.DTMAX
		Detection (Min)	DTMIN	—	2	M000.MR.DTMIN

Note: (1000x) denotes a value multiplied by 1000.

[Shape]
(Corner)

Output type	Symbol	Inspection item	Symbol	Label	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	—	2	M000.JG.MD
		Deviation X	DX	—	2	M000.JG.DX
		Deviation Y	DY	—	2	M000.JG.DY
		Number of detection	N	—	2	M000.JG.N
		Coordinate X	X	—	2	M000.JG.X
		Coordinate Y	Y	—	2	M000.JG.Y
		Angle	XAG	—	2	M000.JG.XAG
Inspection value	MR	Deviation X	DX	0 to 254	4 (1000x)	M000.MR.DX000
		Deviation X (Max)	DXMAX	—	4 (1000x)	M000.MR.DXMAX
		Deviation X (Min)	DXMIN	—	4 (1000x)	M000.MR.DXMIN
		Deviation Y	DY	0 to 254	4 (1000x)	M000.MR.DY000
		Deviation Y (Max)	DYMAX	—	4 (1000x)	M000.MR.DYMAX
		Deviation Y (Min)	DYMIN	—	4 (1000x)	M000.MR.DYMIN
		Number of detection	N	—	2	M000.MR.N
		Coordinate X	X	0 to 254	4 (1000x)	M000.MR.X000
		Coordinate X (Max)	XMAX	—	4 (1000x)	M000.MR.XMAX
		Coordinate X (Min)	XMIN	—	4 (1000x)	M000.MR.XMIN
		Coordinate Y	Y	0 to 254	4 (1000x)	M000.MR.Y000
		Coordinate Y (Max)	YMAX	—	4 (1000x)	M000.MR.YMAX
		Coordinate Y (Min)	YMIN	—	4 (1000x)	M000.MR.YMIN
		Angle	XAG	0 to 254	4 (1000x)	M000.MR.XAG000
		Angle (Max)	XAGMAX	—	4 (1000x)	M000.MR.XAGMAX
		Angle (Min)	XAGMIN	—	4 (1000x)	M000.MR.XAGMIN

Note: (1000x) denotes a value multiplied by 1000.

[Multiple Search]

Output type	Symbol	Inspection item	Symbol	Label	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	—	2	M000.JG.MD
		Number of detection	N	—	2	M000.JG.N
		Group	GN	—	2	M000.JG.GN
		Element	EN	—	2	M000.JG.EN
		Coordinate X	X	—	2	M000.JG.X
		Coordinate Y	Y	—	2	M000.JG.Y
		Angle	AG	—	2	M000.JG.AG
		Matching	SC	—	2	M000.JG.SC
		Deviation X	DX	—	2	M000.JG.DX
		Deviation Y	DY	—	2	M000.JG.DY
		Deviation θ	RA	—	2	M000.JG.RA
Inspection value	MR	Number of detection	N	—	2	M000.MR.N
		Group	GN	0 to 127	2	M000.MR.GN000
		Group (Max)	GNMAX	—	2	M000.MR.GNMAX
		Group (Min)	GNMIN	—	2	M000.MR.GNMIN
		Element	EN	0 to 127	2	M000.MR.EN000
		Element (Max)	ENMAX	—	2	M000.MR.ENMAX
		Element (Min)	ENMIN	—	2	M000.MR.ENMIN
		Coordinate X	X	0 to 127	4 (1000x)	M000.MR.X000
		Coordinate X (Max)	XMAX	—	4 (1000x)	M000.MR.XMAX
		Coordinate X (Min)	XMIN	—	4 (1000x)	M000.MR.XMIN
		Coordinate Y	Y	0 to 127	4 (1000x)	M000.MR.Y000
		Coordinate Y (Max)	YMAX	—	4 (1000x)	M000.MR.YMAX
		Coordinate Y (Min)	YMIN	—	4 (1000x)	M000.MR.YMIN
		Angle	AG	0 to 127	4 (1000x)	M000.MR.AG000
		Angle (Max)	AGMAX	—	4 (1000x)	M000.MR.AGMAX
		Angle (Min)	AGMIN	—	4 (1000x)	M000.MR.AGMIN
		Matching Score	SC	0 to 127	4	M000.MR.SC000
		Matching Score (Max)	SCMAX	—	4	M000.MR.SCMAX
		Matching Score (Min)	SCMIN	—	4	M000.MR.SCMIN
		Deviation X	DX	0 to 127	4 (1000x)	M000.MR.DX000
		Deviation X (Max)	DXMAX	—	4 (1000x)	M000.MR.DXMAX
		Deviation X (Min)	DXMIN	—	4 (1000x)	M000.MR.DXMIN
		Deviation Y	DY	0 to 127	4 (1000x)	M000.MR.DY000
		Deviation Y (Max)	DYMAX	—	4 (1000x)	M000.MR.DYMAX
		Deviation Y (Min)	DYMIN	—	4 (1000x)	M000.MR.DYMIN
		Deviation θ	RA	0 to 127	4 (1000x)	M000.MR.RA000
		Deviation θ (Max)	RAMAX	—	4 (1000x)	M000.MR.RAMAX
		Deviation θ (Min)	RAMIN	—	4 (1000x)	M000.MR.RAMIN

Note: (1000x) denotes a value multiplied by 1000.

[Color Inspection]
(RGB)

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD
		Average (R)	CAR	2	M000.JG.CAR
		Maximum (R)	CLR	2	M000.JG.CLR
		Minimum (R)	CSR	2	M000.JG.CSR
		Density difference (R)	CDR	2	M000.JG.CDR
		Density deviation (R)	CVR	2	M000.JG.CVR
		Average (G)	CAG	2	M000.JG.CAG
		Maximum (G)	CLG	2	M000.JG.CLG
		Minimum (G)	CSG	2	M000.JG.CSG
		Density difference (G)	CDG	2	M000.JG.CDG
		Density deviation (G)	CVG	2	M000.JG.CVG
		Average (B)	CAB	2	M000.JG.CAB
		Maximum (B)	CLB	2	M000.JG.CLB
		Minimum (B)	CSB	2	M000.JG.CSB
		Density difference (B)	CDB	2	M000.JG.CDB
		Density deviation (B)	CVB	2	M000.JG.CVB

[Color Inspection] (RGB)

Output type	Symbol	Inspection item	Symbol	Cell	Output size (bytes)	Display example
Inspection value	MR	Average (R)	CAR	0 to 63	2	M000.MR.CAR00
		Average (R) (Max)	CARMAX	—	2	M000.MR.CARMAX
		Average (R) (Min)	CARMIN	—	2	M000.MR.CARMIN
		Maximum (R)	CLR	0 to 63	2	M000.MR.CLR00
		Maximum (R) (Max)	CLRMAX	—	2	M000.MR.CLRMAX
		Maximum (R) (Min)	CLRMIN	—	2	M000.MR.CLRMIN
		Minimum (R)	CSR	0 to 63	2	M000.MR.CSR00
		Minimum (R) (Max)	CSRMAX	—	2	M000.MR.CSRMAX
		Minimum (R) (Min)	CSRMIN	—	2	M000.MR.CSRMIN
		Density differece (R)	CDR	0 to 63	2	M000.MR.CDR00
		Density differece (R) (Max)	CDRMAX	—	2	M000.MR.CDRMAX
		Density differece (R) (Min)	CDRMIN	—	2	M000.MR.CDRMIN
		Density deviation (R)	CVR	0 to 63	2	M000.MR.CVR00
		Density deviation (R) (Max)	CVRMAX	—	2	M000.MR.CVRMAX
		Density deviation (R) (Min)	CVRMIN	—	2	M000.MR.CVRMIN
Inspection value	MR	Average (G)	CAG	0 to 63	2	M000.MR.CAG00
		Average (G) (Max)	CAGMAX	—	2	M000.MR.CAGMAX
		Average (G) (Min)	CAGMIN	—	2	M000.MR.CAGMIN
		Maximum (G)	CLG	0 to 63	2	M000.MR.CLG00
		Maximum (G) (Max)	CLGMAX	—	2	M000.MR.CLGMAX
		Maximum (G) (Min)	CLGMIN	—	2	M000.MR.CLGMIN
		Minimum (G)	CSG	0 to 63	2	M000.MR.CSG00
		Minimum (G) (Max)	CSGMAX	—	2	M000.MR.CSGMAX
		Minimum (G) (Min)	CSGMIN	—	2	M000.MR.CSGMIN
		Density differece (G)	CDG	0 to 63	2	M000.MR.CDG00
		Density differece (G) (Max)	CDGMAX	—	2	M000.MR.CDGMAX
		Density differece (G) (Min)	CDGMIN	—	2	M000.MR.CDGMIN
		Density deviation (G)	CVG	0 to 63	2	M000.MR.CVG00
		Density deviation (G) (Max)	CVGMAX	—	2	M000.MR.CVGMAX
		Density deviation (G) (Min)	CVGMIN	—	2	M000.MR.CVGMIN
Inspection value	MR	Average (B)	CAB	0 to 63	2	M000.MR.CAB00
		Average (B) (Max)	CABMAX	—	2	M000.MR.CABMAX
		Average (B) (Min)	CABMIN	—	2	M000.MR.CABMIN
		Minimum (B)	CLB	0 to 63	2	M000.MR.CLB00
		Minimum (B) (Max)	CLBMAX	—	2	M000.MR.CLBMAX
		Minimum (B) (Min)	CLBMIN	—	2	M000.MR.CLBMIN
		Maximum (B)	CSB	0 to 63	2	M000.MR.CSB00
		Maximum (B) (Max)	CSBMAX	—	2	M000.MR.CSBMAX
		Maximum (B) (Min)	CSBMIN	—	2	M000.MR.CSBMIN
		Density differece (B)	CDB	0 to 63	2	M000.MR.CDB00
		Density differece (B) (Max)	CDBMAX	—	2	M000.MR.CDBMAX
		Density differece (B) (Min)	CDBMIN	—	2	M000.MR.CDBMIN
		Density deviation (B)	CVB	0 to 63	2	M000.MR.CVB00
		Density deviation (B) (Max)	CVBMAX	—	2	M000.MR.CVBMAX
		Density deviation (B) (Min)	CVBMIN	—	2	M000.MR.CVBMIN

[Color Inspection]
(HSL)

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD
		Average (H)	CAH	2	M000.JG.CAH
		Maximum (H)	CLH	2	M000.JG.CLH
		Minimum (H)	CSH	2	M000.JG.CSH
		Density differece (H)	CDH	2	M000.JG.CDH
		Density deviation (H)	CVH	2	M000.JG.CVH
		Average (S)	CAS	2	M000.JG.CAS
		Maximum (S)	CLS	2	M000.JG.CLS
		Minimum (S)	CSS	2	M000.JG.CSS
		Density differece (S)	CDS	2	M000.JG.CDS
		Density deviation (S)	CVS	2	M000.JG.CVS
		Average (L)	CAL	2	M000.JG.CAL
		Maximum (L)	CLL	2	M000.JG.CLL
		Minimum (L)	CSL	2	M000.JG.CSL
		Density differece (L)	CDL	2	M000.JG.CDL
		Density deviation (L)	CVL	2	M000.JG.CVL

[Color Inspection] (HSL)

Output type	Symbol	Inspection item	Symbol	Cell	Output size (bytes)	Display example
Inspection value	MR	Average (H)	CAH	0 to 63	2	M000.MR.CAH00
		Average (H) (Max)	CAHMAX	—	2	M000.MR.CAHMAX
		Average (H) (Min)	CAHMIN	—	2	M000.MR.CAHMIN
		Maximum (H)	CLH	0 to 63	2	M000.MR.CLH00
		Maximum (H) (Max)	CLHMAX	—	2	M000.MR.CLHMAX
		Maximum (H) (Min)	CLHMIN	—	2	M000.MR.CLHMIN
		Minimum (H)	CSH	0 to 63	2	M000.MR.CSH00
		Minimum (H) (Max)	CSHMAX	—	2	M000.MR.CSHMAX
		Minimum (H) (Min)	CSHMIN	—	2	M000.MR.CSHMIN
		Density differece (H)	CDH	0 to 63	2	M000.MR.CDH00
		Density differece (H) (Max)	CDHMAX	—	2	M000.MR.CDHMAX
		Density differece (H) (Min)	CDHMIN	—	2	M000.MR.CDHMIN
		Density deviation (H)	CVH	0 to 63	2	M000.MR.CVH00
		Density deviation (H) (Max)	CVHMAX	—	2	M000.MR.CVHMAX
		Density deviation (H) (Min)	CVHMIN	—	2	M000.MR.CVHMIN
Inspection value	MR	Average (S)	CAS	0 to 63	2	M000.MR.CAS00
		Average (S) (Max)	CASMAX	—	2	M000.MR.CASMAX
		Average (S) (Min)	CASMIN	—	2	M000.MR.CASMIN
		Maximum (S)	CLS	0 to 63	2	M000.MR.CLS00
		Maximum (S) (Max)	CLSMAX	—	2	M000.MR.CLSMAX
		Maximum (S) (Min)	CLSMIN	—	2	M000.MR.CLSMIN
		Minimum (S)	CSS	0 to 63	2	M000.MR.CSS00
		Minimum (S) (Max)	CSSMAX	—	2	M000.MR.CSSMAX
		Minimum (S) (Min)	CSSMIN	—	2	M000.MR.CSSMIN
		Density differece (S)	CDS	0 to 63	2	M000.MR.CDS00
		Density differece (S) (Max)	CDSMAX	—	2	M000.MR.CDSMAX
		Density differece (S) (Min)	CDSMIN	—	2	M000.MR.CDSMIN
		Density deviation (S)	CVS	0 to 63	2	M000.MR.CVS00
		Density deviation (S) (Max)	CVSMAX	—	2	M000.MR.CVSMAX
		Density deviation (S) (Min)	CVSMIN	—	2	M000.MR.CVSMIN
Inspection value	MR	Average (L)	CAL	0 to 63	2	M000.MR.CAL00
		Average (L) (Max)	CALMAX	—	2	M000.MR.CALMAX
		Average (L) (Min)	CALMIN	—	2	M000.MR.CALMIN
		Maximum (L)	CLL	0 to 63	2	M000.MR.CLL00
		Maximum (L) (Max)	CLLMAX	—	2	M000.MR.CLLMAX
		Maximum (L) (Min)	CLLMIN	—	2	M000.MR.CLLMIN
		Minimum (L)	CSL	0 to 63	2	M000.MR.CSL00
		Minimum (L) (Max)	CSLMAX	—	2	M000.MR.CSLMAX
		Minimum (L) (Min)	CSLMIN	—	2	M000.MR.CSLMIN
		Density differece (L)	CDL	0 to 63	2	M000.MR.CDL00
		Density differece (L) (Max)	CDLMAX	—	2	M000.MR.CDLMAX
		Density differece (L) (Min)	CDLMIN	—	2	M000.MR.CDLMIN
		Density deviation (L)	CVL	0 to 63	2	M000.MR.CVL00
		Density deviation (L) (Max)	CVLMAX	—	2	M000.MR.CVLMAX
		Density deviation (L) (Min)	CVLMIN	—	2	M000.MR.CVLMIN

[OCV]

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD
		Number of characters	CN	2	M000.JG.CN
		Matching	SC	2	M000.JG.SC
		OCR compare	RCG	2	M000.JG.RCG
		OCR Score (Candidate 1)	RS1	2	M000.JG.RS1
		OCR Score (Candidate 2)	RS2	2	M000.JG.RS2
		Stability	RR	2	M000.JG.RR
Inspection value	MR	Number of characters	CN	2	M000.MR.CN
		Matching	SC	2	M000.MR.SC
		OCR compare	RCG	2	M000.MR.RCG
		OCR Score (Candidate 1)	RS1	2	M000.MR.RS1
		OCR Score (Candidate 2)	RS2	2	M000.MR.RS2
		Stability	RR	2	M000.MR.RR
		Set string	SD	Max. 256 ※	M000.MR.SD
		Recognized string	RD	Max. 256 ※	M000.MR.RD
		Recognized string (candidate1)	RS1	2	M000.MR.RS1
		Recognized string (candidate2)	RS2	2	M000.MR.RS2

※ Output size of string data

For variable length output, the size varies with the size of data to output.

For fixed length output, the size is the one set by the Output Setting (1 to 256 bytes).

Spaces (0x20) are added up to the set size when the data is less than the set size.

[Code reader]

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	2	M000.JG.MD
		Detection	DT	2	M000.JG.DT
		Number of data	DN	2	M000.JG.DN
		Num of ERR correction	MCC	2	M000.JG.MCC
		Compare	CM	2	M000.JG.CM
		Print quality test	Q	2	M000.JG.Q
		Overall symbol grade (1D)	QG1	2	M000.JG.QG1
		Element edge	QEE	2	M000.JG.QEE
		Min. reflectance	QRM	2	M000.JG.QRM
		Min. edge contrast	QEC	2	M000.JG.QEC
		Symbol contrast	QSC	2	M000.JG.QSC
		Modulation	QMO	2	M000.JG.QMO
		Defect	QDT	2	M000.JG.QDT
		Decodability	QDA	2	M000.JG.QDA
		Decode	QDC	2	M000.JG.QDC
		Overall symbol grade (CCA)	QG2	2	M000.JG.QG2
		Element edge (CCA)	QEEP	2	M000.JG.QEEP
		Min. reflectance (CCA)	QRMP	2	M000.JG.QRMP
		Min. edge contrast (CCA)	QECP	2	M000.JG.QECP
		Symbol contrast (CCA)	QSCP	2	M000.JG.QSCP
		Modulation (CCA)	QMOP	2	M000.JG.QMOP
		Defect (CCA)	QDTP	2	M000.JG.QDTP
		Decodability (CCA)	QDAP	2	M000.JG.QDAP
		Decode (CCA)	QDCP	2	M000.JG.QDCP
		Unused error correction (CCA)	QNUP	2	M000.JG.QNUP
		Codeword yield (CCA)	QCYP	2	M000.JG.QCYP
		Codeword quality (CCA)	QCWP	2	M000.JG.QCWP
		Unused error correction	QNU	2	M000.JG.QNU
		Fixed pattern damage	QFP	2	M000.JG.QFP
		Axial nonuniformity	QAN	2	M000.JG.QAN
		Grid nonuniformity	QGN	2	M000.JG.QGN

[Code reader]

Output type	Symbol	Inspection item	Symbol	Output size (bytes)	Display example
Inspection value	MR	Detection	DT	2	M000.MR.DT
		Number of data	DN	2	M000.MR.DN
		Num of ERR correction	MCC	2	M000.MR.MCC
		Compare	CM	2	M000.MR.CM
		Print quality test	Q	4 (10x)	M000.MR.Q
		Overall symbol grade (1D)	QG1	4 (10x)	M000.MR.QG1
		Element edge	QEE	4 (10x)	M000.MR.QEE
		Min. reflectance	QRM	4 (10x)	M000.MR.QRM
		Min. edge contrast	QEC	4 (10x)	M000.MR.QEC
		Symbol contrast	QSC	4 (10x)	M000.MR.QSC
		Modulation	QMO	4 (10x)	M000.MR.QMO
		Defect	QDT	4 (10x)	M000.MR.QDT
		Decodability	QDA	4 (10x)	M000.MR.QDA
		Decode	QDC	4 (10x)	M000.MR.QDC
		Overall symbol grade (CCA)	QG2	4 (10x)	M000.MR.QG2
		Element edge (CCA)	QEEP	4 (10x)	M000.MR.QEEP
		Min. reflectance (CCA)	QRMP	4 (10x)	M000.MR.QRMP
		Min. edge contrast (CCA)	QECP	4 (10x)	M000.MR.QECP
		Symbol contrast (CCA)	QSCP	4 (10x)	M000.MR.QSCP
		Modulation (CCA)	QMOP	4 (10x)	M000.MR.QMOP
		Defect (CCA)	QDTP	4 (10x)	M000.MR.QDTP
		Decodability (CCA)	QDAP	4 (10x)	M000.MR.QDAP
		Decode (CCA)	QDCP	4 (10x)	M000.MR.QDCP
		Unused error correction (CCA)	QNUP	4 (10x)	M000.MR.QNUP
		Codeword yield (CCA)	QCYP	4 (10x)	M000.MR.QCYP
		Codeword quality (CCA)	QCWP	4 (10x)	M000.MR.QCWP
		Unused error correction	QNU	4 (10x)	M000.MR.QNU
		Fixed pattern damage	QFP	4 (10x)	M000.MR.QFP
		Axial nonuniformity	QAN	4 (10x)	M000.MR.QAN
		Grid nonuniformity	QGN	4 (10x)	M000.MR.QGN
		Stored data	SD	Max. 256	M000.MR.SD
		Read data	RD	Max. 256	M000.MR.RD

※ Output size of string data

For variable length output, the size varies with the size of data to output.

For fixed length output, the size is the one set by the Output Setting (1 to 256 bytes).

Spaces (0x20) are added up to the set size when the data is less than the set size.

※ For the data with "4 (10x)" under Output size, the integer of the data multiplied by 10 is output.

[Text]

Output type	Symbol	Inspection item	Symbol	Label	Output size (bytes)	Display example
Judgment criteria	JG	Module	MD	—	2	M000.JG.MD
		Output Data 1	DN	—	2	M000.JG.DN
		Compare	CM	—	2	M000.JG.CM
Inspection value	MR	Output Data 1	ID1	—	2	M000.MR.ID1
		Output Data 2	ID2	—	2	M000.MR.ID2
		Output Data	OD	—	2	M000.MR.OD
		Output Data Num	DN	—	2	M000.MR.DN
		Compare	CM	0～254	4 (1000x)	M000.MR.CM

※ Output size of string data

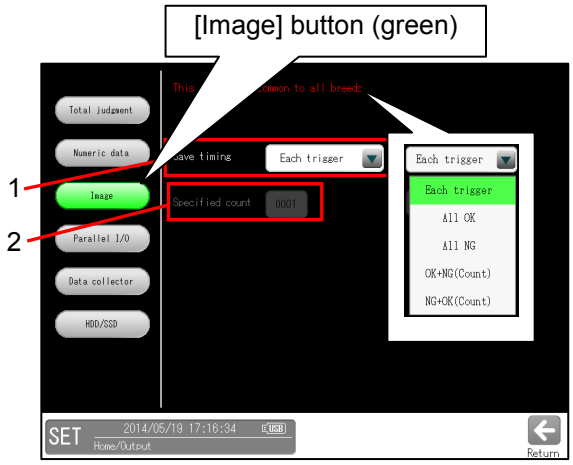
For variable length output, the size varies with the size of data to output.

For fixed length output, the size is the one set by the Output Setting (1 to 256 bytes).

Spaces (0x20) are added up to the set size when the data is less than the set size.

[3] [Image] (Assign image save timing) button

You can select the timing for saving an image to the device:
"Each trigger", "All OK", "All NG",
"OK + NG (Count) " or "NG + OK (Count)".
Touch the [Image] button on the Output setting screen and select the save timing.



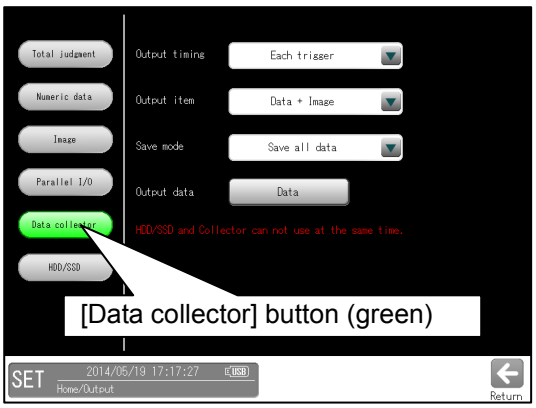
1. **[Save timing] drop down list**
   Select one and the device renews the image memory as follows.
   - **Each trigger**
     At each time triggering inspection
   - **All OK**
     Whenever the total judgment result is OK.
   - **All NG**
     Whenever the total judgment result is NG.
   - **OK + NG (Count) (Each OK + NG)**
     Whenever the total judgment result is OK or When the total judgment results are NG for the specified count.
   - **NG + OK (Count) (Each NG + OK)**
     Whenever the total judgment result is NG or when the total judgment results are OK for the specified count.

2. **[Specified count] data input box**
   When the timing for saving image is set to "OK + NG (Count)" or "NG + OK (Count)", enter the count to save image from 1 to 9999.

[4] [Data collector] button

Data collector is a design support program for the device and when it is installed in a PC, the PC can get data and images from the device via Ethernet.

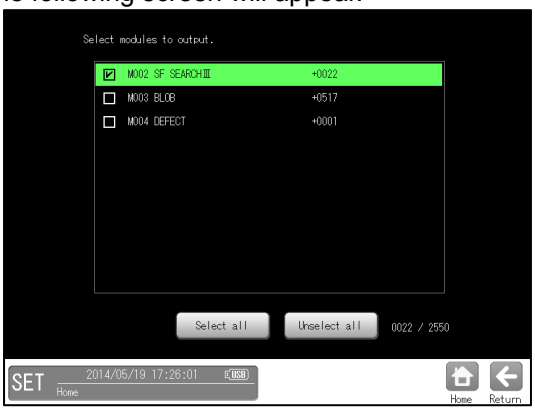
The "Output timing", "Output item", and "Save mode" for Data Collection must be set on the Data output screen.
To set these parameters, touch the [Data collector] button on the Output setting screen.



Select one of the options from each drop down list.

- **[Output Timing] drop down list**
  "Disable", "Each trigger", "All OK" or "All NG"
- **[Output item] drop down list**
  "Data + Image", "Data only" or "Image only".
- **[Save mode] drop down list**
  "Save all data" or "Stop save at trigger"

To set the output data, touch “Data” button.
The following screen will appear.



Select the module to output.
The selected module is highlighted in green.

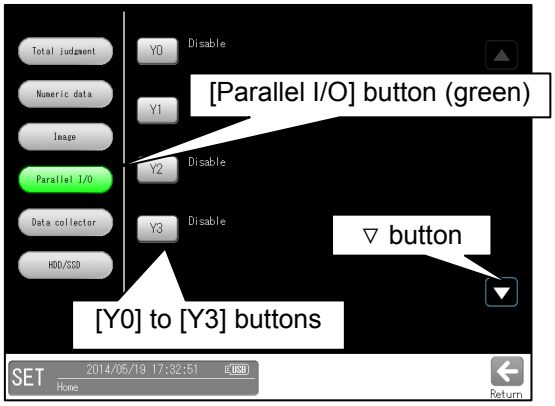
To use this [Data collector] function, be sure to set the Ethernet (port number of the data port) by performing
"Communication" -> "Ethernet" -> "Port number".
=> See page 4-20.

[5] [Parallel I/O] button

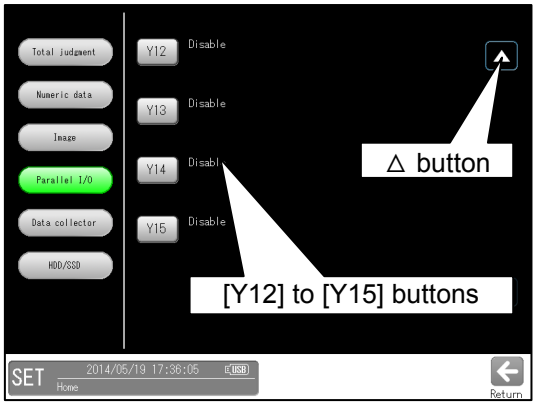
Set the output conditions (Y0 – Y15) for the device according to the following steps:

The screens shown below are typical examples of IV-S300M (1 Trigger Mode).

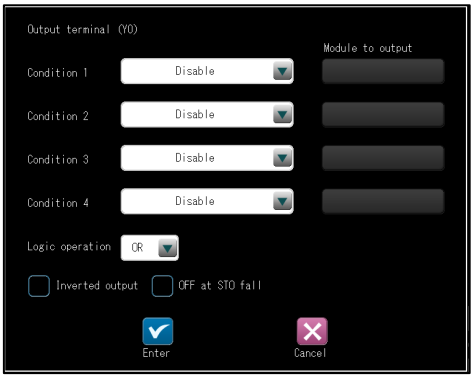
① Touch the [Parallel I/O] button on the Output setting screen, and the condition setting screen for output terminals Y0 to Y15 will appear.



・Touch the ▽ button to scroll to the screen of “Y4 to Y7”, “Y8 to Y11” and “Y12 to Y15”. Touch the △ button and the screen returns to the previous screen.

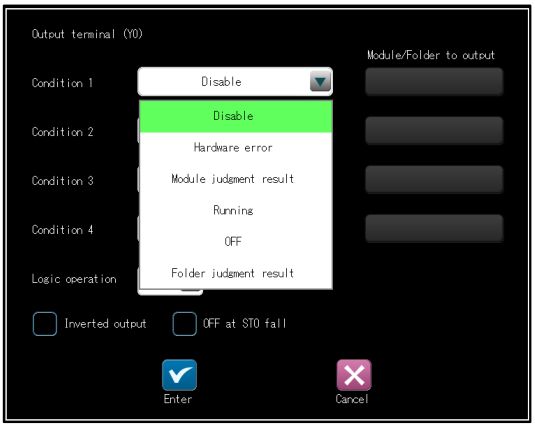


② Touch each [Y0] to [Y15] button to display the condition setting window for the touched output terminal.



③ Select a condition from the drop down list of each [Condition 1] to [Condition 4].

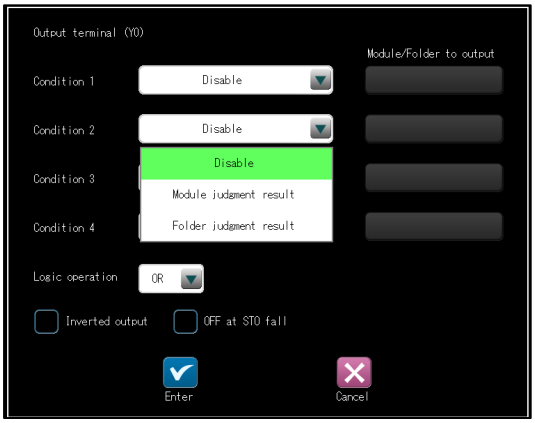
("Condition 1")



[Selectable options]

"Disable": The output terminal is not controlled by this module.
"OFF": The output terminal is always set to OFF.
"Module judgment result": See next page.
"Folder judgment result": See next page.
"Running": See page 4-234.
"Hardware error": See page 4-234.

("Condition 2" to “Condition 4”)

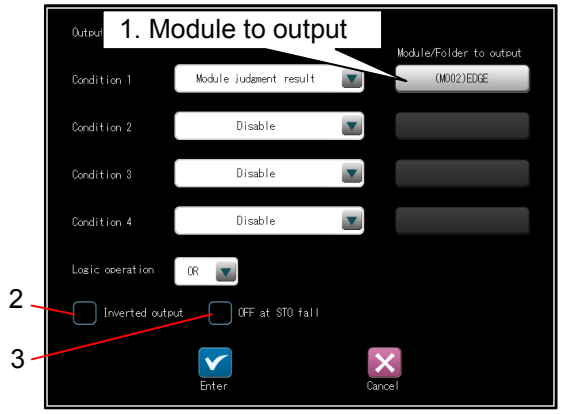


[Selectable options]

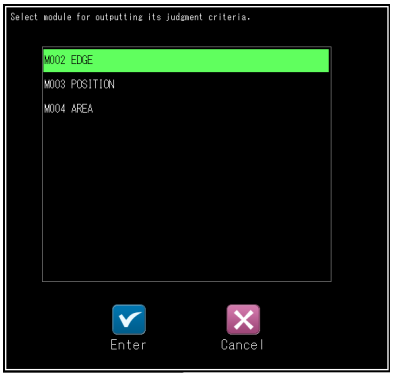
"Disable"
"Module judgment result": See next page.
"Folder judgment result": See next page.

● Selection of Condition

・When [Condition 1] to [Condition 4] is set to "Module judgment result", select a module to output for each condition.



1. [Module to output] button
   Touch the button under "Module/Folder to output", and the window shown below will appear.

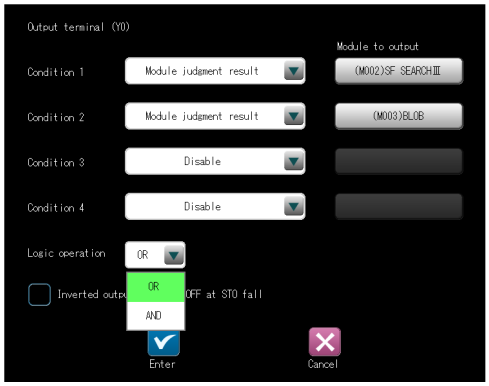


   Touch a desired module for outputting its judgment criteria.

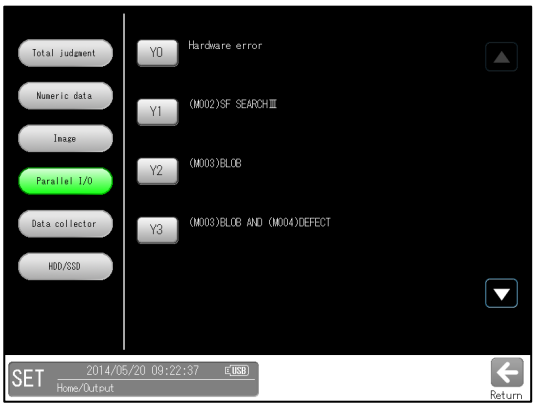
2. [Inverted output] check box
   => See page 4-232

3. [OFF at STO fall] check box
   => See page 4-233

・When setting more than one conditions, select "OR" or "AND" from the [Logic operation] drop down list.



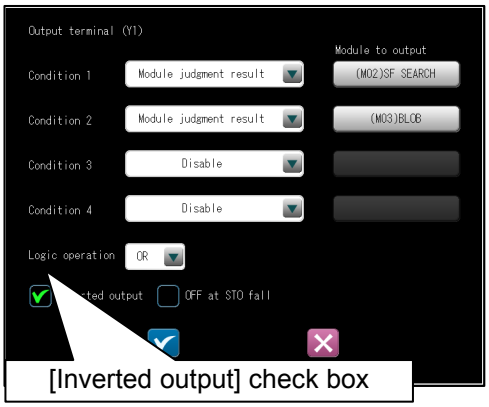
・Setting example



Y0: Turns on when a hardware error occurs.
Y1: Turns on when the SF Search module (module number 2) is OK.
Y2: Turns on when the Blob module (module number 3) is OK.
Y3: Turns on when both the Blob module (module number 3) and the Defect inspection module (module number 4) are OK.

(1) [Inverted output] check box

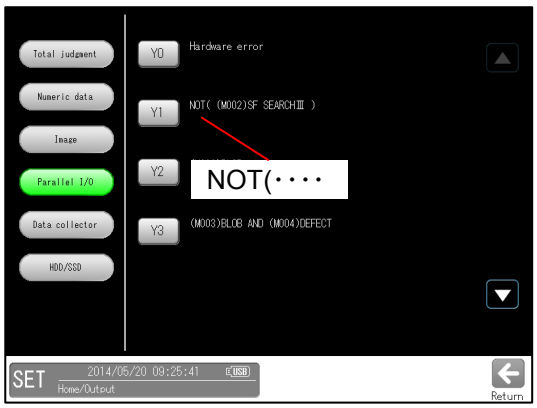
When the "Module judgment result" or "Folder judgment result" is set, the output signal can be inverted. To invert an output signal, touch the [Inverted output] check box to show ☑ on the condition setting window.



・By setting the [Inverted output] check box to show ☑, the output result will become as follows:

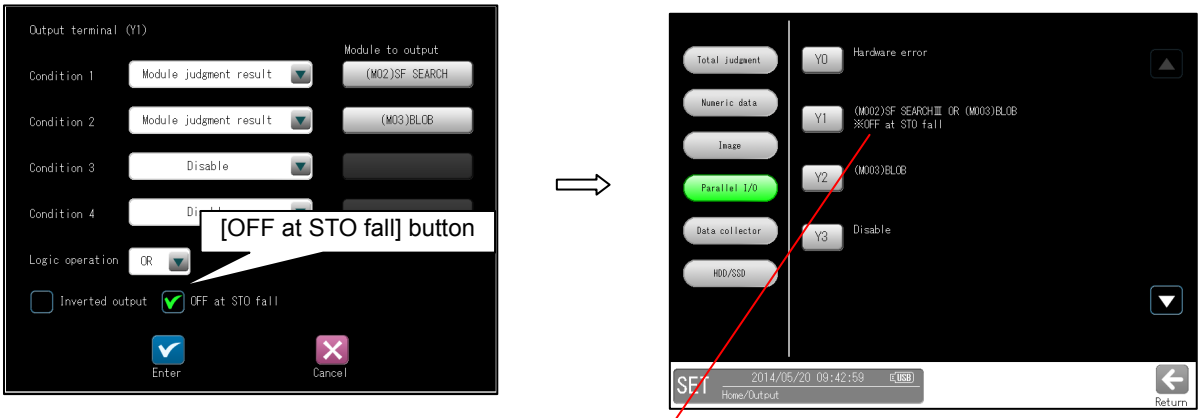
Inverted output	OK	NG	ERR	Disabled
Disabled (☐)	ON	OFF	OFF	OFF
Enabled (☑)	OFF	ON	ON	ON

・When the inverted output is checked (☑), "NOT(・・・・) " will be displayed on the output setting screen.



(2) [OFF at STO fall] check box

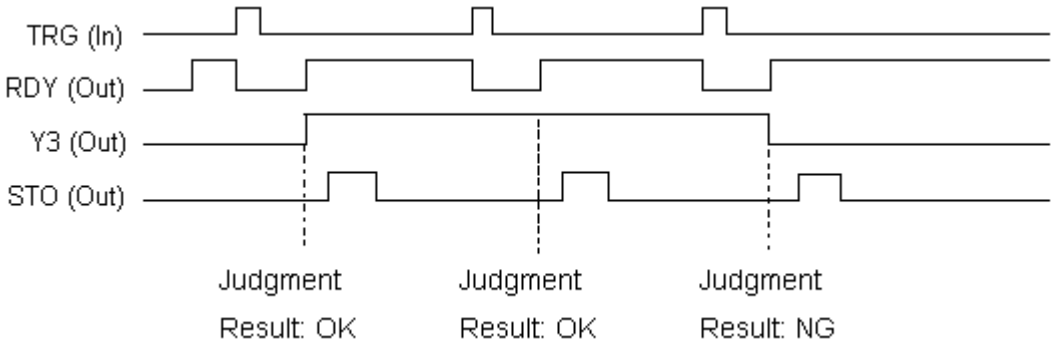
When "Module judgment result" or "Folder judgment result" is set, the output signals can be turned off at the falling timing of the STO signal.
To select this timing, touch the [OFF at STO fall] check box to show ☑ on the condition setting screen.



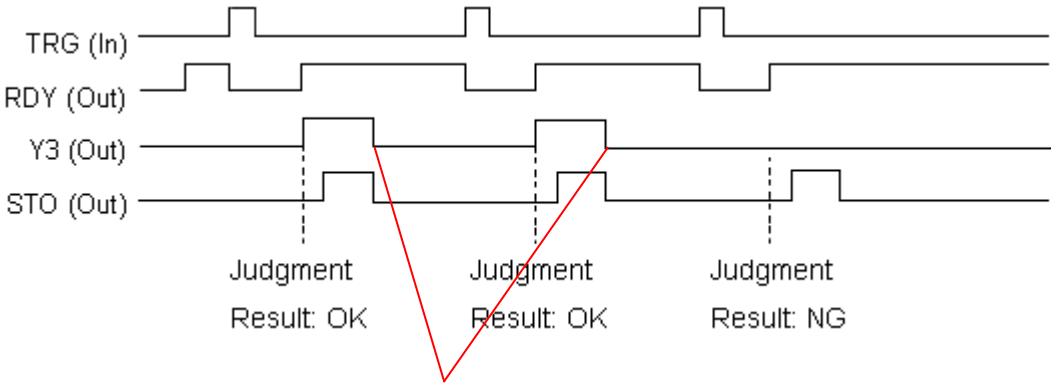
"※ OFF at STO fall" will be displayed.

[Ex.] When the "Module judgment result" signal is selected for Y3

- When "OFF at STO fall" is disabled (☐)



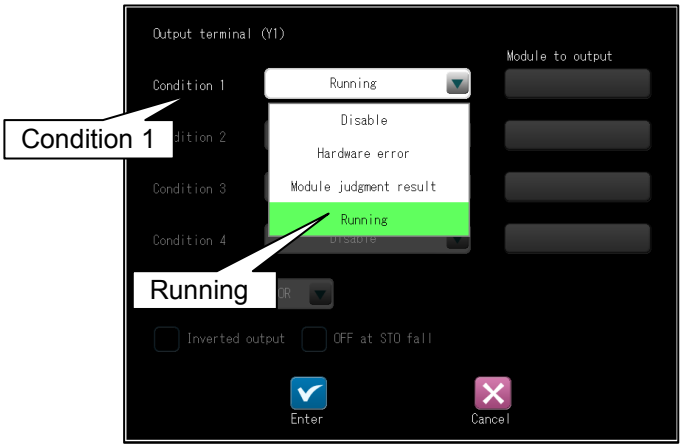
- When " OFF at STO fall" is enabled (☑)



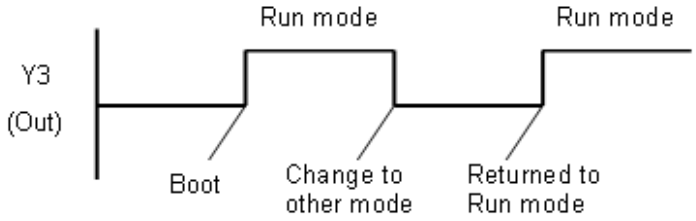
Y3 (output) is turned off at the falling timing of the STO signal.

(3) When "Running" is selected

The device can output a "Running" signal to the general purpose output.
To enable this, select "Running" from the drop down list of "Condition 1" for each Y0 to Y15.



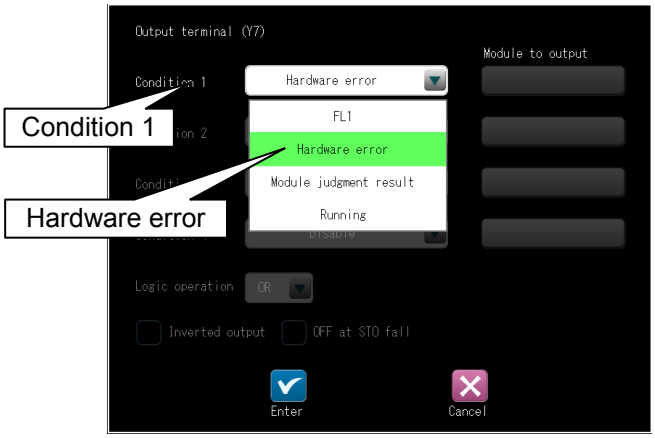
[Ex.] Start the device with Run mode and "Running" is output to Y3.



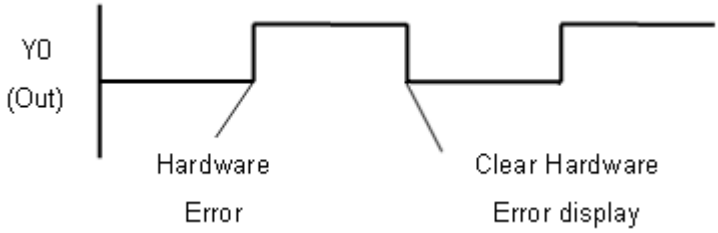
- Y3 is turned on when the device enters into Run mode or Online adjustment mode, and turns off when it goes to other modes (SET, Auto setup, and Offline adjustment).

(4) When "Hardware Error" is selected

The “Hardware Error” signal can be output to the general purpose output.
To enable this, select "Hardware Error" from the drop down list of "Condition 1" for each Y0 to Y15.



[Ex.] When "Hardware Error" is output to Y0.



- Y0 turns on when a hardware error occurs (the error is displayed on the screen).
- Y0 turns off when the “Confirm” check box displayed with the hardware error message is touched. See Section 10.

[6] [USB] button

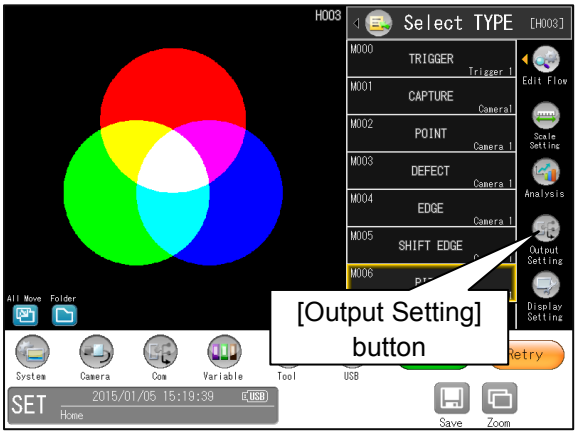
Iamge save via USB port

Captured images can be saved into an external memory via an USB port.

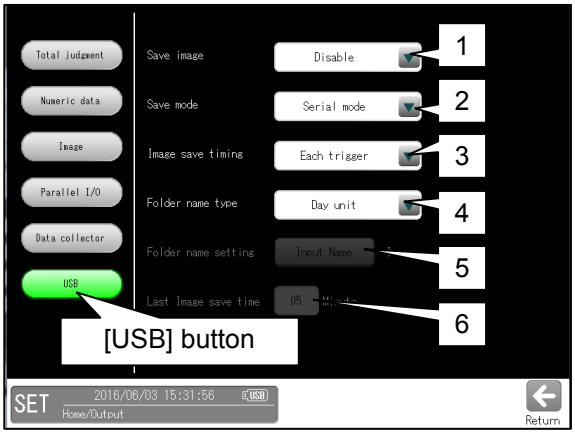
It is possible to save the image on the condition of the total judgment result.

Touch the [USB] button on the Output setting screen to set the Image save via USB port.

① Touch the [Output Setting] button on (Home) SET screen.



② Setting screen will appear.
Touch the “USB” button.



1. [Save image] drop down list

Select “Disable” or “Enable” for the image save.

2. [Save mode] drop down list

Select the mode for image save:

“Serial mode”:

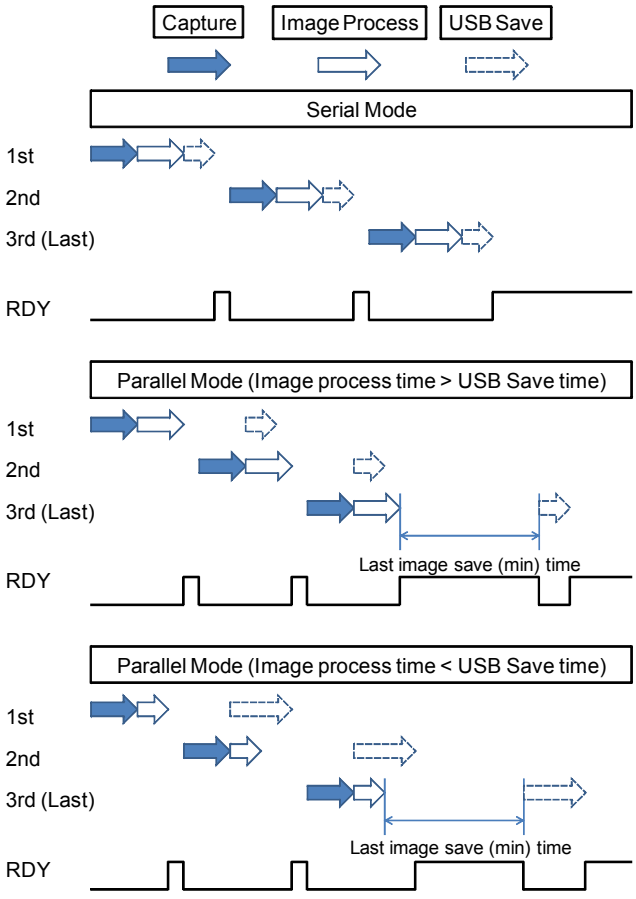
Save an image after image processing. Trigger input is disabled during the image save.

“Parallel mode”:

Save one before captured image for inspection in parallel with image processing.
The time setting for saving the last image for inspection is required.
See item 6 in next page.

・In 2 Trigger mode, image save is always done by Serial mode.

[Operation Flow of Image Save]



3. **[Image Save Timing] drop down list**

Select the timing from the drop down list:

"Each Trigger": All the images are saved at each trigger.

"All OK + NG": Images are saved when the total judgment result is OK and NG.

"All OK": Images are saved when the total judgment result is OK.

"All NG": Images are saved when the total judgment result is NG.

"All Error": Images are saved when the total judgment result is ERROR.

4. **[Folder name type] drop down list**

Select the folder name type from Minute unit, Hour unit, Day unit and Input Name.

5. **[Folder name setting] drop down list**

(When "Input Name" is selected for "Folder name type")

Touch the button and enter a folder name. (Accepts only alphanumeric characters)

6. **[Last Image save time] data input box**

When "Parallel mode" is selected for "Save mode", the last image is saved automatically after the inspection has been done and then the time set by this data input box elapses.

- The image is saved before the time set by this data input box under the following cases:
  - Changed object type
  - Went to setting mode
- When "Serial mode" is selected for "Save mode", this setting is not required because the image is saved automatically after it is processed.
- In 2 trigger mode, "Save mode" is fixed to "Serial mode".
- During the image saving after the time set by this data input box, RDY signal goes OFF.
- The unit of the time set by this data input box is minute.

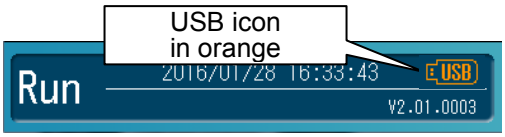
■ **USB Flash Drive Status on RUN Screen**

There are 2 status for an USB flash drive:

The status is displayed on RUN screen.

"Saving ready" status:

The device is connected with an USB flash drive and ready for high speed image saving.



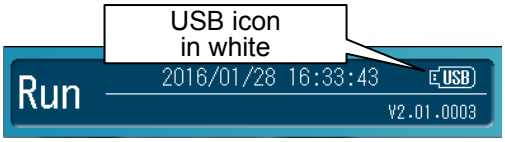
IMPORTANT:

Disconnecting the USB flash drive in this status may damage the saved image data.

"USB flash drive connected" status:

The device is connected with an USB flash drive.

The USB flash drive can be disconnected safely, however, the saving time takes longer compared with when the USB icon is orange.



- The above 2 status can be changed alternately by touching the USB icon.
- To disconnect an USB flash drive, be sure go to (Home) SET screen or make the USB icon white in RUN screen.
- To save not saved images in "Parallel mode", touch the USB icon or go to (Home) SET screen.
- The image save time to USB flash drive is displayed on the Status display area.
- 13,000 images can be stored in one folder.

Requirements for an USB flash drive and USB SSD/HDD

- Class: USB Mass Storage class

- Format: FAT or FAT32
  1. NTFS and exFAT formats are not supported.
  2. 64GB or higher USB memory devices can be used.
     However, Windows cannot format at FAT32 for a drive with 32GB or higher.
     To format 32GB or higher memory device, a format tool provided by SSD/HDD manufacturer is required.

- Do not use the security function of an USB memory device.
  1. Hardware Encrypted USB Flash Drive is not supported
  2. Hardware Encrypted USB Flash Drive can be used if the security software is not installed.
  3. Some USB Flash Drives are installed with the security software in it.
     If so, format it at FAT32 before the use.

  For such ones, use it after formatting at FAT32.

- Do not use an USB Flash Drive with additional functions such as an anti-virus function.

- Do not use an exclusive tool such as for high speed at Windows side.

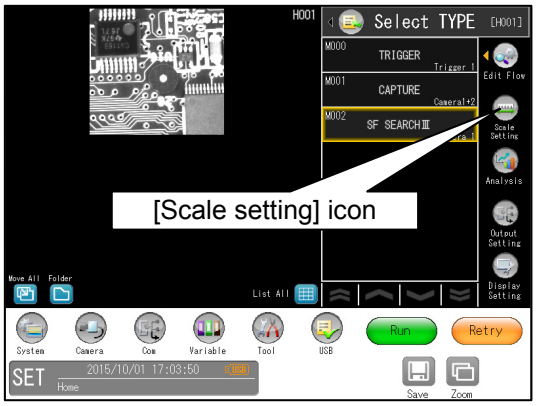
- Do not set such as ReadyBoost for speeding up of Windows.

4-4-23 Scale setting

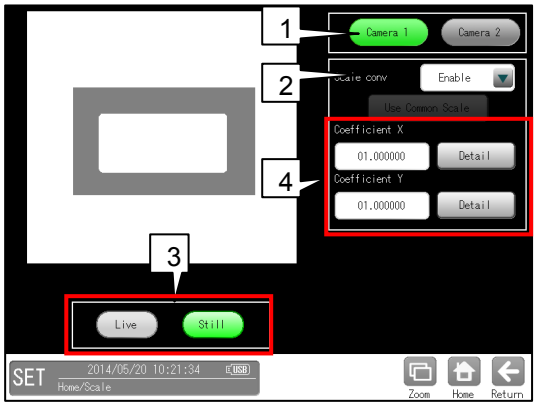
The device displays the inspected distance and area by using the number of pixels.
When a scale is set, the device will display the inspection value in the unit you desire (like mm, inches etc.) by multiplying the number of pixels by a coefficient to be set.

- Capture the image of an object having a known distance of its two points.
- Set coefficients for both X and Y coordinates.
  The device will automatically calculate the distance by using the known distance and coefficients.

① Touch the [Scale setting] button on the Screen setting window.

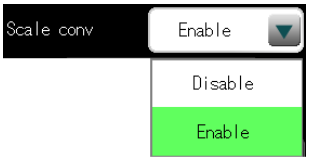


② The Scale setting screen will appear.



1. **[Select Camera] buttons**
   Select a "Camera number to use" when enabled this module: "Camera 1" or "Camera 2".
   In 2 Trigger mode, select a camera depending on the Object type number. See page 4-6.

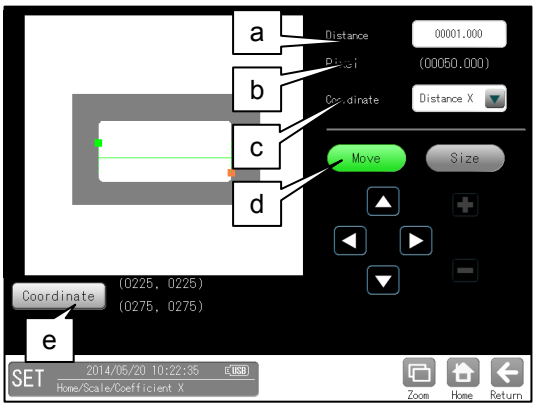
2. **[Scale conversion] drop down list**
   Select “Enable”.



3. **[Image] buttons**
   Touch the [Live] button and capture the image of an object having a known distance and then touch the [Still] button

4. **[Coefficient X/Y] data input boxes, [Manual setting] and [Reference setting] buttons**

A. Manual setting
Touch the [Manual setting] button of [Coordinate X] or [Coordinate Y] button depending on the coordinate which distance you know.
The corresponding coordinate (X or Y) setting screen will appear.



a. [Distance] data input box
Enter the known distance.
(Input range: 1.000 to 99999.999)

b. Pixel
The distance (in selected axis coordinates) of the two points will be displayed in units of pixels.

c. [Coordinate] drop down list (Distance in selected axis coordinate)

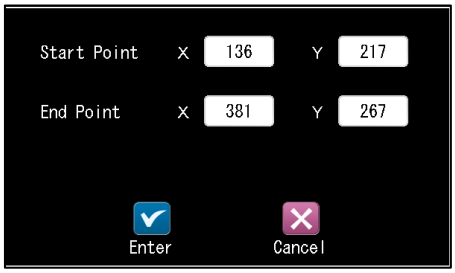
- For the X coefficient, select either "Distance X" or "Distance 2pt."
- For the Y coefficient, select either "Distance Y" or "Distance 2pt."

d. [Move] and [Size] buttons

- Touch the [Move] button and touch and move the center of the top left orange □ to the left side of the known position.
  Then, touch the [Size] button and move the center of the bottom right orange □ to the right side of the known position.
- Touch and move the □ for large movement and use the [Direction] buttons for fine adjustment of the position.

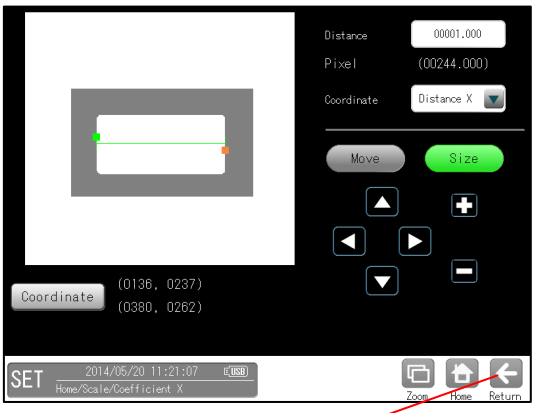
e. [Coordinate] button

With this button, you can directly enter the X and Y coordinates of the starting and end points if you know them.
Touch the button and enter the coordinates with the respective data input box and number key pad.



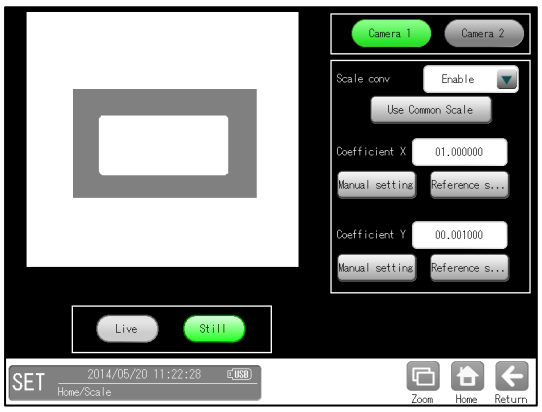
[Display examples]

- When the "Distance X" is selected.
  (See horizontal line in green)

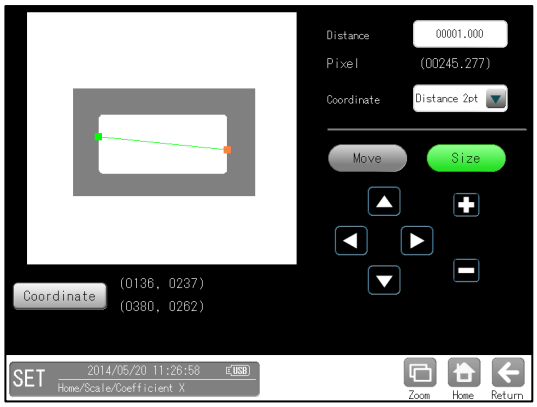


After [Return] icon is touched

<Scale setting screen will appear>



- When the "Distance 2pt" on the X axis is selected.
  (See the line connecting the two points in green)

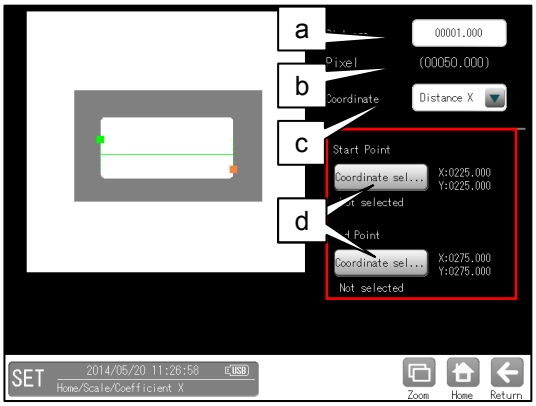


B. Reference setting

Scale can be set by referencing to the inspection result of a module with a reference image.
Touch the [Reference setting] button of [Coordinate X] or [Coordinate Y] button.

The following inspection results can be referenced.

Module	Inspection result
SF Search	Coordinate XY
Gray Search	
Multiple Search	
Edge	
Shift Edge	
Blob	Center XY
Shape	Start point
	End point
	Center point
Distance/Angle	Middle point of 2 points

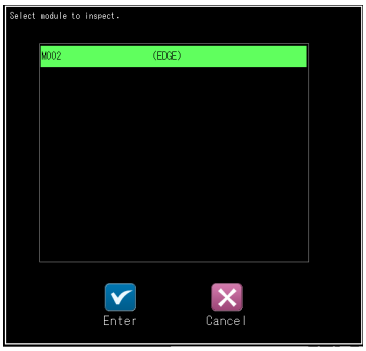


a. [Distance] data input box
Enter the actual distance between the Start and End points.

b. Pixel
The distance between the Start and End points will be displayed in units of pixels.

c. [Coordinate] drop down list
Select "Distance X" or "Distance 2pt.".

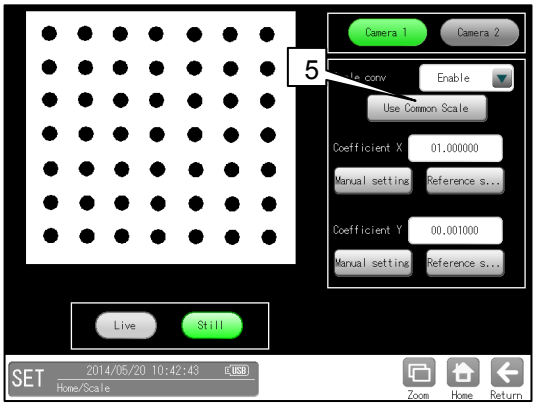
d. Start/End point [Coordinate select] buttons
Touch the [Coordinate select] button of [Start point] and [End point].



Select the module to be referenced and touch [Enter] icon, and the following window will appear.

Select the inspection result to be referenced from the combo box on the right and [Enter] icon.

5. [Use Common Scale] button
This button will appear when the following have been set:
(1) "Scale conversion" is "Enable".
(2) "Unit cell" is selected for the “Reference plate” on Home/Camera/Image distort correct screen
(3) "Share with all TYPEs" is "Enable" on Home/Camera/Image distort correct/ Mark array screen
See page 4-16.

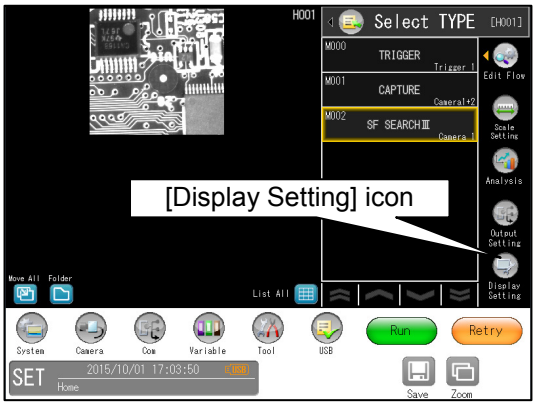


Touch this button to use the coefficient for image distortion correction for both the Coefficient X and Coefficient Y.

4-4-24 Display setting

You can customize the items to display on Run screen.
(The screens shown below are typical example)

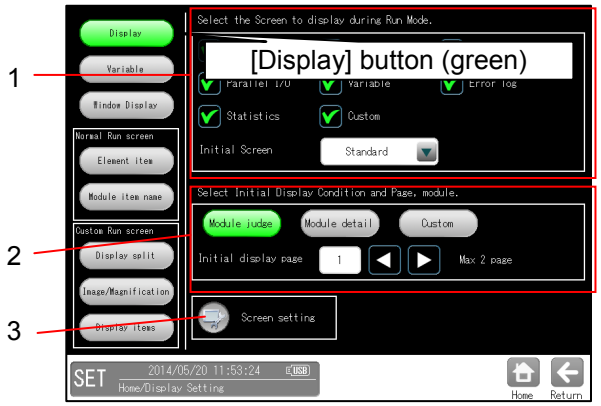
① Touch the [Display Setting] icon on the (Home) SET screen



② The Display setting window will appear.

The following items can be set on this screen:
“Display” and “Variable”
For Normal Run screen
“Window Display”, “Element item” and “Module item name”
For Custom Run screen
“Display split”, “Image/Magnification” and “Display items”

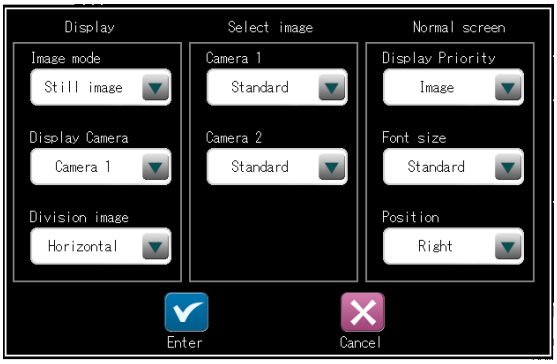
A. [Display] button



1. Select the screens to display during Run mode with the check boxes:
   “Standard”, “Module judge”, “Module detail”, “Parallel I/O”, “Variable”, “Error log”, “Statics”, or “Custom”.
   Also, select the initial screen to display in Run mode with the [Initial Screen] drop down list.

2. Select initial display condition, page and module and enter their page or module with the data input box or arrow buttons.
   (When “Module judge” button is selected)
   “Initial display page”: 1 – 2
   (When “Module detail” button is selected)
   “Initial display module”: 1 – 127
   (When “Custom” button is selected)
   “Initial display page”: 1 – 8

3. [Screen setting] icon
   Touch the icon to set “Display”, “Select image” and “Normal setting screen”.



● Display Setting

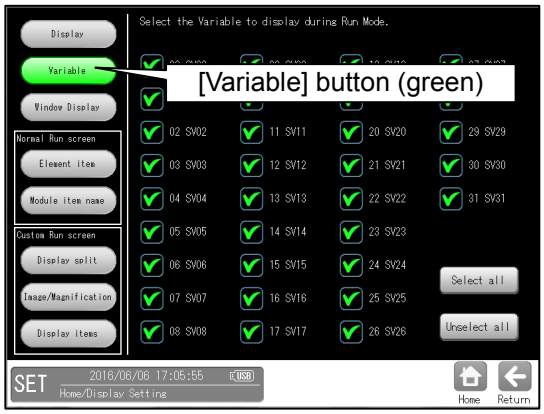
・[Image mode] drop down list
Select one from “Live image”, “Still image” and “Processed image”.
“Live”: Displays live image of the camera.
NOTE: Capture timing may delay against the trigger input or image process time may take longer.
“Still image”: Displays camera captured image.
“Processed image”: Displays processed image and binarized image.
NOTE: Image process time may take longer.

・ [Display camera] drop down list
Select one from “Camera 1”, “Camera 2” and “Camera 1+2”.
・ [Division image] drop down list
Select one from “Horizontal” and “Vertical”.

● Select image
・[Camera 1] drop down list
Select one from “Disable”, “All” and “Standard”.
・[Camera 2] drop down list
Select one from “Disable”, “All” and “Standard”.
“Disable”: Do not display an image.
“All”: Displays all the module areas.
“Standard”: Displays the module set by [Window Display] button on Home/Display setting.

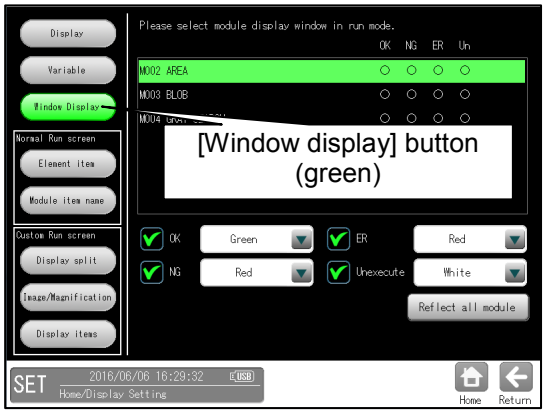
● Normal screen
・[Display priority] drop down list
Select one from “Image”, and “Message”.
・[Font size] drop down list
Select one from “Small”, “Standard” and “Large”.
・[Position] drop down list
Select one from “Right”, and “Bottom”.

B. [Variable] button



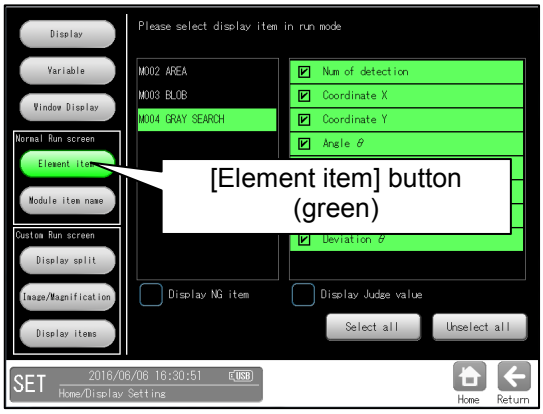
Select a variable number (SV00 –SV31) to d isplay during Run mode by touching the check box.

C. [Window display] button



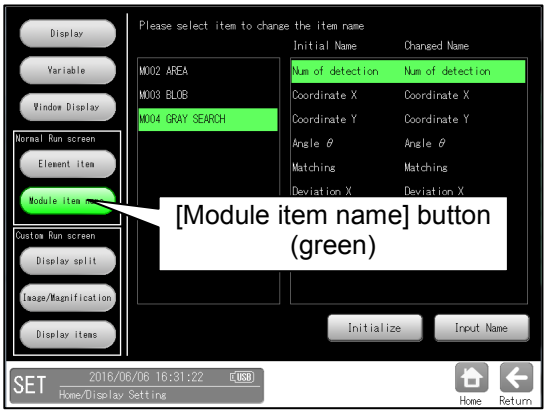
(When “Standard” is selected for “Camera 1” and “Camera 2” in the “Select image” window when touching “Screen setting” icon)
Select the frame color of each “OK”, “NG”, “ERR” and “Unexecute”.

D. [Element item] button



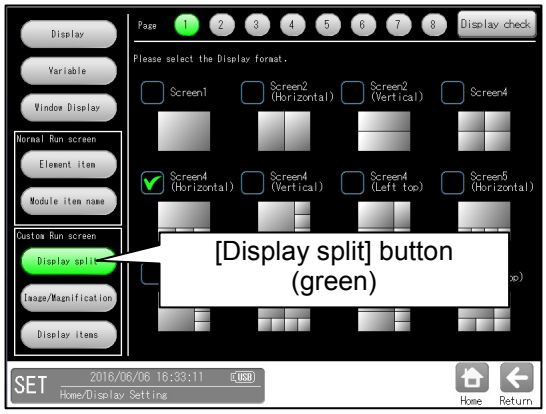
Select the inspection items to display on Run screen.
To display “NG item” and/or “Display judge Value”, touch the respective check box.

E. [Module item name] button



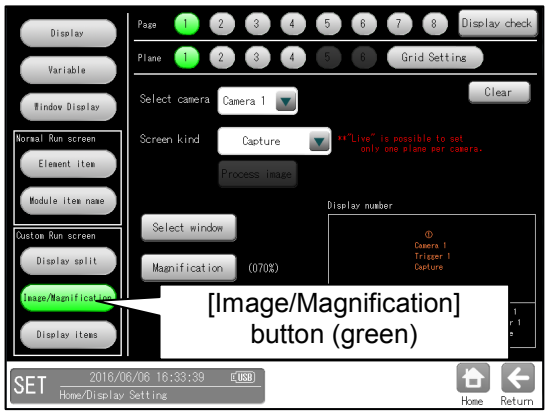
You can change the inspection item name on this screen.
Select the item, touch [Add name] button and enter new name with key board.
See page 4-26 for how to change a name.

F. [Display Sprit] button



You can change the split or division display of the screen.
Select the desired one with the check box.

G. [Image/Magnification] button

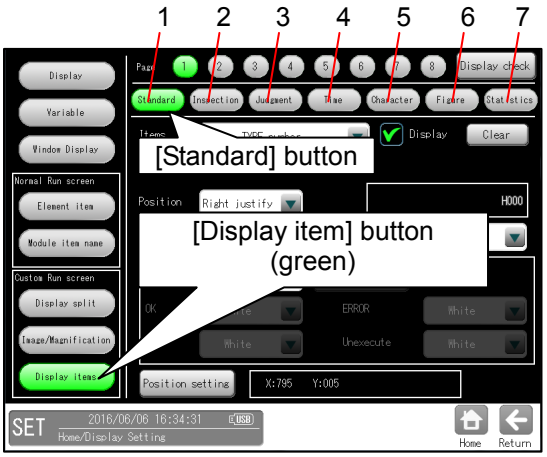


Select “Camera”, “Screen kind” and “Magnification”.

[Screen kind] drop down list
Select one from “None”, “Reference image”, “Captured image”, “Processed image”, “Live image”, NG (Latest)”, NG (2nd to 5th), OK (Latest)” and “OK (2nd to 5th),

- When “Capture” or “Processed” image is selected, touch [Select window] button and select a module.
- When “Processed” image is selected, touch [Process image] button and select process image.

H. [Display Item] button



There are 7 display items which you can change the setting:
“Standard”, “Inspection”, “Judgment”, “(Process) Time”, “Character”, “Figure” and “Statics”.

1. [Standard] button

Set the following:

[Item] drop down list:
Select one from “TYPE number”, “TYPE name”, “Total judgment”, “Total time”, “Number of inspection”, “Number of OKs”, “Number of NGs”, “OK rate”, “Number of NGs”, “OK rate”, “NG rate”, “Min inspection time” and “Max inspection time”.

[Position] drop down list
Select one from “Left adjust”, “Centering” and “Right adjust”.

[Size] drop down list
Select one from “Small”, “Middle”, “Large” and “Extra large”.

[Display format] drop down list
Select one from “Standard”, “Framed” and “Inverted”.

[Color] drop down list
Select one from “Judge-related”, “Yellow”, “Green”, “Red”, “White”, “Orange”, “Black”, “Blue”, “Pink”, “Cyan” and “None”.
(When “Judge-related” is selected, touch “Interlocking module” button and select a module and also set the color for “OK”, “NG”, “ERROR” and “Unexecute” from the respective drop down list.

[Position setting] button
You can change the display position of the selected item with the 4 arrow keys.

2. **[Inspection] button**
Set the following:

[Register Number] data input box
Enter the register number. (0 – 31)

[Inspection item] button
Select the inspection item.

[Position] drop down list
[Size] drop down list
[Display format] drop down list
[Color] drop down list
[Position setting] button
See each item in above 1. [Standard] button in the previous page.

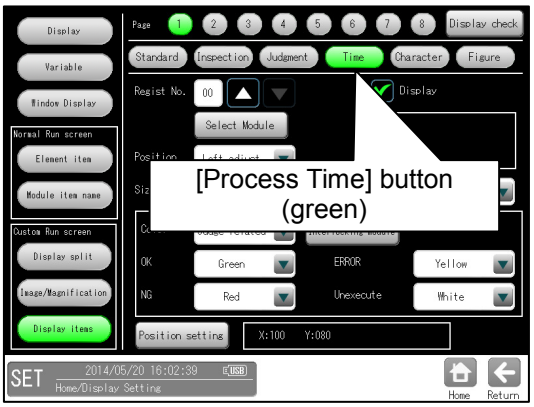
3. **[Judgment] button**
Set the following:

[Register Number] data input box
Enter the register number. (0 – 31)

[Judgment] button
Select the judgment item.

[Position] drop down list
[Size] drop down list
[Display format] drop down list
[Color] drop down list
[Position setting] button
See each item in above 1. [Standard] button in the previous page.

4. **[(Process) Time] button** Set the following:

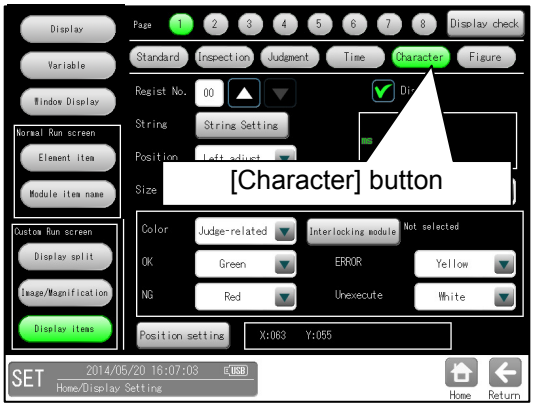


[Register Number] data input box
Enter the register number. (0 – 31)

[Select module] button
Select the module.

[Position] drop down list
[Size] drop down list
[Display format] drop down list
[Color] drop down list
[Position setting] button
See each item in above 1. [Standard] button in the previous page.

5. **[Character] button**
Set the following:

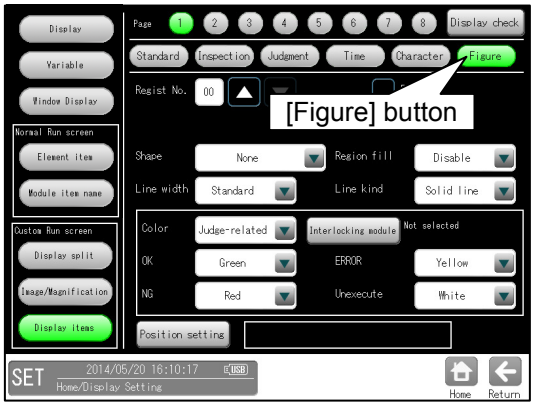


[Register Number] data input box
Enter the register number. (0 – 31)

[String Setting] button
Set the string.

[Position] drop down list
[Size] drop down list
[Display format] drop down list
[Color] drop down list
[Position setting] button
See each item in above 1. [Standard] button in the previous page.

6. [Figure] button
Set the following:



[Register Number] data input box
Enter the register number. (0 – 31)

[Shape] drop down list
Select one from “Standard”, “Double”, and “Triple”.

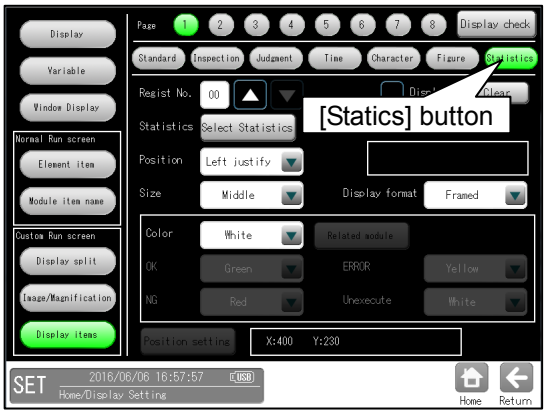
[Line width] drop down list
Select one from “None”, “Line”, “Cross (small)”, “Cross (large)”, “Rectangle”, “Circle” and “Ellipse”.

[Region fill] drop down list
Select one from “Disable” and “Enable”.

[Line kind] drop down list
Select one from “Solid line”, “Dot line”, “Broken line” and “Chain line”.

[Color] drop down list
[Position setting] button
See each item in above 1. [Standard] button in page 4-243.

7. [Statics] button
Set the following:



[Register Number] data input box
Enter the register number. (0 – 31)

[Select Statics] button
Select one from the combo box.

[Position] drop down list
Select one from “Left justify”, “Centering” and “Right justify”.

[Size] drop down list
Select one from “Small”, “Middle”, “Large” and “Extra large”.

[Display format] drop down list
Select one from “Standard”, “Framed” and “Ivert”.

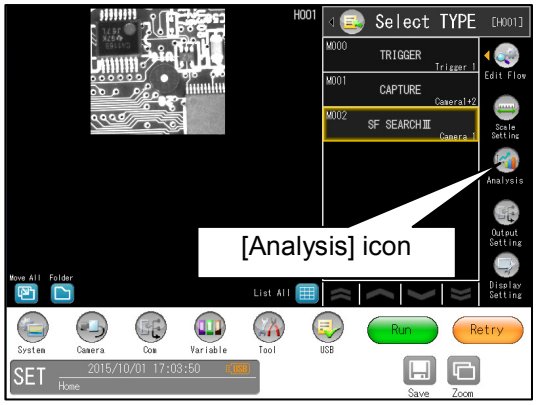
[Color] drop down list
[Position setting] button
See each item in above 1. [Standard] button in page 4-243.

4-4-25 Analysis

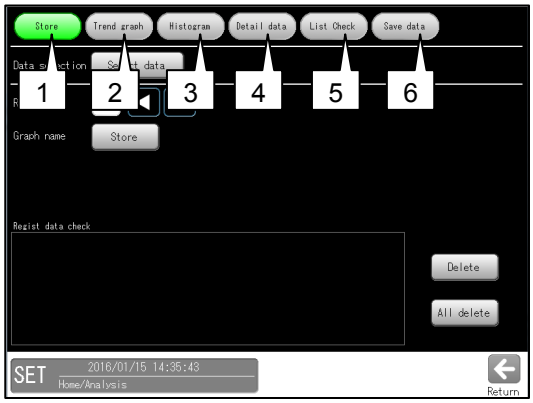
This function allows you to check the statistical data.
You can adjust the upper and lower limits of judgment criteria while checking the real time graph that is displayed on the screen during operation.
You can also check retry of NG result.
(The screens shown below are typical example)

[1] Setting of statistical analysis

① Touch the [Analysis] icon on the (Home) SET screen.



② The Analysis setting screen will appear.



Touch the appropriate button.
The currently selected item button is displayed in green.

- Store=> [1]
- Trend graph => [2]
- Histogram => [3]
- Detail data => [4]
- List check => [5]
- Save data => [6]

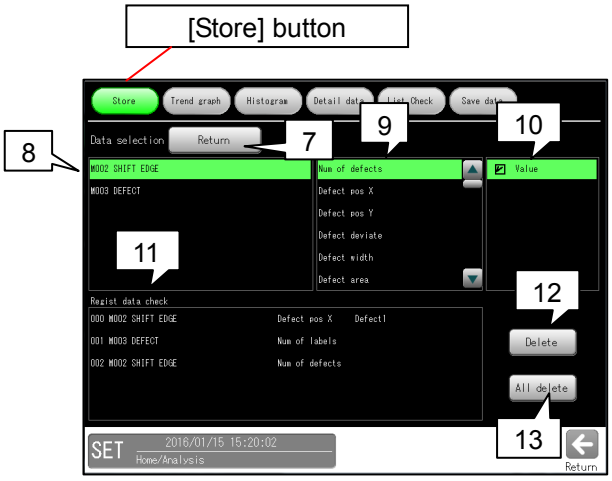
(1) [Store] button

Touch this button to display the Store screen.
The screen is used to save the inspection items for statistical analysis.
The saved inspection items can be deleted.

1. **[Select data] button**
   Touch this button to select the module and the output for statistical analysis.
   See next page.
   The selected items are displayed in the “Regist data check” frame. (See item 4 below)
2. **[Regist No] data input box**
   Enter the number of the registration number to which you are going to do the analysis.
   You can use arrow keys to select the number.
   The selected item is displayed on the right of the arrow keys.
3. **[Graph name] button**
   Touch this button and assign a name to the Regist No. with the key board displayed.
   The name will be displayed on the right of the button.
4. **Registered data check display**
   The registered data are displayed in here.
5. **[Delete] button**
   Touch this button to delete selected registered data.
6. **[All Delete] button**
   Touch this button to delete all the registered data.

■ **Statistical Data Select Screen**

Touch [Select data] button and the following screen will appear.



7. [Return] button

Touch this button to return to Analysis setting screen.

8. Module list

Select the module to register for statistical analysis.

9. Inspection item list

Select the inspection item to register for statistical analysis.

10. Inspection sub-item list

Select the inspection sub-item to register for statistical analysis.

The check box on the left of the selected sub-item will have check mark and highlighted in green.

11. Registered data check display

The registered data are displayed in here.

12. [Delete] button

Touch this button to delete selected registered data.

13. [All Delete] button

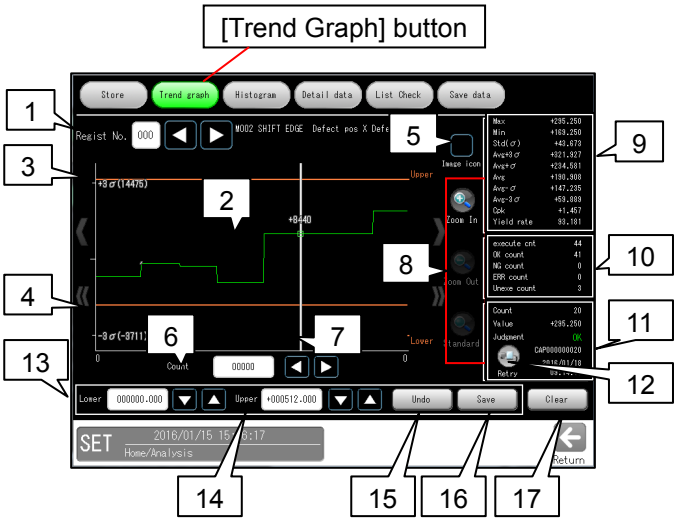
T ouch this button to delete all the registered data.

(2) [Trend graph] button

Touch this button to display the Trend graph screen.

The screen is used to display the trend graph of the registered inspection item.

You can change the upper and lower limits of the judgment criteria for the inspection item and retry with the new setting.



1. [Regist No] data input box

Enter the number of the registration number to which you are going to do the analysis.

You can use arrow keys to select the number.

The selected item is displayed on the right of the arrow keys.

2. Trend graph display

The trend graph of the selected registration number is displayed.

3. Upper limit bar

The upper limit of the selected registration number is displayed on the graph.

4. Lowest limit bar

The lowest limit of the selected registration number is displayed on the graph.

5. [Image icon] check box

Check this box to display data points on the graph.

6. [Count] data input box

Enter the data in interest (data at Nth count).

You can also use the arrow keys on the right of the box for the selection.

7. Data point selection cursor

Select the data point in interest (data at Nth count) by clicking on the screen.

The selected data is displayed and the number (Nth) is displayed in the [Count] data input box.

When the image of the selected data exists, the square mark at the cross point turns green.

8. [Zoom In/Zoom Out/Standard] icons

Touch this icon change the display around the selected data point in zoom in, zoom out or standard mode.

When Standard is selected, maximum 480 data can be displayed.

9. Statistical data display

The statistical data as follows from the saved data are displayed.

Note:

The data remain unchanged even if changed the upper and lower limits for the criteria.

[Statistical data]

Max:	Maximum of the inspected data
Min:	Minimum of the inspected data
Std(σ):	Standard deviation of the inspected data
Avg+3σ :	Average + 3σ
Avg+σ :	Average + σ
Avg:	Average
Avg-σ :	Average - σ
Avg-3σ :	Average - 3σ
Cpk:	Process capability index This is calculated based on the upper/lower limits.

Yield rate:

[Conditions for calculating Statistical data]

All the items except Yield rate in the above are calculated based on OK/NG judgment results.

For the Yield, the following formula is used:

Yield rate =

Number of OKs/Number of inspections

10. Count of Inspection display

The counts of executed/OK/NG/un executed of the saved data are displayed.

11. Data point information display

The information of the selected data point is displayed:

- Count,
- Value
- Judgment result
- Registration number (when an image exits)
- Date and Time stamp.

12. [Retry] icon

Touching this icon brings the screen to:

In setting mode: Retry screen.

In run mode: Image memory screen.

13 and 14. [Lower/Upper] data input boxes

Enter the lower and upper limits for judgment criteria.

- When changed these values in run mode, they are reflected in the inspection result. To memorize the new setting, touch 16. [Save] button on the setting screen.

15. [Undo] button

Touch this button to cancel the lower and upper limits entered before touching 16. [Save] button.

16. [Save] button

Touch this button to save the lower and upper limits entered.

17. [Clear] button

Touch this button to clear all the statistical data saved in the memory of this device.

Note:

The inspection items saved are not cleared.

(3) [Histogram] button

Touch this button to display the Histogram screen. The screen displays the histogram of the registered inspection data.

You can change the upper and lower limits of the judgment criteria for the inspection item and retry with the new setting.

1. [Regist No] data input box

Enter the number of the registration number to which you are going to do the analysis.

You can use arrow keys to select the number. The selected item is displayed on the right of the arrow keys.

2. Histogram

The histogram of the inspection result of the selected registration number is displayed.

3. and 4. Lower/Upper limit display

The lower/upper limits are displayed on the histogram.

5. Bar graph selection cursor

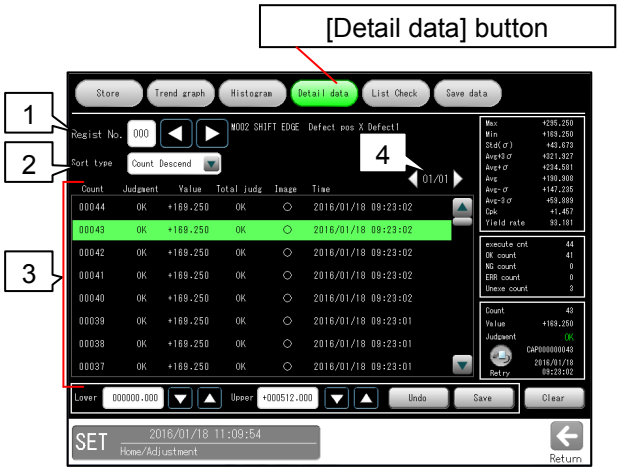
Select the bar graph in interest by clicking on the screen.

The data range and the number of data are displayed.

6. **[Cursor] data input box**
   Enter the number of the data within the selected bar graph to check the data point information.
7. **[Image icon] check box**
   Check this box to display the information of the histogram.
   - Gray ☐ is displayed at the foot of the bar graph when an image is saved.
   - Green ☐ is displayed when the judgment result was OK.

(4) [Detail data] button

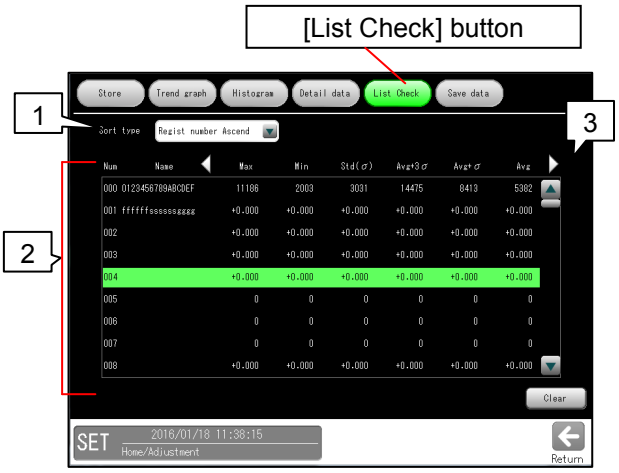
Touch this button to display the Detail data screen.
The screen displays the judgment result, inspected value, total judgment, existence of an image and date and time stamp.
You can change the upper and lower limits of the judgment criteria for the inspection item and retry with the new setting.



1. **[Regist No] data input box**
   Enter the number of the registration number to which you are going to do the analysis.
   You can use arrow keys to select the number.
   The selected item is displayed on the right of the arrow keys.
2. **[Sort type] drop down list**
   Select one from the following for data list display order:
   Count Ascend/ Descend,
   Value Ascend/Descend,
   Judge Ascend/Descend.
3. **Data list display**
   The inspection data saved are displayed.
   ○ is displayed under Image column when an image is saved.
4. **[Page change] buttons**
   Touch the arrow key to access another page of the data list.
   Maximum 1024 inspection result can be displayed on 1 page.

(5) [List Check] button

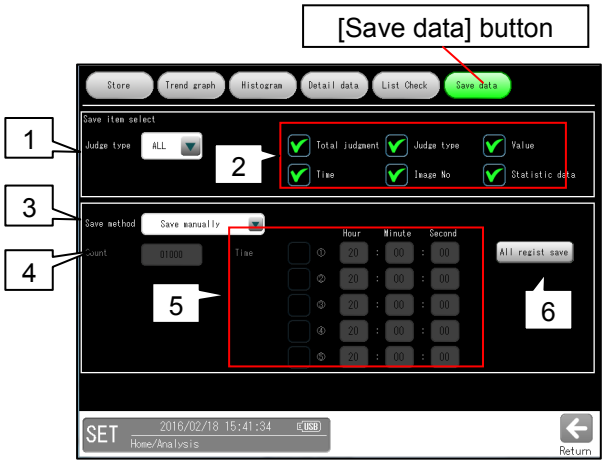
Touch this button to display the List check screen.
The screen displays the statistical data of all the registered inspection data.



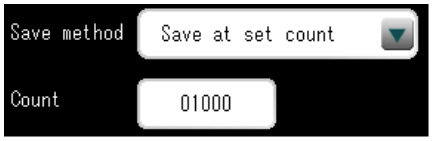
1. **[Sort type] drop down list**
   Select one from the following for data list display order:
   Regsit number Ascend/Descend
   Yield rage Ascend/Descend
   Cpk Ascend/Descend
   OK count Ascend/Descend
   NG count Ascend/Descend
   Unexecution Ascend/Descend
   Maximum value Ascend/Descend
   Minimum value Ascend/Descend
   Standard value Ascend/Descend
   Average + 3 σ Ascend/Descend
   Average + σ Ascend/Descend
   Average Ascend/Descend
   Average - σ Ascend/Descend
   Average - 3 σ Ascend/Descend
2. **Data list display**
   The statistical data of the registered inspection items are displayed.
3. **[Page change] buttons**
   Touch the arrow key to access another page of the data list.

(6) [Save data] button

Touch this button to display the Save data screen
The screen is used to set save item and storage kind or type.

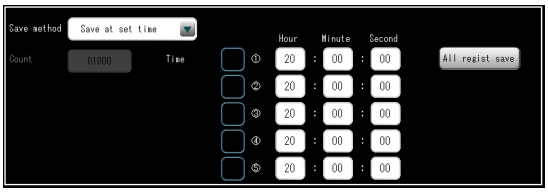


1. **[Judge type] drop down list**
   Select judgment type from the following to the inspection data of the device into USB flash drive:
   All, OK, NG, OK+NG, Error and Unexecuted.
2. **Save item check boxes**
   Check the boxes for the items to save data into USB flash drive:
   Total judgment, Each judge, Value, Time, Image No. and Statistical data.
3. **[Save method] drop down list**
   Select the save method to save data into USB flash drive:
   - Save manually:
     Select this to manually save by touching 6. [All regist save] button.
   - Save at set count:
     The data is saved into USB flash drive at the set count of inspections.
     (The Save manually is effective even when this is set)
   - Save at set time:
     The data is saved into USB flash drive at the set time.
     (The Save manually is effective even when this is set)
4. **[Count] data input box**
   (When "Save at set count" is selected)
   Enter a count within 1 to 20,000.



5. **[Time] check boxes and data input boxes (When "Save at set time" is selected)**

   Enter the time to save and check the check box of the corresponding setting.
   Maximum 5 time can be set.



6. **[All regist save] button**
   Touching this button saves all the registered items into USB flash drive.

[Cautions in saving data into USB flash drive]

- The file name format for save will become:
  Saved date _ saved time_analysis_data_object type_Resistered number.csv
- The date and time basis on master time of the controller.
- When "Save at set time" is selected for "Save method", there may be a case the time of the file differs from that of the controller when it requires much time for the saving.
- For second and on saving into USB flash drive, only the data that have not been saved will be saved.
- When 2 or more set time are set for "Save at set time" and the second set time comes while the data is saved for the first set time, no data will be saved for the second set time.

[2] Operation of statistical analysis

Each timing for statistical data, etc. are described in this section.

(1) Clear timing of statistical data

The data are cleared at the following timing:

1. When the power to the controller is turned off.
2. [Count Clear] button is touched on Run screen.
3. [Clear] button is touched on (Home) setting/Tool/Statistics screen.
4. When module flow is edited.
5. When inspection item of a module is changed.
6. When number of inspection of a module is changed.
7. When object type is changed.
   (The trigger of which object type has been changed is cleared)
8. When the module flow is changed.

(2) Save timing of statistical data

The data are stored at the following timing:

1. After finished inspection in Run mode.

(3) Not saved timing of statistical data

The data are not stored at the following timing:

1. When changed object type.
2. Clear timing of statistical data.
3. When Retrying.
4. When saving statistical data to USB flash drive.
5. When No update is selected in Run/Analysis screen.
   Note:
   Update will be resumed when returned to Run screen.

(4) Number of statistical data to be saved

1. The statistical data are saved for each Trigger separately.
   Therefore, it is necessary to clear the data for each trigger when 2 Trigger mode is selected.
2. Maximum 128 inspection items data can be saved for a trigger.
3. Maximum 20,000 data can be saved for an inspection item.
4. When exceeded the 20,000 data, the older data are overwritten with the new ones.

(5) Calculation of statistical data

The statistical data is calculated based on the saved inspection results.

(6) [Update/No update] button

Either “Update” or “No update button will appear when [Analysis] icon is touched on Run screen.

1. **[No update] button**
   Touch this button to stop saving data for Analysis and saving to Image memory.
   Note:
   The data saving will be resumed when the screen changes to Run screen.

2. **[Update] button**
   Touch this button to resume saving data for Analysis and saving to Image memory.

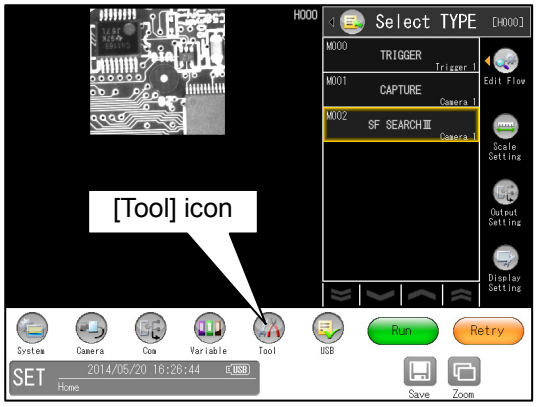
4-5 Tool settings

You can check communication, the logs of inspections, errors, and communication, and monitor images on a connected PC using this function.

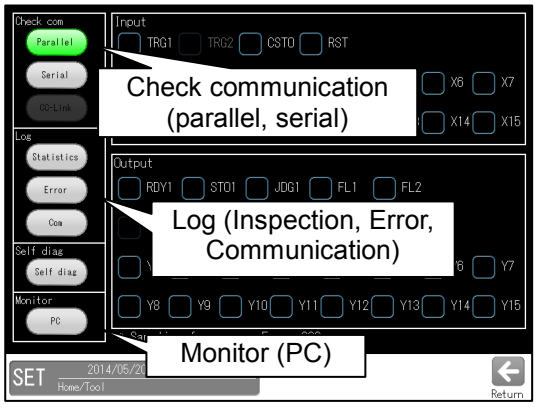
- **Communication**
  - Parallel I/F connection
  - Serial communication
  - CC-Link communication (When CC-Link is set)
- **Log**
  - Statistic (Inspection) log
  - Error log
  - Communication log
- **Monitor**
  - PC

(The screens shown below are typical example)

① Touch the [Tool] icon on the (Home) SET screen.

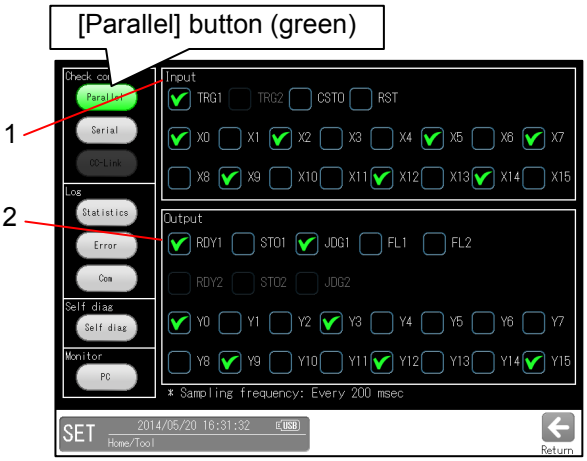


② The Tool setting screen will appear.



Touch the button of an item (such as [Parallel]) you want to check, and the check screen of the respective item will appear. The currently selected item button is displayed in green. => (1) to (8) below

[1] [Parallel] (communication) button



1. [Input] check boxes

Each check box shows the present status.

ON: ☑ OFF: ☐

2. [Output] check boxes

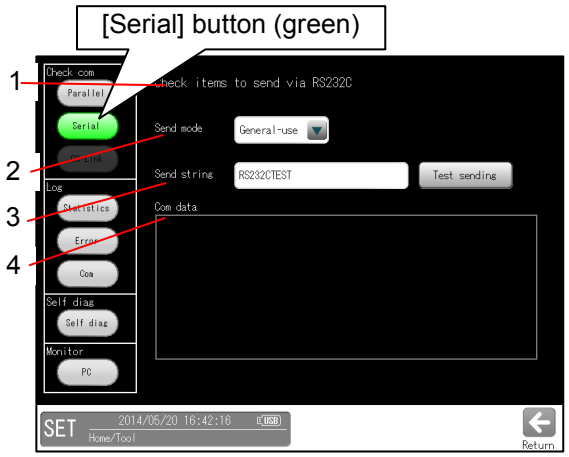
Each check box shows the present status.

ON: ☑ OFF: ☐

- To change the setting of output, touch the respective check box to show ☐ for off or ☑ for on.
-

The input and Parallel output are renewed every 200 ms while this screen is displayed.

[2] [Serial] (communication) button



1. **Communication protocol**: RS-232C

2. **[Send mode] drop down list**:
   Select one from "General use" or "PLC".
   When "PLC" is selected," the device communicates with the "PLC" by the setting made in 4-2-3 (4).

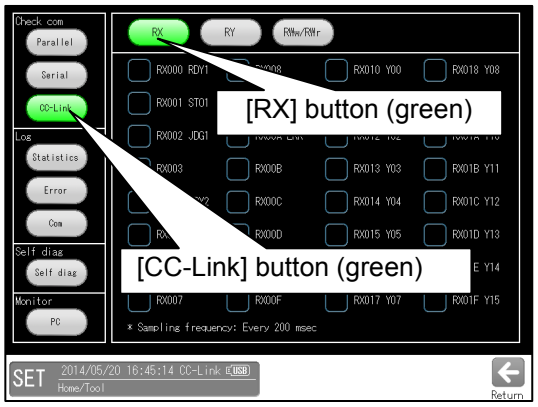
3. **[Send string] data input box:**
   Touch the button and a number keypad will appear. Enter character strings to send in here.
   Touch the [Test sending] button to send the entered strings.

4. **[Communication data] display area**:
   The sent string communication results will be displayed.

[3] [CC-Link] button

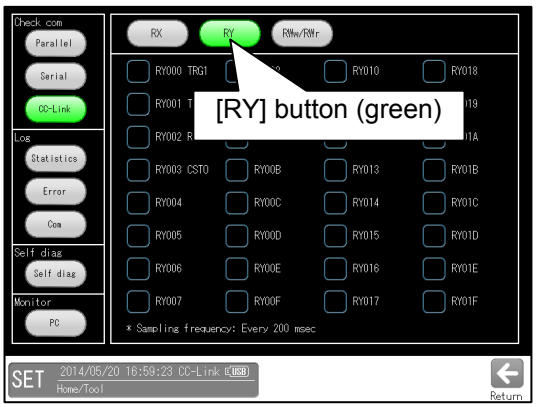
When "PLC" is selected," the device communicates with the "PLC" by the setting made in Section 4-2-3 (4).

・When [RX] button is selected



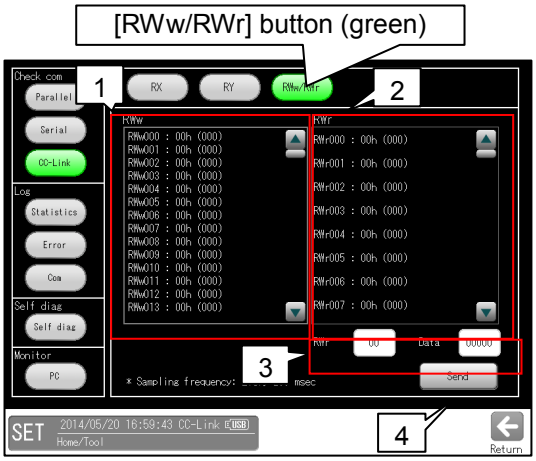
Each check box shows the present status of Remote input/output RX bit:.
ON: ☑ OFF: ☐

・When [RY] button is selected



Each check box shows the present status of Remote input/output RY bit:.
ON: ☑ OFF: ☐

・When [RWw/RWr] button is selected



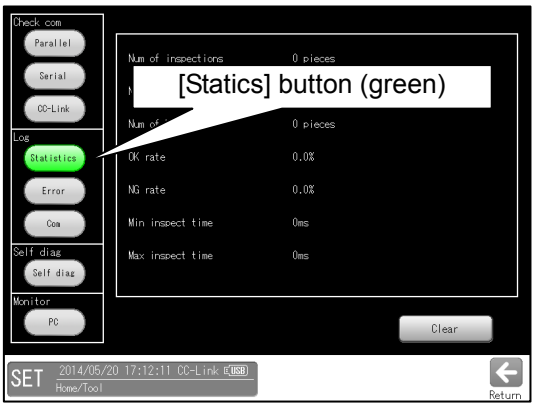
1. **RWw:**
   Displays data of each address of Remote register RWw.

2. **RWr:**
   Displays data of each address of Remote register RWr.

3. **[RWr] and [Data] data input boxes:**
   Used to set address (0 -32) of remote register RWr and data (0 – 255).

4. **[Send] button:**
   Used to send the address and data set by RWr / Data data input boxes.

[4] [Statistic] (Log) button

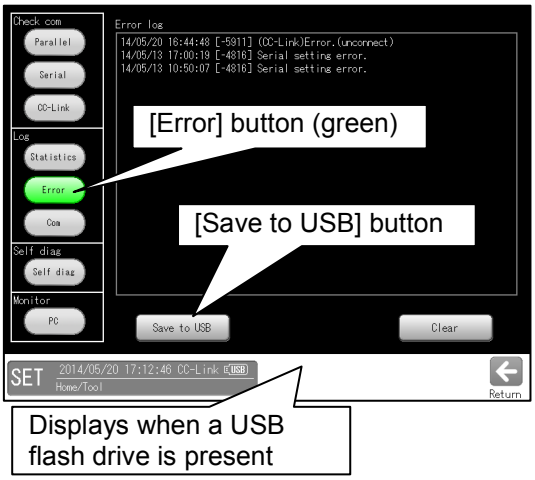


The following data will be displayed on the screen:

- Number of inspections
- Number of OKs
- Number of NGs
- OK rate
- NG rate
- Minimum inspection time
- Maximum inspection time

[5] [Error] (Log) button

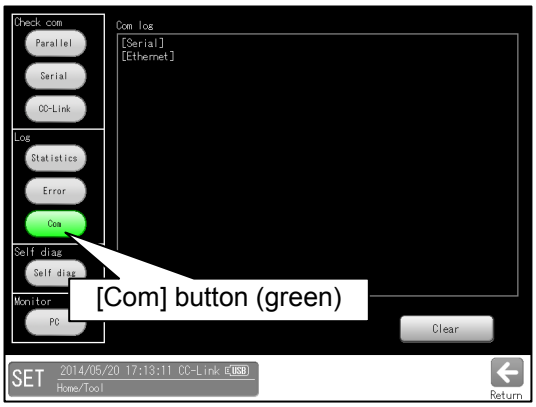
The error log will be displayed.
The error log can be saved to a USB memory.
Be sure to connect a USB flash drive to the USB port of the device.



Touch the button and the screen displays the error logs.

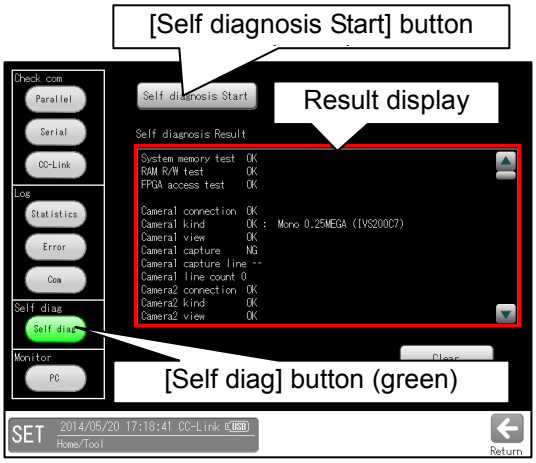
- Touch the [Save to USB] button to store the logs in a USB flash drive.
  Saved file: ¥ivs300m¥errlog.txt

[6] [Com] (communication) (Log) button



The communication logs of serial and Ethernet communications will be displayed.

[7] [Self diagnosis Start] button



Touch the button and the self diagnosis will be executed and the following results (“OK” or “NG”) are displayed.

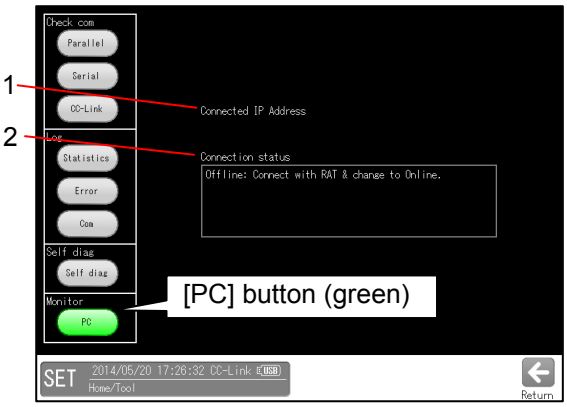
1. System memory test
2. RAM R/W test
3. FPGA access test
4. Camera 1 test
   (connection/kind/view/capture/capture line/line count)
5. Camera 2 test
   (connection/kind/view/capture/capture line/line count)

[NOTE]
In case of Camera connection test, if a camera is not connected, it will result in “NG”.
Be sure to check the connection carefully.

If one of the results is “NG”, please consult our dealer.

[8] [PC] button (support tool)

The information of the PC Remote Access tool is displayed.



1. Connected IP address:
   IP address of the connected device is displayed.

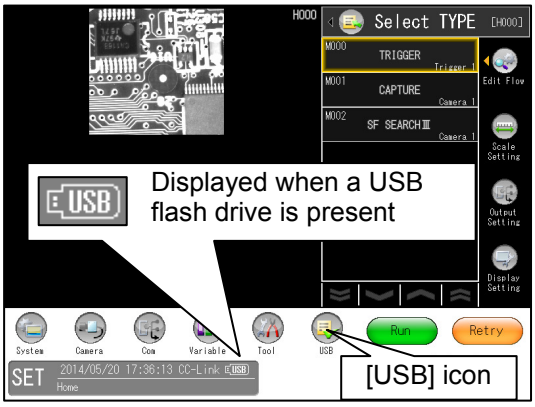
2. Connection status:
   This screen appears automatically when the Design Support software, IV-S300SPM, is connected with this device online and the IP address is displayed.

4-6 USB (file operation)

Be sure to connect a USB flash drive to the USB port of this device before using this function.

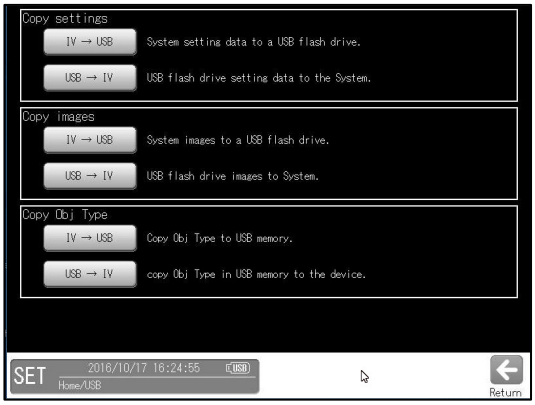
Setting data and stored images can be copied between the device and a USB flash drive.
(The screens shown below are typical example)

① Touch the [USB] icon on the (Home) SET screen.



② The screen to copy data between the system (IV) and the USB flash drive (USB) will appear.

Touch the [IV -> USB] or [USB -> IV] button to copy setting data or images of IV to USB or USB to IV, respectively.



- **[Copy settings] buttons**
  "IV -> USB", "USB -> IV" => [1]
- **[Copy image] buttons**
  "IV -> USB", "USB -> IV" => [2]
- **[Copy Obj Type] buttons**
  "IV -> USB", "USB -> IV" => [3]

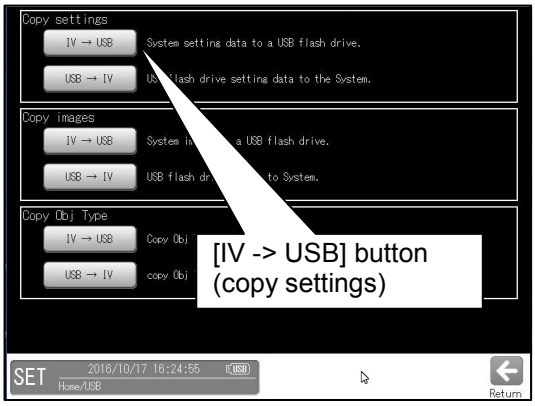
[1] [Copy settings] select buttons

Copy the setting data from the system (IV) to a USB flash drive (USB) or from the USB to IV.

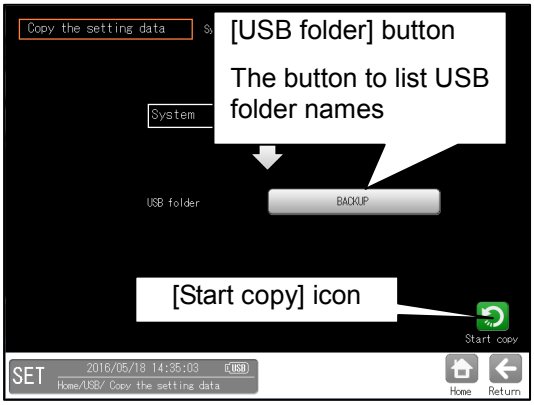
(1) [IV -> USB] button

Copy the setting data in the IV (system) to the USB flash drive.

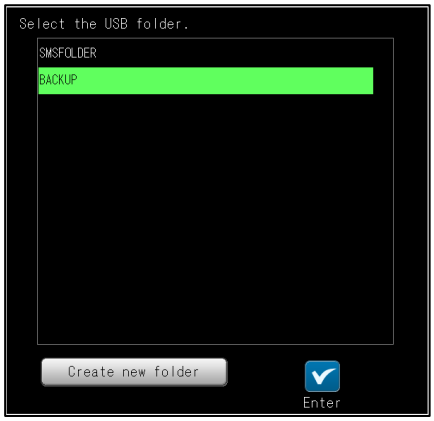
① Touch the [IV -> USB] button.



② The setting data copy (IV -> USB) screen will appear.



1. Touch the [USB folder] button and a window that lists the folder names in the USB flash drive will appear.
2. Select a folder name (touch the folder name to make it green) and touch the [Enter] icon. You may be able to create a new folder with [Create new folder] button, if necessary.



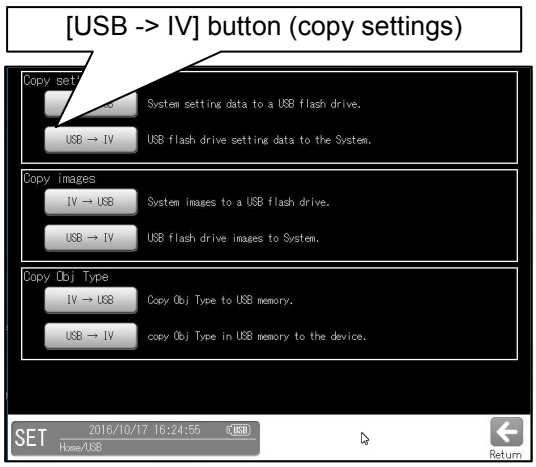
3. Touch the [Start copy] icon to start copying the setting data.

When the data already exist in the USB flash drive, overwrite confirmation window will appear.
Touch the ☑[Yes] icon to overwrite.

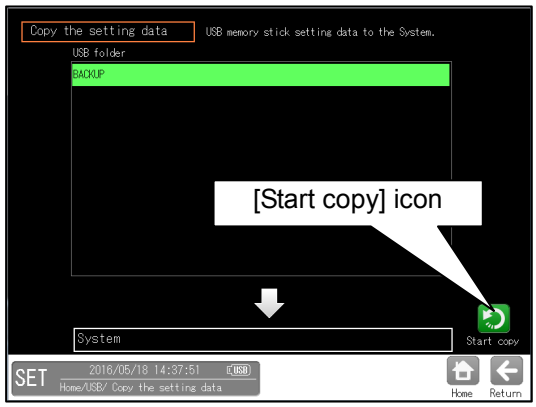
(2) [USB->IV] button

Copy the setting data in the USB flash drive (USB) to the system (IV).

① Touch the [USB -> IV] button.



② The setting data screen will appear.



1. Touch one of the folder names in the USB flash drive to copy.
2. Touch the [Start copy] icon to start copying the setting data from the USB flash drive to the system (IV).

   Copy confirmation window will appear.
   Touch the ☑[Yes] icon to copy.
   Note: The system will reboot after copying.

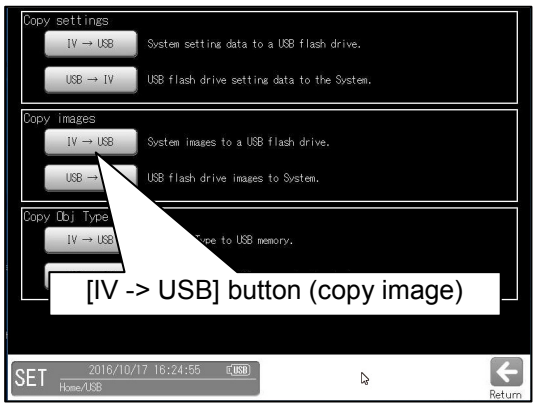
[2] [Copy image] select buttons

Copy the stored images from the system (IV) to a USB flash drive (USB) or from the USB to IV.

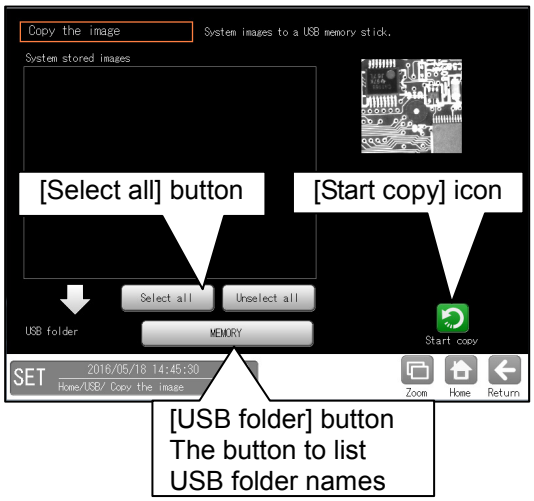
(1) [IV -> USB] button

Copy the stored image in the system (IV) to the USB flash drive.

① Touch the [IV -> USB] button.



② The setting screen will appear.

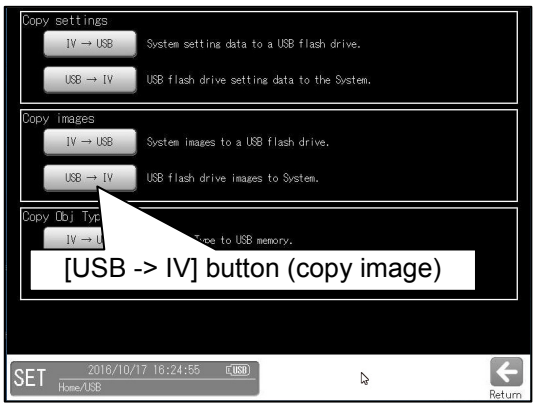


1. The image data in the system (IV) are listed.
2. Select images (touch the image data name to make it green) to copy to the USB flash drive from the [System stored images] combo box. If you want to copy all the image data, touch the [Select all] button. To unselect all the image data, touch the [Unselect all] button.
3. Touch the [USB folder] button and the screen that lists the folder names in the USB flash drive will appear.
4. Touch a folder name and then touch the ☑ [Enter] icon.
   You may be able to create a new folder with [Create new folder] button, if necessary.
5. Touch the [Start copy] icon to start copying the image data.

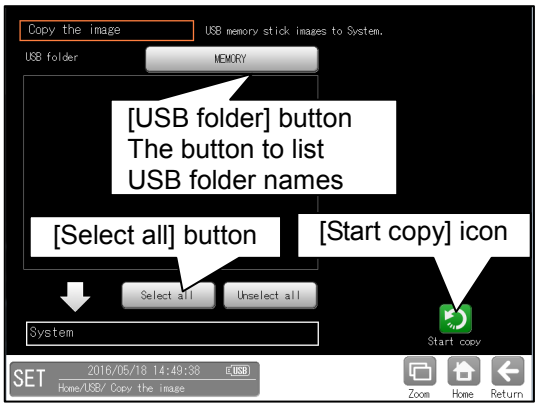
(2) [USB -> IV] button

Copy the stored images in the USB flash drive to the system (IV).

① Touch the [USB -> IV] button.



②The setting screen will appear.



1. Touch the [USB folder] button and a window that lists the folder names in the USB flash drive will appear.
2. Select a folder (touch the folder name to make it green) in which the images to copy are contained and touch the ☑ [Enter] icon.
3. Select images (touch the image list line to make it green) to copy to the system (IV) from the [USB folder] combo box. If you want to copy all the image data, touch the [Select all] button. To unselect all the image data, touch the [Unselect all] button.
4. Touch the [Start copy] icon to start copying the image data.

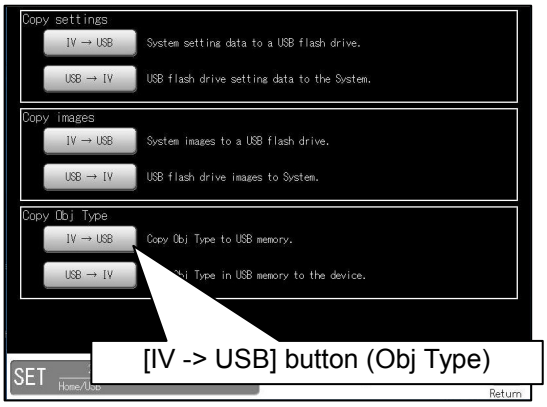
[3] [Copy Obj Type] select buttons

Copy the selected object type from the system (IV) to a USB flash drive (USB) or from the USB to IV.

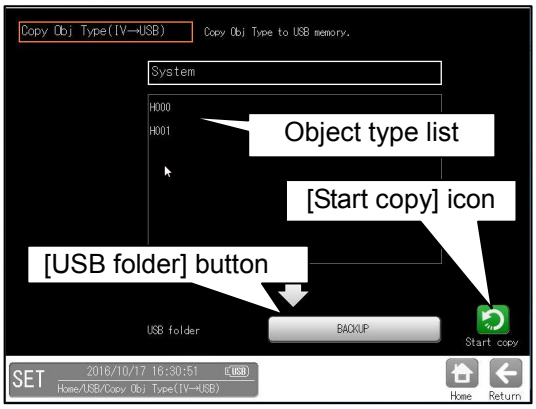
(1) [IV -> USB] button

Copy the selected object type in the system (IV) to the USB flash drive.

① Touch the [IV -> USB] button.



② The setting screen will appear.



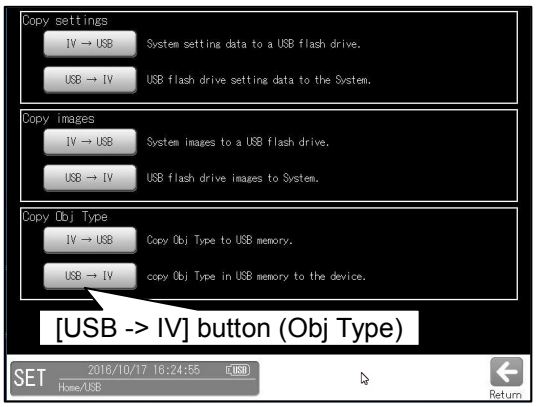
1. The object types in the system (IV) are listed. Select the object type (touch the object type to make it green) to copy to the USB flash drive.
2. Touch the [USB folder] button and a window that lists the folder names in the USB flash drive will appear.
3. Touch a folder name and then touch the ☑ [Enter] icon.
   You may be able to create a new folder with [Create new folder] button, if necessary.
4. Touch the [Start copy] icon to start copying the image data.

   When the data already exist in the USB flash drive, overwrite confirmation window will appear.
   Touch the ☑[Yes] icon to overwrite.

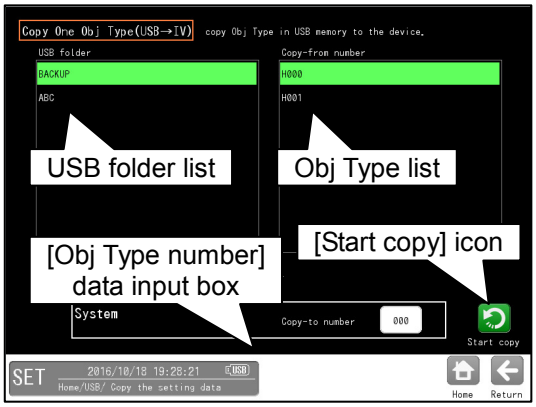
(2) [USB -> IV] button

Copy the selected object type in the USB flash drive to the system (IV).

① Touch the [USB -> IV] button.



②The setting screen will appear.



1. USB folder names and object type numbers of the selected folder are displayed.
2. Select a folder (touch the folder name to make it green) in which the object type to copy is contained and select the object type (touch the object type to make it green).
   You may be able to change the object type number with the [Obj Type number] data input box
3. Touch the [Start copy] icon to start copying the selected object type.

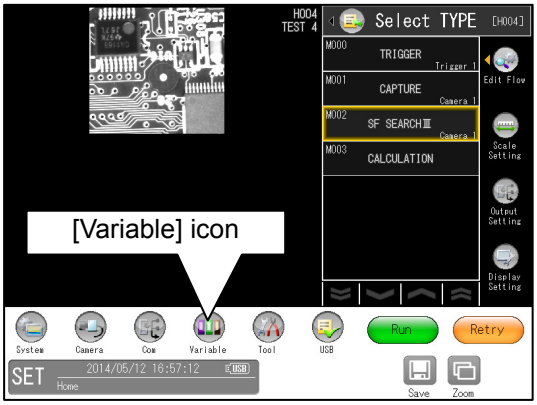
   Copy confirmation window will appear.
   Touch the ☑[Yes] icon to copy.
   Note: The system will reboot after copying.

4-7 Variable Setting

Variable is used in CALCULATION module.
This section describes how to set the variable.

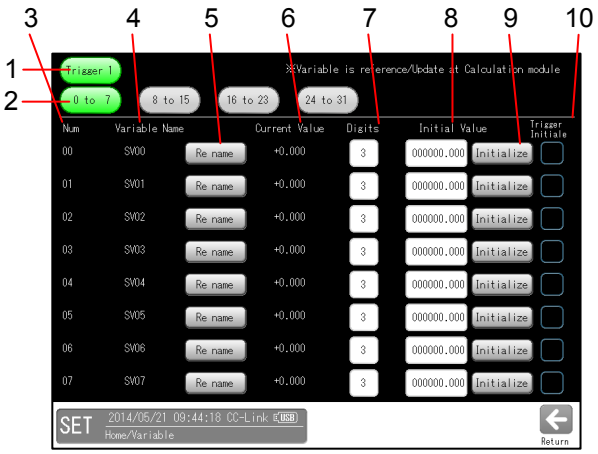
(The screens shown below are typical example)

① Touch the [Variable] icon on the (Home) SET screen.

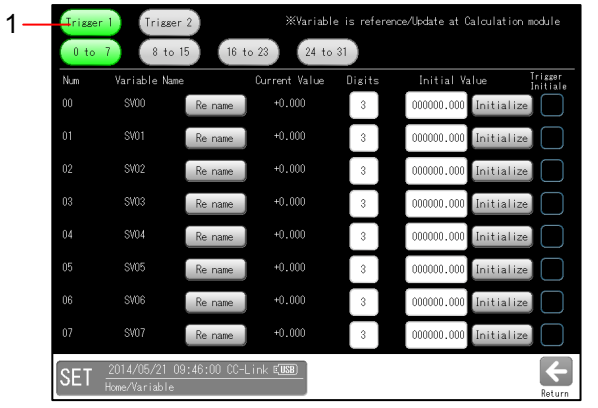


Variable Setting screen will appear.

・When 1 Trigger mode is selected



・When 2 Trigger mode is selected



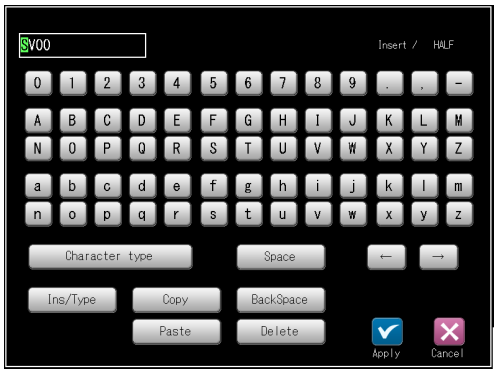
1. **[Trigger 1] / [Trigger 2] button**
   When 1 Trigger mode is selected, [Trigger 2] Button does not appear.

2. **[0 to 7] / [8 to 15] / [16 to 23] / [24 to 31] buttons**
   Used to select a variable number.

3. **Number**
   Displays a number.

4. **Variable Name**
   Displays a variable number

5. **[Rename] button**
   Used to rename a variable name.
   Keyboard will appear when the button is touched.



See page 4-26 for renaming procedure.

6. **Current Value**
   Displays current value of a variable.

7. **[Digits] data input box**
   Used to set digit below decimal point (0 – 7) of a variable.

8. **[Initial Value] data input box**
   Used to enter the initial value (-999999.999 - 999999.999) of a variable.

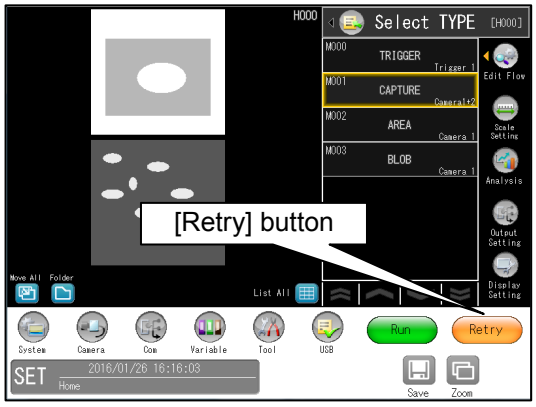
9. **[Initialize] button**
   Touch this button to set the Initial Value entered in above 8.

10. **[Trigger Initialize] check box**
    When this check box is checked, the variable becomes the Initial Value set in above 8 upon trigger input.

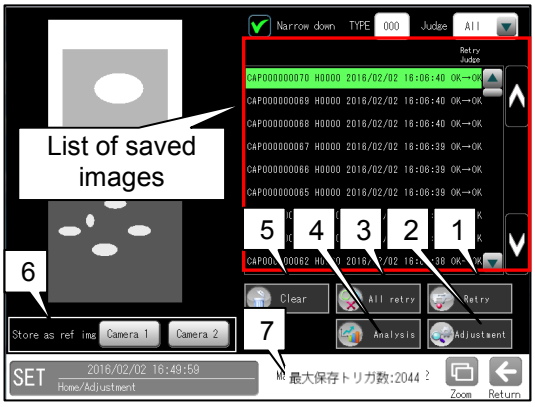
4-8 Retry (Adjustment of saved image)

There is a case you want to make an image judged "NG" or "ERR" as "OK" or vice versa, for instance.
You can adjust the settings by utilizing the saved image.
(The screens shown below are typical example)

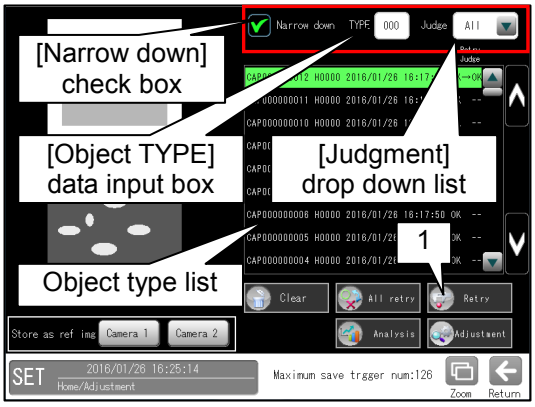
① Touch the [Retry] button on the (Home) SET screen,



② The saved image selection screen will appear.
Select the desired image from the combo box and touch [Retry] icon.
The selected image is displayed on the left.

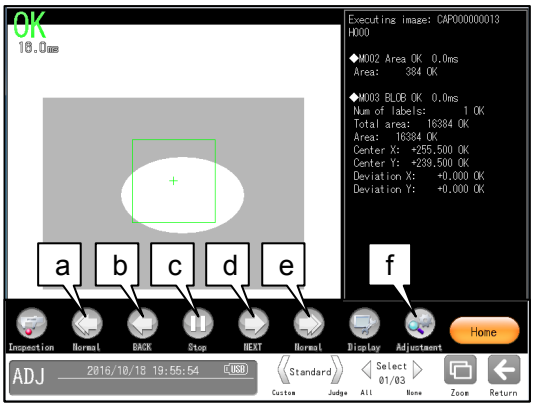


When [narrow down] check box is checked:



You can narrow down the images to be listed by touching the [Narrow down] check box to show ☑ and enter the object TYPE number in the [TYPE] data input box and selecting one from the [Judgment] drop down list ("All", "OK", "NG" or "ERR") and then touch the [Retry] icon.

[1] [Retry] icon
Touch this icon to redo inspection on the selected image.
The Retry screen will appear.
Note: Double clicking an object number on the list also accesses the Retry screen.



a. [Play Backwards] icon
Touch this icon to redo inspection on the images by playing them backwards.
There are 3 speed for the playing and the speed changes at each touch of the icon:
Normal → High →Low → Normal →

b. [Back] icon
Touch this icon to redo inspection only on one before image.

c. [Stop] icon
Touch this icon to stop inspection.

d. [Next] icon
Touch this icon to do inspection on next image.

e. [Play Forwards] icon
Touch this icon to redo inspection on the images by playing them forwards.
There are 3 speed for the playing and the speed changes at each touch of the icon:
Normal → High →Low → Normal →

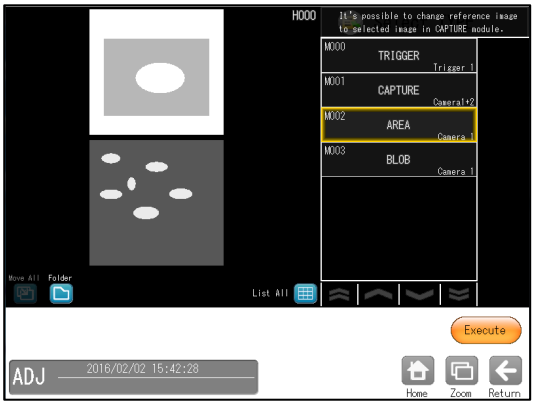
[Display of Play Forwards/Backwards icons]

The selected icon will be yellow framed.
At each touch of the icon, the text under the icon changes to show the speed.
Normal → High →Low → Normal →

f. [Adjustment] icon
The following screen will appear.

[2] [Adjustment] icon

Touch this icon to adjust the parameters of the selected image.
The adjustment screen will appear.



Touch the Flow button, like Area or Blob in the above example, you want to make adjustment.

Adjust the flow on the screen accessed.

[3] [All retry] icon

Touch this icon to do retry on all the images in the list and get the result.

The Retry judgment window will pop up and the results are shown.

a. Number of Images
b. Number of OK images
c. Number of NG images
d. Number of ERROR images
e. Yield rate

Result

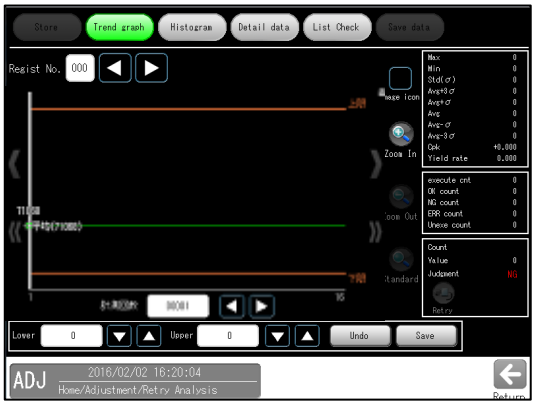
f. Number of OK result image/Total number of retried images
g. Number of NG result image/Total number of retried images
h. Number of ERROR result image/Total number of retried images
i. Yield rate

- If [Cancel] button is pressed during All retry, the results of the images just before the button is touched are displayed.
- When the images are narrowed down, All retry is done on the narrowed down images.

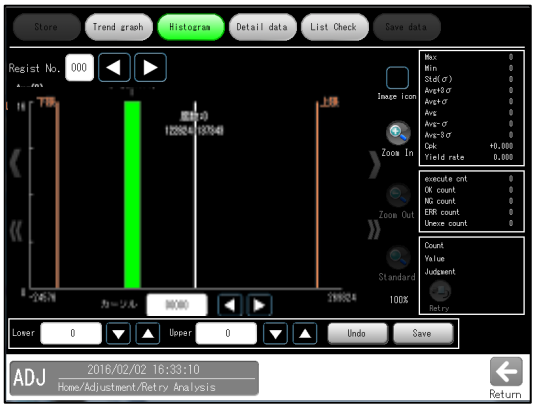
[4] [Analysis] icon

Touch this icon to do retry on all the images in the list and get the statistical data.
The Analysis screen will appear.
You can select one of the 4 screens by touching the respective button.

[Trend graph] screen



[Histogram] screen



[Detail data] screen

[List check] screen

- If [Cancel] button is pressed during All retry, the results of the images just before the button is touched are displayed.
- When the images are narrowed down, All retry is done on the narrowed down images.

[5] [Clear] icon

Touch this icon to clear all the images in the system.

[6] [Camera] buttons

Touch this icon to register the selected image as the reference image.

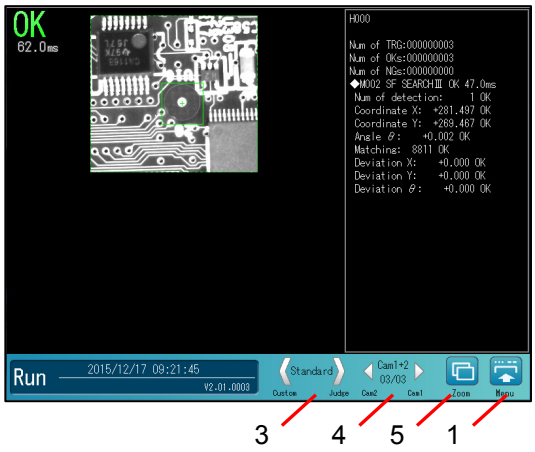
[7] Maximum save trigger number display

This indicates the maximum number of triggers that can be saved in the image memory.
(The number changes depending on the cameras connected)

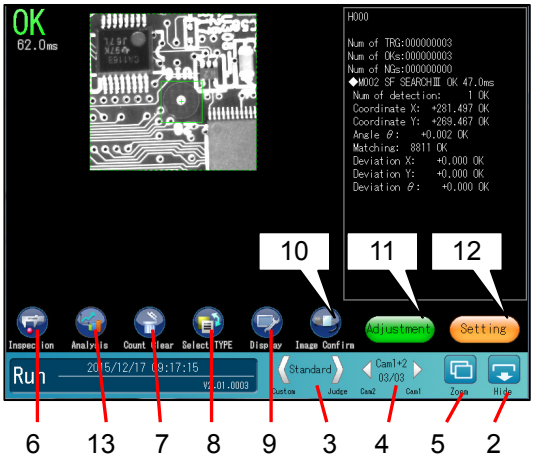
Section 5: Operation

This section describes operations using the buttons and icons on the Run screen.
(The screens shown below are typical example)

[Run screen with the buttons and icons hidden]



[Run screen with the buttons and icons]



1. [Menu] button
The device will display the Run screen with the menu (buttons and icons).

2. [Hide] icon
The device will display the Run screen without the menu.

3. Screen format change buttons => [5]

4. Page change buttons

5. [Zoom] icon => Page 3-13

6. [Inspection] icon => [1]

7. [Count Clear] button
Used to initialize trigger statistics information.

8. [Select TYPE] icon => [2]

9. [Display] icon => [3]

10. [Image Confirm] icon
Used to confirm the image in the image memory.

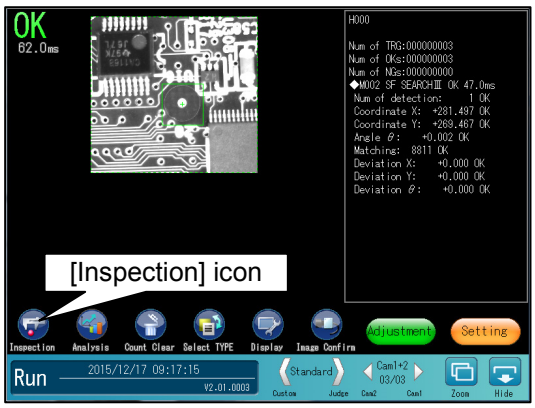
11. [Adjustment] button => [4]

12. [Setting] button => Page 3-5

13. [Analysis] icon => [6]

[1] [Inspection] icon

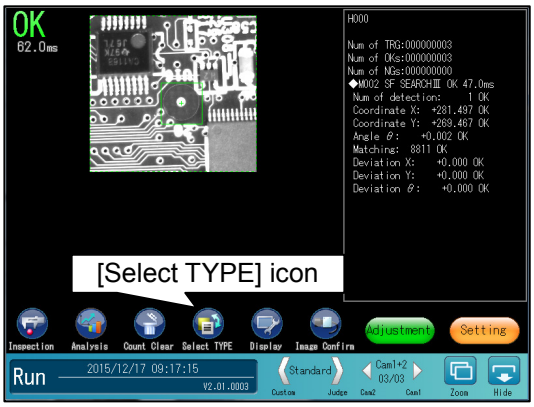
Touch the [Inspection] icon on the Run screen and the device will start inspection of the selected object TYPE.



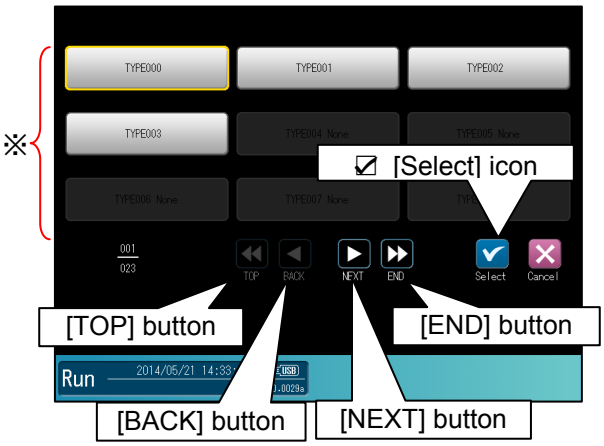
[2] [Select TYPE] icon

This icon is used to select an object TYPE you want to display on the Run screen.

① Touch the [Select TYPE] icon on the Run screen.



② The Object type selection window will appear. Touch an object type number you want to display and then touch ☑ [Select] icon to display your selection.



※ Object type number display area

- A maximum of 9 object type numbers can be displayed in one screen.
- Functions of buttons

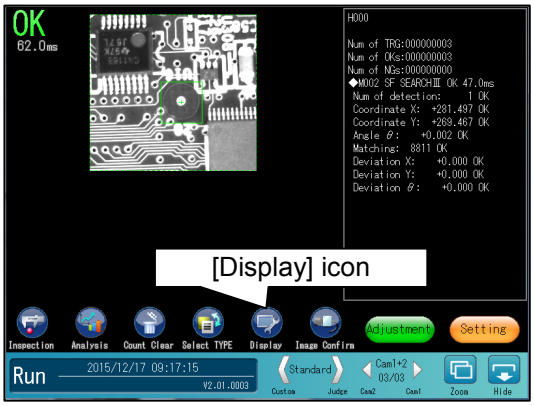
[TOP] button --- Displays the first 9 object type numbers stored
[BACK] button --- Displays the previous 9 object type numbers
[NEXT] button --- Displays the next 9 object type numbers
[END] button --- Displays the last object type numbers stored

③ The Run screen for the selected object type number will be displayed.

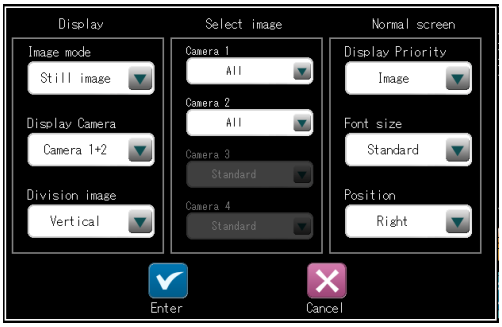
[3] [Display] icon

Set the image mode, division mode, etc. that you want to display on the Run screen.

① Touch the [Display] icon on the Run screen,



② The Display setting menu window will appear.



Touch one of the options from the drop down lists to change the setting.

● **Display**

- **[Image mode] drop down list**

Select one from “Live image”, “Still image” and “Processed image”.

Live: Displays live image of the camera.

NOTE: Capture timing may delay against the trigger input or image process time may take longer.

Still image: Displays camera captured image.

Processed image: Displays processed image and binarized image.

NOTE: Image process time may take longer.

- **[Display camera] drop down list**

Select one from “Camera 1”, “Camera 2” and “Camera 1+2”.

- **[Division image] drop down list**

Select one from “Horizontal” and “Vertical”.

● **Select image**

- **[Camera 1] drop down list**
  Select one from “Disable”, “All”, “Module” and “Standard”.
- **[Camera 2] drop down list**
  Select one from “Disable”, “All”, “Module” and “Standard”.

Disable: Do not display an image.
All: Displays all the module areas.
Module: Displays only current module. This is selectable only when the Screen format has been set to “Module”.
Standard: Displays the module set by [Window Display] button on Home/Display setting. See page 4-241.

● Normal screen

- **[Display priority] drop down list**
  Select one from “Image”, and “Message”.
- **[Font size] drop down list**
  Select one from “Small”, “Standard” and “Large”.
- **[Position] drop down list**
  Select one from “Right”, and “Bottom”.

[4] [Adjustment] button

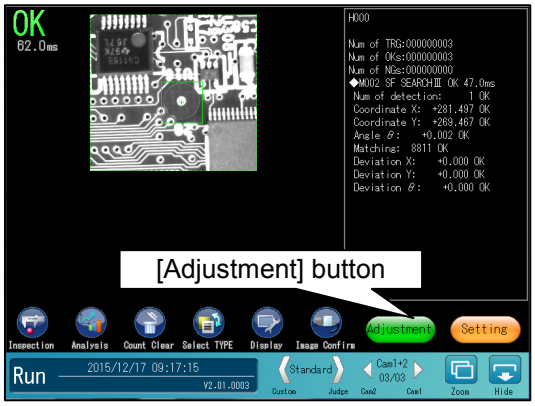
The device has online adjustment function. You can change and enter the inspection conditions and the image display options, even when on line (Running).

[Setting items that can be changed]
Each module and clock setting.
(For others, only check can be done.)
[Note]

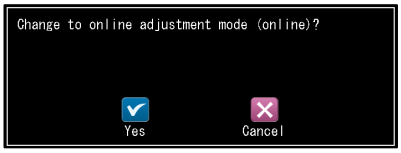
- Judgment results and the current values for each inspection setting are not displayed while using the online adjustment function.
- Changes in the settings will not be applied until the device is placed into the Run mode.

To adjust the settings on line, do the following.

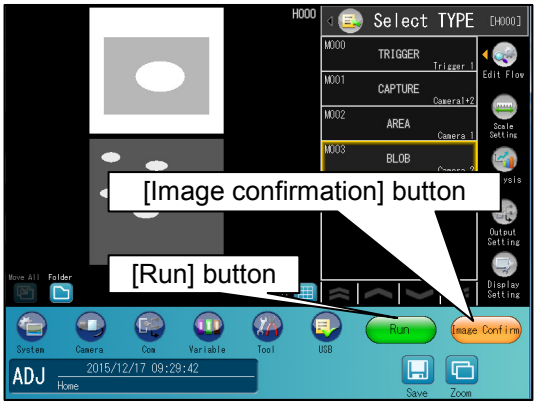
① Touch the [Adjustment] button on the Run screen.



② A window will appear to confirm that you want to enter the online adjustment mode.
Touch the [Yes] icon.



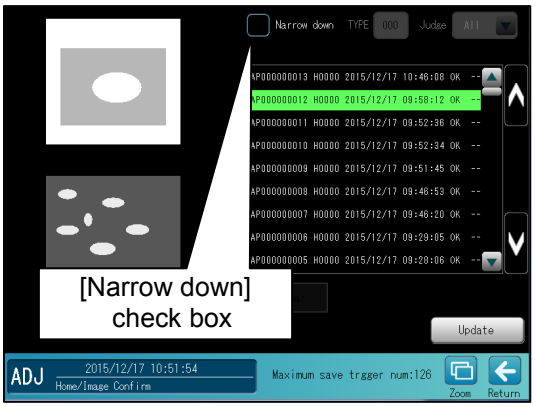
③ A window will appear for the online adjustment mode.



Touch one of the modules which setting can be changed (such as Area module), change the setting and touch the [Run] button. The changed setting will be stored and enter Run mode.

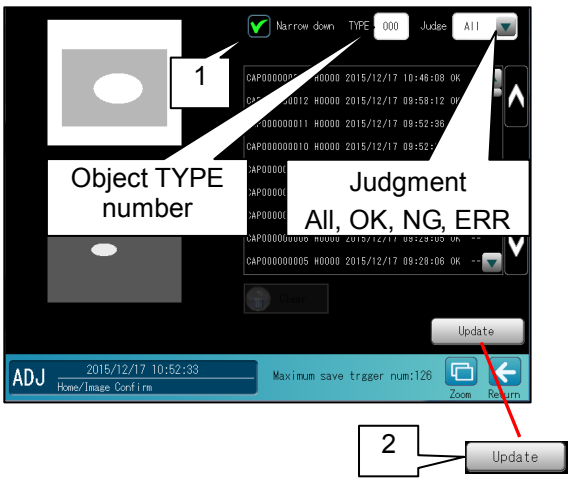
■ **[Image confirmation] button**
You can check the images in the memory of the DEVICE while in the online adjustment mode. Touch the [Display image] button on the online adjustment mode screen and the combo box of the images will appear.

● **When [Narrow down] check box is unchecked (☐)**



Select an image from the list you want to check. The selected image will appear on the left of the screen.

● **When [Narrow down] check box is checked (☑)**



1. **[Narrow down] check box**
To narrow down the list, touch the [Narrow down] check box to show ☑, enter an object type number and then select a "Judgment" result type from "All", "OK", "NG" or "ERR".

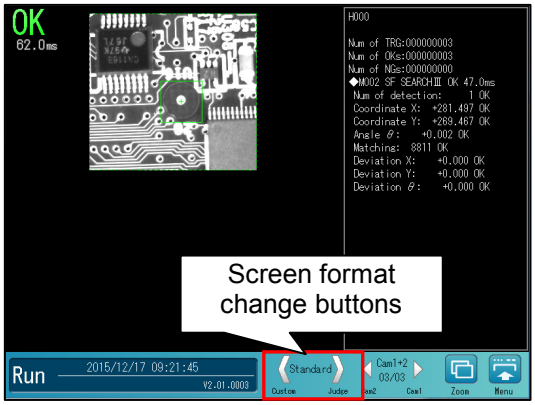
2. **[No update/Update] button**
While the button shows “Update”, the image in the memory will be updated when the device receives a trigger while you are checking the image.

To stop updating of the image, touch the button to show [No update].

Note: When the Image confirm screen is exited while the button shows “No Update”, the device will start image update automatically.

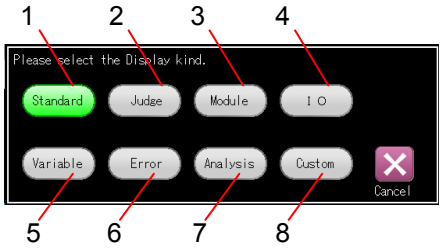
[5] Screen format change buttons

You can change the information to display on the screen with the buttons.



Touching the arrow buttons changes the screen format on the screen.

The following window will appear when you touch the area between the two arrow buttons

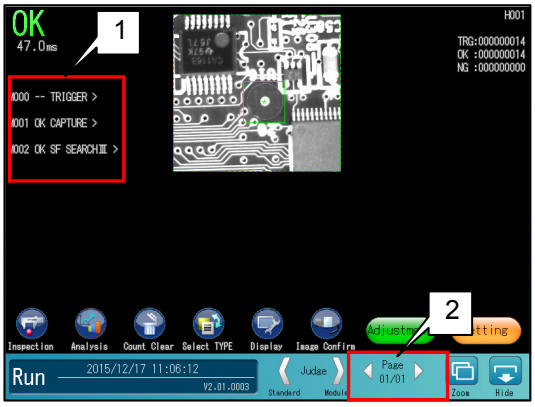


There are 8 screen formats you can select:

1. **[Standard] button**
2. **[Judgment] button => (1)**
3. **[Module] button => (2)**
4. **[I/O] button => (3)**
5. **[Variable] button => (4)**
6. **[Error] button => (5)**
7. **[Analysis] button => (6)**
8. **[Custom] button => (7)**

(1) [Judgment] button

Displays the judgment result of each module.

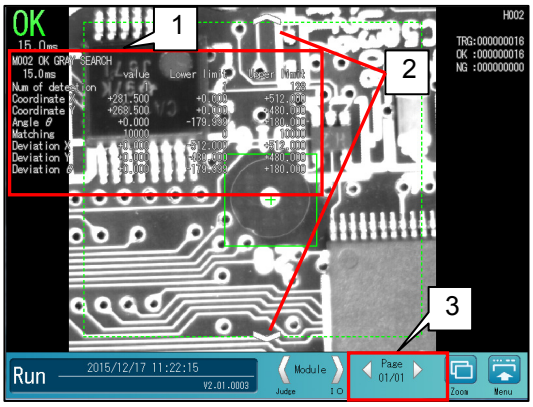


1. **Judgment result**
   Module number, name and the judgment result are displayed.
   Touch the desired module line, then the Module Detail screen will appear.

2. **[Page change] buttons**
   Use the buttons to access previous or next module when 32 or more modules are set.

(2) [Module Detail] button

Displays the detailed inspection results.



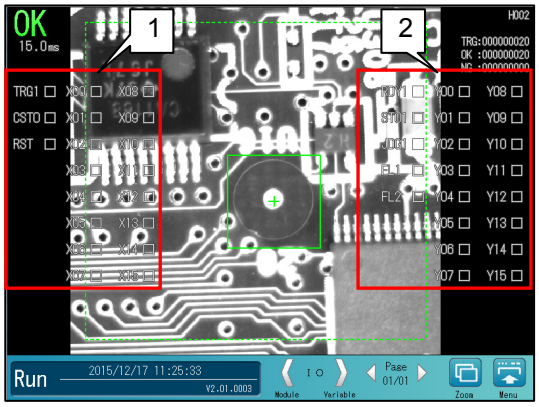
1. **Detailed Inspection Result**

2. **Module change buttons**
   Used to change module.

3. **[Page change] buttons**
   Use the buttons to access previous or next page when the inspection results have more than one page.

(3) [I/O] button

Displays Parallel I/O status.

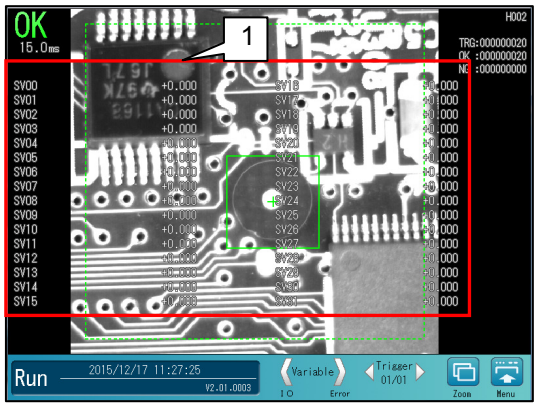


1. Parallel Input status

2. Parallel Output status

(4) [Variable] button

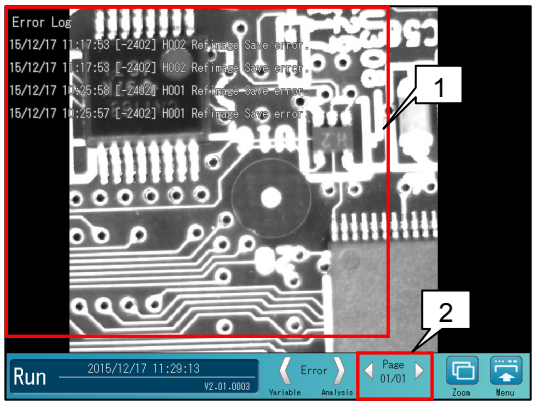
Displays variable information.



1. **Variable**
   Displays variable name and the current value.

(5) [Error] button

Displays error information.

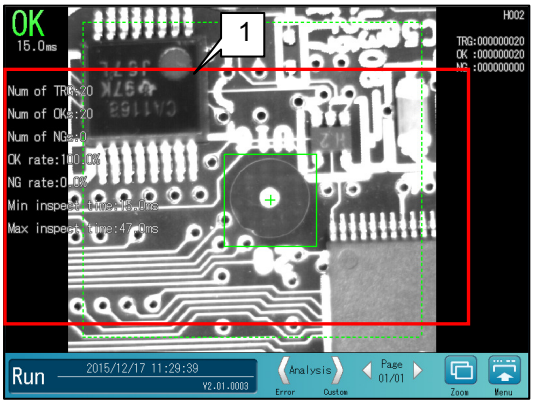


1. **Error Log**
   Displays error occurred time, error code and error content.
   - Maximum 12 errors are displayed in one page.
   - No windows will be displayed when this screen format is selected.

2. **[Page change] buttons**
   Use the buttons to access previous or next error information when the page is more than one page.

(6) [Analysis] button

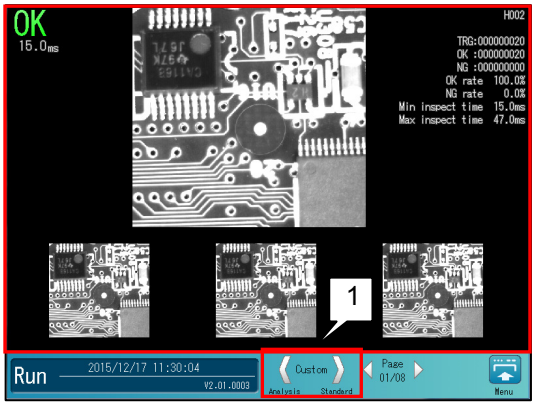
Displays inspection statics.



1. **Statics**
   The following are displayed:
   - Number of inspections
   - Number of OKs
   - Number of NGs
   - OK rate
   - NG rate
   - Minimum inspection time
   - Maximum inspection time

(7) [Custom] button

Displays the screen you have customized. Maximum 8 pages can be customized.
See page 4-241.

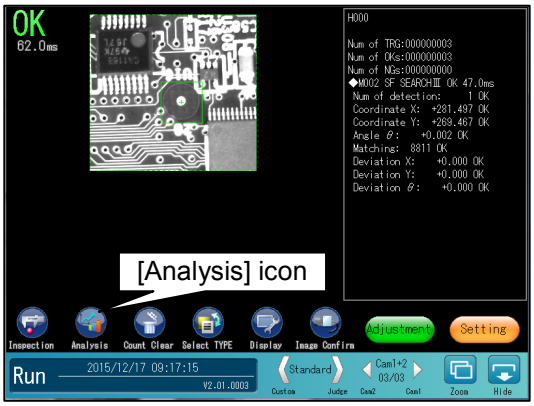


1. **[Page change] buttons**
   Use the buttons to access previous or next page when the page is more than one page.

[6] [Analysis] icon

Touch this icon to access statistical data setting screen.
You can set lower and upper limits for each inspection judgment while checking the real time data graph to be shown on the screen during run.

① Touch the [Analysis] icon on the Run screen.



② The statistical data setting screen will appear.

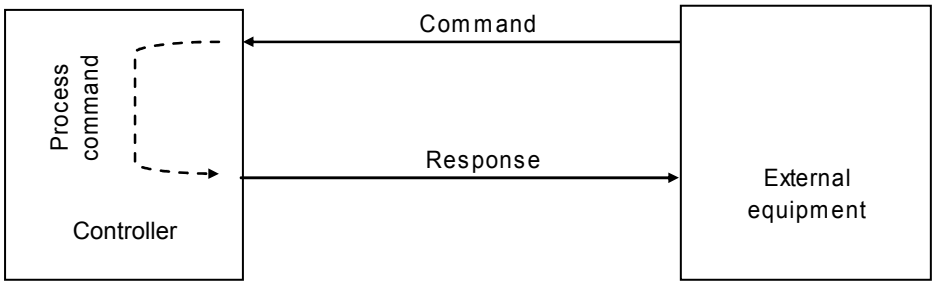
1. [No update/Update] button
Touch this button to show “No Update” to stop updating the image and touch to show “Update” to restart image update.

Section 6: Serial Communication (No Protocol)

This section describes communication procedures between the controller, IV-S300J, IV-S300M or IV-S310M, and external equipment using a serial interface (RS-232C, RS-422, or Ethernet).

6-1 Serial communication (no protocol)

The controller can communicate with external equipment using commands and responses via serial communication (no protocol).
The data flow in serial communication (non-procedure) is shown in the figure below.



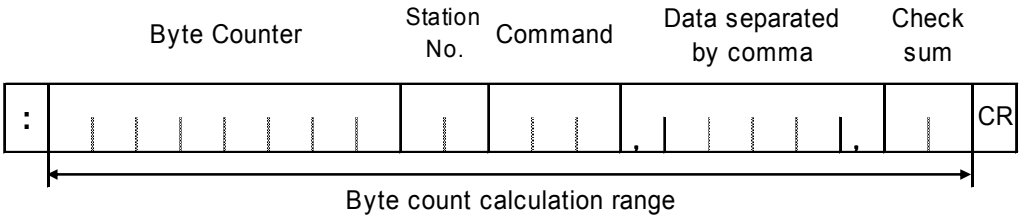
When the controller receives a command from a PC or external equipment, it processes the command and returns a response when it has completed the command process. If there is an error in the command sent from the PC, or if an error occurs in the controller while processing the command, it returns an error.

6-2 Communication format

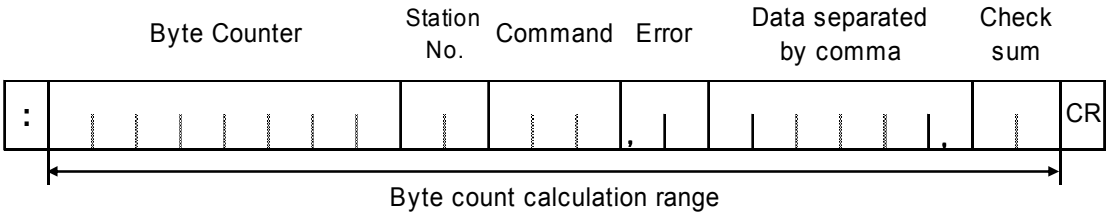
Communication format

The command and response are configured using ASCII character strings in the format shown below.

● Command



● Response



Header (letters)

The text data colon, (:), indicates the start of the data.

Byte counter (hexadecimal)

Contains the number of data bytes, excluding the header and footer (CR) from the total number of data bytes. (Command to send to the controller can be omitted by filling with zeroes.)

Station number (hexadecimal)

Enter the station number assigned to the controller.

Command (character string)

Enter a command code.

Error (hexadecimal)

Contains an error code, if any. => See next page.

Data separated by commas (decimal data)

Provide the data to send *separated by commas (,).

Some commands and responses do not need data separated by commas.

Checksum (hexadecimal)

Contains the checksum. The checksum is used to determine if data corruption occurred in the communication channel. For details, see the "Checksum calculation method" below.

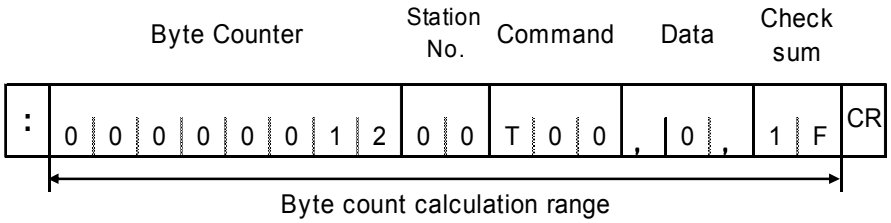
CR (Carriage Return control code)

Control code that indicates the end of the data.

Checksum calculation method

A checksum is created by adding all the data from the byte counter to just before the checksum as ASCII codes. The lower one byte of the total is converted to an ASCII code and the data is added to the data to be sent as a checksum. The data receiving side uses the same procedure to calculate the checksum, and then compares its checksum with the checksum received. By comparing the checksums, the controller can detect whether corruption occurred during the communication.

■ **Checksum calculation example**



Data	ASCII code
0	$30_{(H)}$
0	$30_{(H)}$
0	$30_{(H)}$
0	$30_{(H)}$
0	$30_{(H)}$
0	$30_{(H)}$
1	$31_{(H)}$
2	$32_{(H)}$
0	$30_{(H)}$
T	$54_{(H)}$
0	$30_{(H)}$
0	$30_{(H)}$
,	$2C_{(H)}$
0	$30_{(H)}$
,	$2C_{(H)}$
Total =	$31F_{(H)}$

! Memo

Put two @ (at sign: $40_{(H)}$) in the checksum positions, and the controller does not calculate Checksum.

Note: (H) denotes hexadecimal.

From the data given above, the controller converts all of data into ASCII code and sum them.
The result is 31F.
The lowest byte of this sum is converted to ASCII code and is referred to as a checksum.

Error code

When the command process completes normally, the controller will store $00_{(H)}$ in the error area and return the response. If any error occurs when receiving or processing the command, the controller stores the following error code and returns it in a response.

Error	Error message	Detail
$00_{(H)}$	Ended normally	The command process completed normally.
$10_{(H)}$	Command error	The specified command does not exist.
$11_{(H)}$	Command length error	The command length or data length is out of range.
$12_{(H)}$	Data range error	The specified data value is out of range.
$13_{(H)}$	Checksum error	The checksum of the command and the calculated checksum are different.
$20_{(H)}$	Serial communication disabled	Received a command while serial communication is disabled.
$21_{(H)}$	Processing a command	Received a command while processing a command.
$30_{(H)}$	Time out error	A time out occurred while the system is receiving a command.
$41_{(H)}$	Data range error while executing a command	The specified data value is out of range during processing the command.
$50_{(H)}$	Command rejected while executing another command	Received a command while the system is not in the Run mode. Or, the system refused to execute the command for some reason.
$60_{(H)}$	Individual error while the system was executing the command	The numbers follow are defined individually.
$61_{(H)}$	Busy	Ask the host to resend the command.
$63_{(H)}$	Ref image store Image processing error	Error happened during image processing for Ref image store. Change the capture image or parameter such as of Area.
$64_{(H)}$	Ref image store Image capture error	No image with the Camera for Ref image store which number was assigned to the previous inspection image by an argument. Run inspection and get an inspection image.
$65_{(H)}$	Ref image store No capture error	Cameras for Ref image store which numbers were assigned by an argument are not connected or the Execute is set to Disable on Capture module. Change the argument or set Execute setting on Capture module.

6-3 List of commands

The table below shows the list of commands that can be used in serial communication.

- An '○' in the table indicates a legal command in the specified mode or condition.
  A '−' indicates that the command is unavailable in those conditions or the controller operation in those conditions is not guaranteed.

Function	Command	Setting mode	Run mode	RS-232C RS-422	Ethernet
Trigger (with a result output)	T00	−	○	○	○
Trigger (without a result output)	T01	−	○	○	○
Read output data	T02	−	○	○	○
Read object type number	C00	−	○	○	○
Write object type number	C01	−	○	○	○
Read image mode	C20	−	○	○	○
Write image mode	C21	−	○	○	○
Read image display mode	C30	−	○	○	○
Write image display mode	C31	−	○	○	○
Clear statistics	C40	−	○	○	○
Read current variable value	C80	−	○	○	○
Write current variable value	C81	−	○	○	○
Reference image store	R00	−	○	○	○
Read date and time setting	R50	−	○	○	○
Write date and time setting	R51	−	○	○	○
Read stored data (Code Reader)	R80	−	○	○	○
Write stored data (Code Reader)	R81	−	○	○	○
Write set string (Date block x 8, with camera selection)	R89	−	○	○	○
Read set string (Module)	R90	−	○	○	○
Read set string (Block)	R92	−	○	○	○
Write set string (Block designation, w/o space at end)	R93	−	○	○	○
Write set string (Block designation, w space at end)	R94	−	○	○	○
Write set string (Variable block x 5, w/o space at end)	R95	−	○	○	○
Write set string (Variable block x 20, w/o space at end)	R96	−	○	○	○
Write set string (Variable block x 10, w/o space at end)	R98	−	○	○	○
Store snapshot image on an USB flash drive	I01	○	○	○	○
Store settings	D11	○	○	○	○
Store settings (System, Object)	D14	○	○	○	○
Read average intensity	D20	−	○	○	○
Read parallel input/output	D21	○	○	○	○
Self diagnosis	D40	○	○	○	○

6-4 Command details (External equipment -> Controller)

■ **T00: Trigger (with a result output)**

Send a trigger for image processing and receive the result.

Command Header [T00] , (Trigger No.) , Footer

Response Header [T00] , (Output Data) , Footer

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.

(Output data): Output data are stored.

- For detail about the output data, see the "Output data format." => Page 6-16
- If you request data with size exceeding the communication buffer capacity(4 K-bytes), the data exceeded it will not be output.

[When a 50(H) error code occurs]

A command was given when the controller was unable to receive a trigger (e.g.: Ready is not on).
Or, a command was received while in the setting mode.

■ **T01: Trigger (without a result output)**

Send a trigger for image processing.

Command Header [T01] , (Trigger No.) , Footer

Response Header [T01] Footer

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).

- T01 command returns a response right after a trigger is received.
  T01 command does not output results. Therefore, if you want to obtain the results, check the Ready bit status using a D21 command and then read the output data using the T02 command.

[When a 50(H) error code occurs]

A command was given when the controller was unable to receive a trigger (e.g.: Ready is not on).
Or, a command was received while in the setting mode.

■ **T02: Read output data**

Read the latest output data.
Use this command when the controller failed to read the results with a T00 command.

Command Header [T02] , (Trigger No.) , Footer

Response Header [T02] , (Output Data) , Footer

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.

(Output data): Output data are stored.

- For details about the output data, see the "Output data format." => Page 6-16
- If you request data with size exceeding the communication buffer capacity(4 K-bytes), the data exceeded it will not be output.
- If you changed the object type, the inspection output data will be initialized.
- If no inspection data when the command is received, an error occurs.

[When a 50(H) error code occurs]

No inspection output data.

■ **C00: Read object type number**

Read an object type number that is active.

Command Header [C00] Footer

Response Header [C00] , (Object type No.1) , (Object type No.2) , Footer

(Object type No.1): Object type number (0 to 99) can be stored.
(Object type No.2): Object type number (100 to 199) can be stored.
In 1 Trigger mode, always 0.

■ **C01: Write object type number**

Write an object type number and activate the object type.

Command Header [C01] , (Object type No.) , Footer

Response Header [C01] Footer

(Object type No.): Specify object type number to use for inspection (0 to 199).

- If you enter an object type number that is not set for inspection, an error will occur.

[When a 50(H) error code occurs]
Specified object type that is not inspected or received command in modes other than RUN mode.

■ **C20: Read image mode**

Read images.

Command Header [C20] Footer

Response Header [C20] , (Mode) , Footer

(Mode): Image mode is stored.
LV: Live image
SC: Still image (camera image)
RC: Processed image

■ **C21: Write image mode**

Write images.

Command Header [C21] , (Mode) , Footer

Response Header [C21] Footer

(Mode): Specify the image mode.
LV: Live image
SC: Still image (camera image)
RC: Processed image

■ **C30: Read image display mode**

Read camera image.

Command [Header [C30]] [Footer]

Response [Header [C30]] , (Mode) , [Footer]

(Mode): Camera mode is stored.

C1: Camera 1	C2: Camera 2	C3: Camera 3	C4: Camera 4
DV: Camera 1 + 2	DW: Camera 3 + 4	DX: Camera 1 + 2 + 3 + 4	

■ **C31: Write image display mode**

Write camera display.

Command [Header [C31]] , (Mode) , [Footer]

Response [Header [C31]] [Footer]

(Mode): Specify the image display mode.

C1: Camera 1	C2: Camera 2	C3: Camera 3	C4: Camera 4
DV: Camera 1 + 2	DW: Camera 3 + 4	DX: Camera 1 + 2 + 3 + 4	

■ **C40: Clear statistics**

Clear number of inspection.

Command [Header [C40]] [Footer]

Response [Header [C40]] [Footer]

This command does not update screen.
Be sure to execute this command before C00 to clear statistics when changing an object type.

■ **C80: Read current variable value**

Read current value of the designated variable no.

Command [Header [C80]] , (Trigger No.) , (Variable No.) , [Footer]

Response [Header [C80]] , (Variable Value) , [Footer]

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.

(Variable No.): Specify 0 to 31.

(Variable): Current value of the designated variable is stored.

■ **C81: Write current variable value**

Write current value to the designated variable no.

Command [Header [C81]] , (Trigger No.) , (Variable No.) , (Variable Value) , [Footer]

Response [Header [C81]] [Footer]

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.

(Variable No.): Specify 0 to 31.

(Variable): Specify actual number to be set as a current value.

■ **R00: Reference Image Save.**

Store the last camera captured image as the Reference image. (save to a non-volatile memory)
Note:
The reference image for each camera needs to be stored object type by object type.
Therefore, it is required to run one or more inspection for the same object type before executing this command.

Command Header [R00] , (Trigger No.) , (Camera Combination No.) , Footer

Response Header [R00] Footer

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.

(Camera Combination No.):
Specify a Camera combination number according to the following table.

Camera Combination	Camera Combination No.
No cameras	0
Camera 1	1
Camera 2	2
Camera 3	4
Camera 4	8
Camera 1 + 2	3
Camera 1 + 3	5
Camera 1 + 4	9
Camera 2 + 3	6
Camera 2 + 4	10
Camera 3 + 4	12
Camera 1 + 2 + 3	7
Camera 1 + 2 + 4	11
Camera 1 + 3 + 4	13
Camera 2 + 3 + 4	14
Camera 1 + 2 +3 +4	15

Example: Trigger No.:1, Camera 1+2+3+4
Command: 0000001500R00,0,15,B2
Response: 0000001100R0000F4

Note:

- **Time out**
  Time out error happens if reference image store (including model saving process for search type) takes 15 seconds or more.
  However, the reference image change process will be done.
  When time out happens, change the setting and redo the reference image save.

- **Capture Setting**
  For the camera which Execute is set to “Disable” on the Capture module screen, capture is not made even if it is assigned by the command’s argument.
  Example: When the command assigns Camera 1+2 and Execute of camera 2 is disabled, the reference image store process is done on only on camera 1.

- **Error Code**
  R00 has its own error codes ($63 \sim 65_{(H)}$). => See Page 6-3.

■ **R50: Read date and time settings.**

Read day and time settings.

Command [Header [R50]] [Footer]

Response [Header [R50]] , (Y) , (M) , (D) , (h) , (m) , (s) , [Footer]

The following parameters are stored.

(Y): Year (2000 to 2099) **(M)**: Month (1 to 12) **(D)**: Day (1 to 31)

(h): Hour (0 to 23) **(m)**: Minute (0 to 59) **(s)**: Second (0 to 59)

[Note] The clock precision is ±3 minutes/month.

Set the time on the Controller before starting operation. => See Page 4-4.

■ **R51: Write date and time settings**

Write the day and time settings

Command [Header [R51]] , (Y) , (M) , (D) , (h) , (m) , (s) , [Footer]

Response [Header [R51]] [Footer]

Specify the following date parameters.

(Y): Year (2000 to 2099) **(M)**: Month (1 to 12) **(D)**: Day (1 to 31)

(h): Hour (0 to 23) **(m)**: Minute (0 to 59) **(s)**: Second (0 to 59)

■ **R80: Read Stored data (Code Reader module)**

Read the Stored data of Code Reader module.

Command [Header [R80]] , (Trigger No.) , (Module No.) , [Footer]

Response [Header [R80]] , (Stored Data) , [Footer]

(Trigger number): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.

(Module No.): Specify a module number (0 to 127).

(Stored data): Stored data is stored.

■ **R81 Write Stored data (Code Reader module)**

Write the Stored data of Code Reader module.

Command [Header [R81]] , (Trigger No.) , (Module No.) , (Stored Data) , [Footer]

Response [Header [R81]] [Footer]

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.

(Module No.): Specify a module number (0 to 127).

(Stored data): Stored data
Add FNC1 (0x1D) at the top when an application identifier (AI) is required for GS1 Code.

Note:

- Writing to an USB flash drive is not made when executing this command.
  To write, execute the command D11 or D14.

■ **R89: Write set string (Date block x 8, with camera selection)**

Write the set string of the OCV module.

Command Header [R89],(Trigger No.), (Camera No.),
(Y1) , (M1) , (D1) , (Y2) , (M2) , (D2) ,
(Y3) , (M3) , (D3) , (Y4) , (M4) , (D4) ,
(Y5) , (M5) , (D5) , (Y6) , (M6) , (D6) ,
(Y7) , (M7) , (D7) , (Y8) , (M8) , (D8) , Footer

Response Header [R89] Footer

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.
(Camera No.): Specify 1, 2, 3 or 4. (ASCII code) (3 & 4 are for IV-S310M)
(Y1 –Y8): Offset value of Year (ASCII code)
(M1 –M8): Offset value of Month (ASCII code)
(D1 –D8): Offset value of Day (ASCII code)

Note:

- String can be max. 16 bytes.
- Effective only when the kind of the designated block is “Date”.
- Up to 8 strings can be set.
- When the number of strings is less than 8, enter only the comma (,).
- When using current value, enter only comma (,) for the offset portion.
- Writing to an USB flash drive is not made when executing this command.
  To write, execute the command D11 or D14.

Example: Trigger No.:1, Camera No.: Do not designate, for the 1st date, set +5 as the offset
Command: 0000000000R89,0,-1,0,0,5,,,,,,,,,,,,,,,,,,,,,,6D
Response: 0000001100R890005

■ **R90: Read set string (Module)**

Read the set string of the OCV module.

Command Header [R90] , (Trigger No.) , (Module No.) , Footer
Response Header [R90] , (String) , Footer

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.
(Module No.): Specify a module number (0 to 127). (ASCII code)
(String): Set string is stored (ASCII code)

Note: When the module is not designated as OCV module, an error will occur.

■ **R92: Read set string (Block)**

Read the set string of the OCV module.

Command Header [R92] , (Trigger No.) , (Module No.) , (Block No.) , Footer

Response Header [R92] , (String) , Footer

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.
(Module No.): Specify 0 to 127. (ASCII code)
(Block No.): Specify 0 to 7. (ASCII code)
(String): Set string is stored (ASCII code)

Note: When the module is not designated as OCV module, an error will occur.

■ **R93: Write set string (Block designation, without space at end)**

Write the set string of the OCV module.

Command Header [R92] , (Trigger No.) , (Module No.) , (Block No.) , (String) , Footer

Response Header [R92] Footer

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.
(Module No.): Specify 0 to 127. (ASCII code)
(Block No.): Specify 0 to 7. (ASCII code)
(String): Specify set string. (ASCII code)

Note:

- When the module is not designated as OCV module, an error will occur.
- String can be max. 16 bytes.
- Effective only when the kind of the designated block is “Fixed” and “Variable”.
- The data is written without a space (0x20) at the end of designated string.
- Writing to an USB flash drive is not made when executing this command.
  To write, execute the command D11 or D14.

■ **R94: Write set string (Block designation, with space at end)**

Write the set string of the OCV module.

Command Header [R94] , (Trigger No.) , (Module No.), (Block No.) , (String) , Footer

Response Header [R94] Footer

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.
(Module No.): Specify 0 to 127. (ASCII code)
(Block No.): Specify 0 to 7. (ASCII code)
(String): Specify set string. (ASCII code)

Note:

- When the module is not designated as OCV module, an error will occur.
- String can be max. 16 bytes.
- Effective only when the kind of the designated block is “Fixed” and “Variable”.
- The data is written with a space (0x20) at the end of designated string.
- Writing to an USB flash drive is not made when executing this command.
  To write, execute the command D11 or D14.

■ **R95: Write set string (Variable Block x 5, with space at end)**

Write the set string of the OCV module.

Command [Header [R95]] , (Trigger No.) , (String1) , (String2) , (String3) ,
(String4) , (String5) , [Footer]

Response [Header [R95]] [Footer]

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.

(String): Specify set string. (ASCII code)

Note:

- String can be max. 16 bytes.
- Effective only when the kind of the designated block is “Variable”.
  This command cannot be used for other kinds: “Fixed”, “Date”, etc.
- The data is written without a space (0x20) at the end of designated string.
- Up to 5 strings can be set.
- When the number of strings is less than 5, enter only the comma (,).
- Writing to an USB flash drive is not made when executing this command.
  To write, execute the command D11 or D14.

Example: Trigger No.:1, Set String: “08.8.12” “08.8.8”

Command: 0000000000R95,0,08.8.12,08.8.8,,,,9D

Response: 0000001100R950000

■ **R96: Write set string (Variable Block x 20, without space at end)**

Write the set string of the OCV module.

Command [Header [R96]] , (Trigger No.) ,
(String1) , (String2) , (String3) , (String4) , (String5) ,
(String6) , (String7) , (String8) , (String9) , (String10) ,
(String11) , (String12) , (String13) , (String14) , (String15) ,
(String16) , (String17) , (String18) , (String19) , (String20) , [Footer]

Response [Header [R96]] [Footer]

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.

(String): Specify set string. (ASCII code)

Note:

- String can be max. 16 bytes.
- Effective only when the kind of the designated block is “Variable”.
  This command cannot be used for other kinds: “Fixed”, “Date”, etc.
- The data is written without a space (0x20) at the end of designated string.
- Up to 20 strings can be set.
- When the number of strings is less than 5, enter only the comma (,).
- Writing to an USB flash drive is not made when executing this command.
  To write, execute the command D11 or D14.

Example: Trigger No.:1, Set String: “08.8.12” “08.8.8”

Command: 0000000000R96,0,08.8.12,08.8.8,,,,,,,,,,,,,,,,,,92

Response: 0000001100R960000

■ **R98: Write set string (Variable Block x 10, with space at end)**

Write the set string of the OCV module.

Command Header [R98] , (Trigger No.) , (Camera No.) ,
(String1) , (String2) , (String3) , (String4) , (String5) ,
(String6) , (String7) , (String8) , (String9) , (String10) , Footer

Response Header [R98] Footer

(Trigger No.): Specify a trigger number (0 = Trigger 1, 1 = Trigger 2).
The number corresponds to TRG1 and TRG2 of Parallel I/O.
(Camera No.): Specify 1, 2, 3 or 4. (ASCII code) (3 & 4 are for IV-S310M)
(String 1 – String10): Specify set string. (ASCII code)

Note:

- String can be max. 16 bytes.
- Effective only when the kind of the designated block is “Variable”.
  This command cannot be used for other kinds: “Fixed”, “Date”, etc.
- The data is written without a space (0x20) at the end of designated string.
- Up to 10 strings can be set.
- When the number of strings is less than 10, enter only the comma (,).
- Writing to an USB flash drive is not made when executing this command.
  To write, execute the command D11 or D14.

Example: Trigger No.:1, Set String: “2011.7.25” “2011.7.28”
Command: 0000003100R98,0,1,2011.7.25,2011.7.28,,,,,,,,C2
Response: 0000001100R980005

■ **I01: Store snapshot images in an USB flash drive**

Store snapshot images in an USB flash drive.

- If an USB flash drive is not connected or the memory space of the USB flash drive is not enough, an error will occur.

Command Header [I01] Footer

Response Header [I01] Footer

[When a 50(H) error code occurs]
USB flash drive is not connected or there is not enough free space.

■ **D11: Store settings**

Save the setting of object type that is currently displayed on the screen.

Command Header [D11] Footer

Response Header [D11] Footer

・ Store only the settings for the active object type.

■ **D14: Store settings (System, Object type)**

Save the system settings and object type settings.

Command Header [D14] Footer

Response Header [D14] Footer

・ Store only the settings for the active object type.

■ **D20: Read average intensity**

Read the average intensity.

Command Header [D20] , (Camera No.) , (x1) , (y1) , (x2) , (y2) , Footer

Response Header [D20] , (Average Intensity) , Footer

(Camera number): Specify a camera number (1, 2)
(x1): Specify the upper left X coordinates.
(y1): Specify the upper left Y coordinates.
(x2): Specify the lower right X coordinates.
(y2): Specify the lower right Y coordinates.
(Average intensity): The average intensity of the specified area is stored.

■ **D21: Read parallel input/output**

Read the I/O status of the parallel communication.

Command Header [D21] , (I/O Type) , Footer

Response Header [D21] , (I/O Status) , Footer

(I/O Type): Specify input and/or output.
(0: Input/output, 1: Input only, 2: Output only)
(I/O Status): Output I/O status in ASCII hexadecimal codes (00 to FF) is output.

When I/O type is set to 0 (Input/Output)
(Input 1), (Input 2), (Input 3), (Input 4), (Output 1), (Output 2), (Output 3), (Output 4)

Bit	Input				Output			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**
1	TRG1	-	X00	X10	RDY1	RUN	Y00	Y10
2	CSTO	-	X01	X11	STO1	ERR	Y01	Y11
3	TRG2	-	X02	X12	JDG1	-	Y02	Y12
4	RST	-	X03	X13	-	-	Y03	Y13
5	-	-	X04	X14	RDY2	FL1	Y04	Y14
6	-	-	X05	X15	STO2	FL2	Y05	Y15
7	-	-	X06	X16	JDG2	-	Y06	Y16
8	-	-	X07	X17	-	-	Y07	Y17

■ **D40 Self Diagnosis**

Perform Self Diagnosis (5 kinds of test)

Command [Header [D40]] [Footer]

Response [Header [D40]] , (System memory) , (RAM) ,
(FPGA Access),
(Camera 1 connection) , (Camera 2 connection) ,
(Camera 3 connection) , (Camera 4 connection) , [Footer]

(System memory): Test result of system memory (※1)
(RAM): Test result of RAM (※1)
(FPGA Access): Access test result of FPGA (※2)
(Camera 1 connection): Camera 1 connection test result (※2)
(Camera 2 connection): Camera 2 connection test result (※2)
(Camera 3 connection): Camera 3 connection test result (※2)
(Camera 4 connection): Camera 4 connection test result (※2)

Note: For IV-S300J and IV-S300M, “Camera 3 connection” and “Camera 4 connection” are 1.

※1: Test Result
0: Normal
1: Abnormal

※2: Camera Test Result
0: Normal
1: Failed in camera connection test
2: Failed in camera type test
3: Failed in view test
4: Failed in camera capture test
5: Failed in camera capture line test

6-5 Output data format

Shown below are output examples of the (output data) format that are stored using the following two commands.

- T00: Trigger (with a result output)
- T02: Read output data

(Command T00, T02 => Page 6-5)

- For output setting details, see Section 4-4-22 “Output settings."

● General-purpose serial (numeric data) output example

Output format	Data example	2 bytes	4 bytes	4 bytes (10x)	4 bytes (1000x)
		16 bits	32 bits	32 bits (10x)	32 bits (1000x)
Fixed length	0	000000	+00000000000	+000000000.0	+0000000.000
	123	000123	+00000000123	+000000123.0	+0000123.000
	123.4	N/A	N/A	+000000123.4	+0000123.400
	123.45	N/A	N/A	N/A	+0000123.450
	-123	N/A	-00000000123	-000000123.0	-0000123.000
	-123.4	N/A	N/A	-000000123.4	-0000123.400
	-123.45	N/A	N/A	N/A	-0000123.450
Variable length	0	0	0	0.0	0.000
	123	123	123	123.0	123.000
	123.4	N/A	N/A	123.4	123.400
	123.45	N/A	N/A	N/A	123.450
	-123	N/A	-123	-123.0	-123.000
	-123.4	N/A	N/A	-123.4	-123.400
	-123.45	N/A	N/A	N/A	-123.450

N/A: Not Available

● General-purpose serial (text data) output example

Data Example	Output Format		Output Data									
“12345”	Variable length		‘1’	‘2’	‘3’	‘4’	‘5’					
		Hexadecimal	31	32	33	34	35					
	Fixed length		‘1’	‘2’	‘3’	‘4’	‘5’	SP	SP	SP	SP	SP
		Hexadecimal	31	32	33	34	35	20	20	20	20	20
“ABCDEF”	Variable length		‘A’	‘B’	‘C’	‘D’	‘E’	‘F’				
		Hexadecimal	41	42	43	44	45	46				
	Fixed length		‘A’	‘B’	‘C’	‘D’	‘E’	‘F’	SP	SP	SP	SP
		Hexadecimal	41	42	43	44	45	46	20	20	20	20
“消費期限”	Variable length		“消”		“費”		“期”		“限”			
		Hexadecimal	8F	C1	94	EF	8A	FA	8C	C0		
	Fixed length		“消”		“費”		“期”		“限”		SP	SP
		Hexadecimal	8F	C1	94	EF	8A	FA	8C	C0	20	20
“08.9.17”	Variable length		‘1’	‘8’	‘.’	‘9’	‘.’	‘1’	‘7’			
		Hexadecimal	31	38	2E	39	2E	31	37			
	Fixed length		‘1’	‘8’	‘.’	‘9’	‘.’	‘1’	‘7’	SP	SP	SP
		Hexadecimal	31	38	2E	39	2E	31	37	20	20	20

Note: When the output size of the text data is set to 10 byte.

Section 7: Serial Communication (PLC Link)

This section describes the PLC link communication procedures between the controller, IV-S300J, IV-S300M or IV-S310M, and external equipment using a serial interface (RS-232C or RS-422).

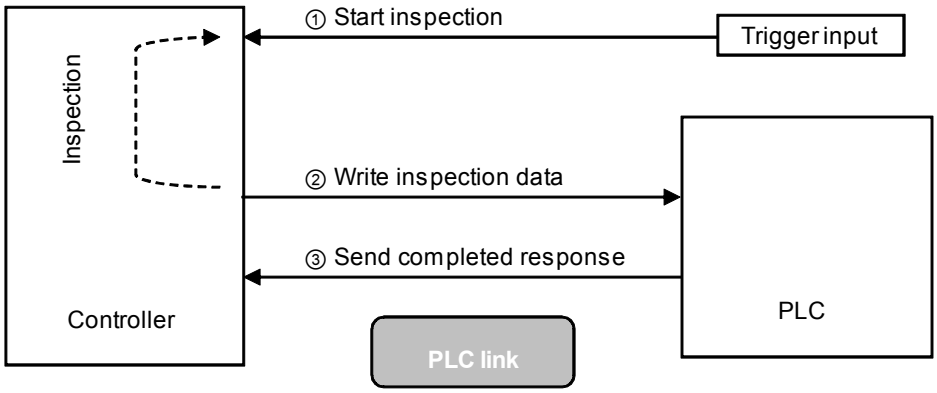
[Numbers used in this section]

This section shows octal and hexadecimal notations as follows:

Octal notation ····(8) Hexadecimal notation ····(H)

7-1 Serial communication (PLC link)

The data flow in serial communication using a PLC link is shown in the figure below.



When connected to a Sharp PLC:

The controller sends write enable command to a PLC when the Command error (code 10(H)) occurs after sending its inspection data to PLC and no response from the PLC is received.

When connected to a Mitsubishi PLC:

The controller sends the information ② and ③ in the figure above by separating them into packets.

7-2 Register setting

The controller uses the PLC's register (Write: Maximum 512 bytes) for the computer linking.

Setting item	Address range
Write register (Max. 512 bytes)	・Sharp: 09000～389777 ・Mitsubishi: D0000 to D1023 (When using the WW series) ・Mitsubishi: D0000 to D9999 (When using the QW series) ・Yokogawa: D00001～D16384 ・Omron: DM0000～DM9999

[Note 1] In case of using a Sharp PLC, use even number address to store the inspection result.

[Note 2] In case of using a Sharp PLC and use 512 bytes for write register, set the inspection result storage address to any of the followings:
09000, 19000, 29000, 39000, 49000, 59000, 69000, 79000, 89000, 99000

[Note 3] In case of using a JW300 series PLC, the following addresses can be included as well.
109000, 119000, 129000, 139000, 149000, 159000, 169000, 179000, 189000,
209000, 219000, 229000, 239000, 249000, 259000, 269000, 279000, 289000,
299000, 309000, 319000, 329000, 339000, 349000, 359000, 369000, 379000, 389000

Output example

Output example of numeric data

Data example	2 bytes 16 bits		4 bytes 32 bits		4 bytes (10x) 32 bits (10x)			4 bytes (1000x) 32 bits (1000x)		
	H	L	H	L		H	L		H	L
0	0000	0000	0000	0000	0	0000	0000	0	0000	0000
123	0000	007B	0000	007B	1230	0000	04CE	123000	0001	E078
123.4	Not available		Not available		1234	0000	04D2	123400	0001	E208
123.45	Not available		Not available		Not available			123450	0001	E23A
-123	Not available		FFFF	FF85	-1230	FFFF	FB32	-123000	FFFE	1F88
-123.4	Not available		Not available		-1234	FFFF	FB2E	-123400	FFFE	1DF8
-123.45	Not available		Not available		Not available			-123450	FFFE	1DC6

Note: (10x) denotes a value multiplied by 10.
Note: (1000x) denotes a value multiplied by 1000.

- Output example of text data

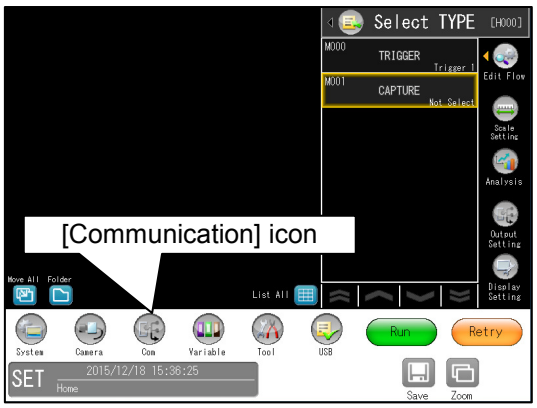
“12345”			“ABCDEF”			“消費期限”			“18.9.17”		
	Hexadecimal			Hexadecimal			Hexadecimal			Hexadecimal	
	Variable	Fixed		Variable	Fixed		Variable	Fixed		Variable	Fixed
‘1’	0031	0031	‘A’	0041	0041	“消”	008F	008F	‘1’	0031	0030
‘2’	0032	0032	‘B’	0042	0042		00C1	00C1	‘8’	0038	0038
‘3’	0033	0033	‘C’	0043	0043	“費”	0094	0094	‘.’	002E	002E
‘4’	0034	0034	‘D’	0044	0044		00EF	00EF	‘9’	0039	0039
‘5’	0035	0035	‘E’	0045	0045	“期”	008A	008A	‘.’	002E	002E
SP		0020	‘F’	0046	0046		00FA	00FA	‘1’	0031	0031
SP		0020	‘G’	0047	0047	“限”	008C	008C	‘7’	0037	0037
SP		0020	SP		0020		00C0	00C0	SP		0020
SP		0020	SP		0020	SP		0020	SP		0020
SP		0020	SP		0020	SP		0020	SP		0020

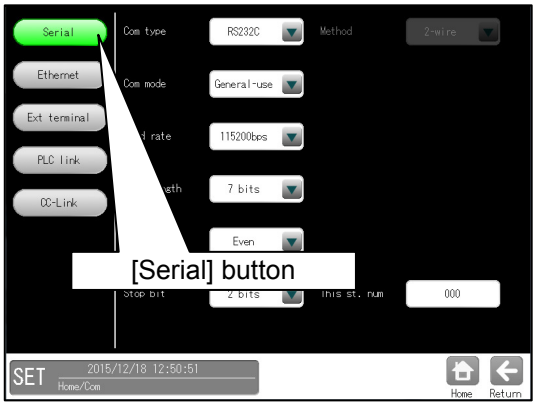
Note: When the text data output size is set to 10 byte.

7-3 PLC link output setting method

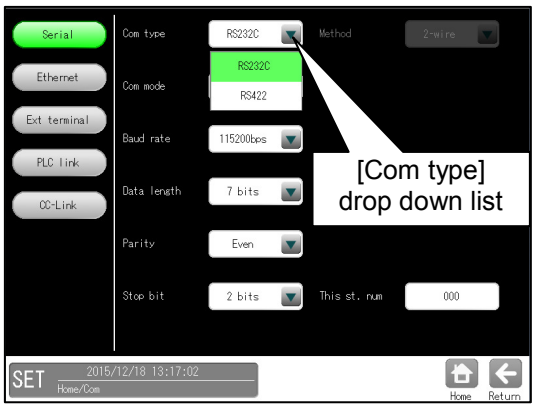
If you want to use the PLC link:

① Touch the [Com] icon on the (Home) SET screen.
The Communication setting screen will appear.



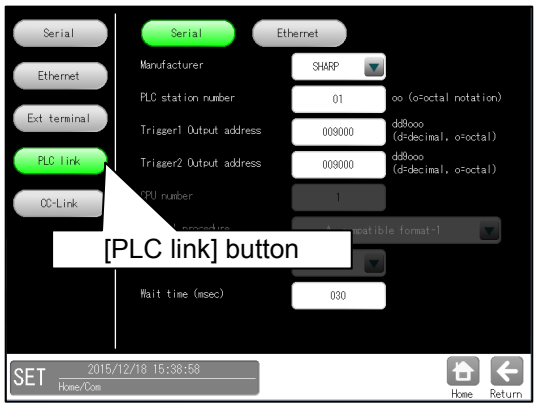


② Touch [Serial] button and select an output type from the [Com type] drop down list.
"RS-232C" or "RS-422"
Select “PLC link” from [Com mode] drop down list.

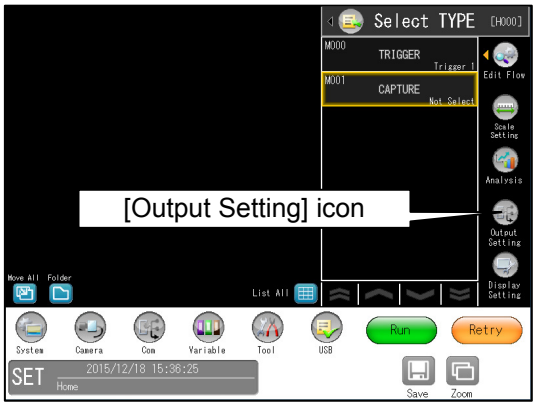


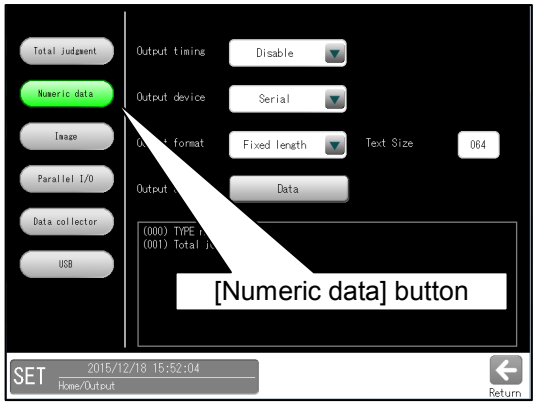
③ Set the items displayed, “Baud rate”, etc., based on the information written in 7.4.

④ Touch the [PLC link] button and set the items displayed, “Manufacturer”, etc.



⑤ Touch the [Output Setting] icon on the (Home) SET screen.
The Output setting screen will appear.

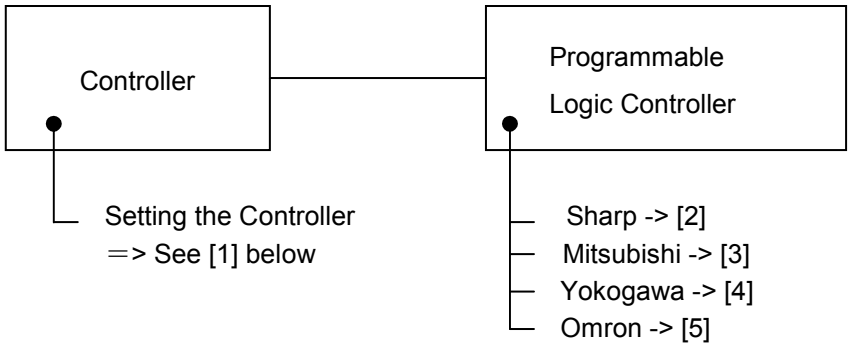




⑤ Touch the [Numeric data] button and set the items displayed, “Output timing”, etc.
=> See Section 4-4-22.

7-4 Interface

This section describes the interfaces with each manufacturer's PLC.



[1] Items to set on the Controller

Item	Setting detail
Baud rate (k-bit/sec)	115.2, 57.6, 38.4, 19.2, 9.6, 4.8, 2.4
Data length (bit)	7, 8
Parity	None, Odd, Even
Stop bit	1, 2
Error check	Checksum
Station number	・ Sharp: 00 to 37(8) ・ Mitsubishi: 00 to 31 ・ Yokogawa: 01 to 32 ・ Omron: 00 to 31
Write address (Max. 512 bytes)	・ Sharp: 009000 to 389777 ・ Mitsubishi: D0000 to D1023 (when using WW series) ・ Mitsubishi: D0000 to D9999 (when using QW series) ・ Yokogawa: D00001 to D16384 ・ Omron: DM0000 to DM9999
CPU No.	・ Yokogawa: 1 to 4

[2] Connection method for the Sharp PLC

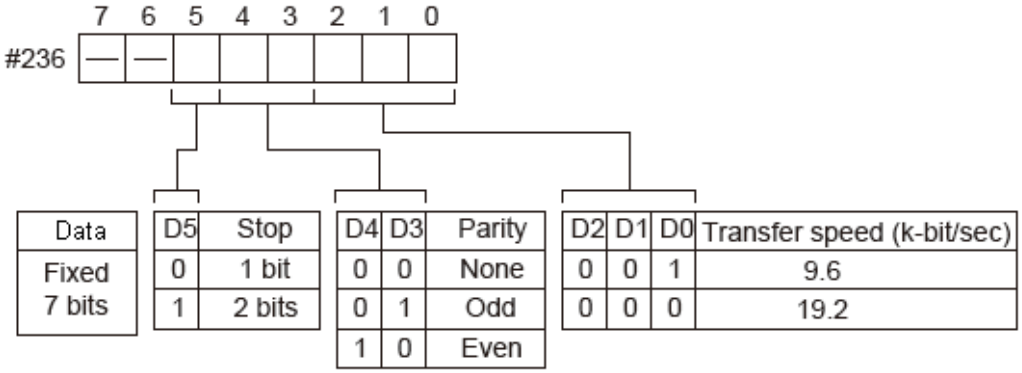
- **Connectable models**

1. Control module: JW-22CU (Compatible with ROM version 2.2 or higher)
   JW-70CUH/100CUH、JW-32CUS/33CUS
   JW-32CUS1/33CUS1/33CUS2/33CUS3
   JW-311CUS/312CUS/321CUS/322CUS/331CUS/
   JW-332CUS/341CUS/342CUS/352CUS/362CUS
2. Base module: JW-1324K/1342K/1424K/1442K/1624K/1642K
3. CPU board: Z-311J/312J
4. Link module: JW-21CM. JW-10CM
5. Communication board: Z-331J/332J

(1) PLC module setting

① For the JW-22CU, JW-70CUH/100CUH, Z-311J/312J

Set the communication port conditions in system memory #236 and #237.
Set the D0 to D5 bit in #236.



Data	D5	Stop
Fixed 7 bits	0	1 bit
	1	2 bits

D4	D3	Parity
0	0	None
0	1	Odd
1	0	Even

D2	D1	D0	Transfer speed (k-bit/sec)
0	0	1	9.6
0	0	0	19.2

#237 Station number (001 to $037_{(8)}$)

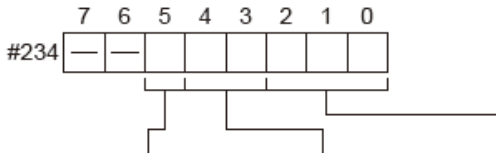
Set the station number assigned to the controller

Default is 000 for both #236 and #237.

② For the JW-32CUS/33CUS, JW-32CUS/33CUS

1. When using communication port 1 (PG/COMM1 port)

Set the communication port conditions in system memory #234 and #235.
Set the D0 to D5 bits in #234.
Connect the PG/COMM1 port only when connecting to an RS-422 device.



Data	D5	Stop
Fixed 7 bits	0	1 bit
	1	2 bits

D4	D3	Parity
0	0	None
0	1	Odd
1	0	Even

D2	D1	D0	Transfer speed (k-bit/sec)
0	0	1	9.6
0	0	0	19.2
1	1	1	38.4 *
1	1	0	57.6 *
1	0	1	115.2 *

* JW-32CUH1/33CUH1/33CUH2/33CUH3 only

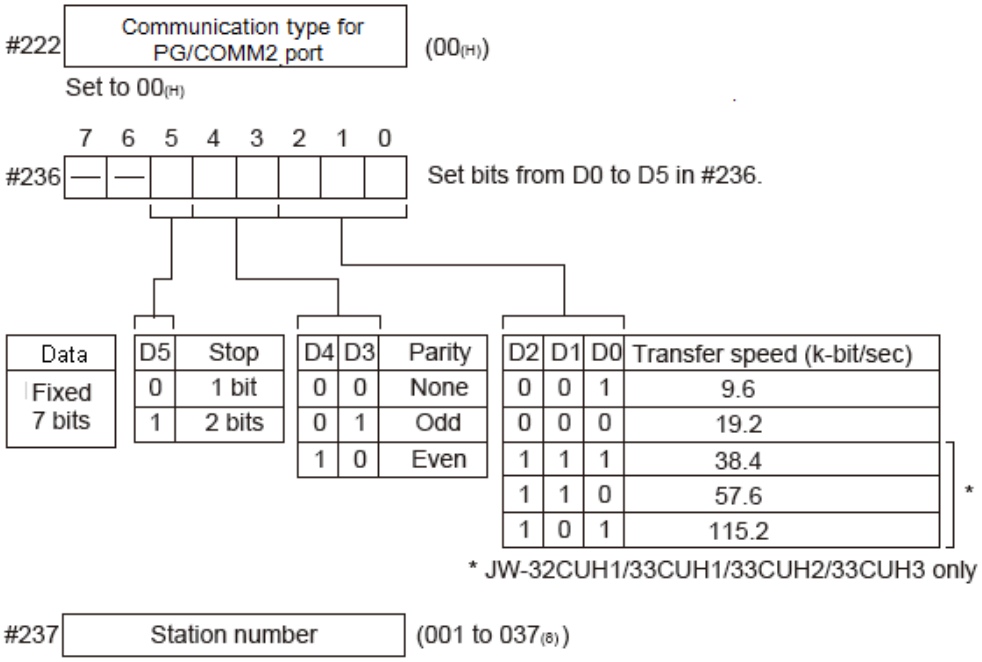
#235 Station number (001 to $037_{(8)}$)

Set the station number assigned to the controller.

Default is 000 for both #234 and #235.

2. When using communication port 2 (PG/COMM2 port)

Set the communication port conditions in system memory #222, #236, and #237.
You can connect the PG/COMM2 port to either a RS-232 or RS-422 device.

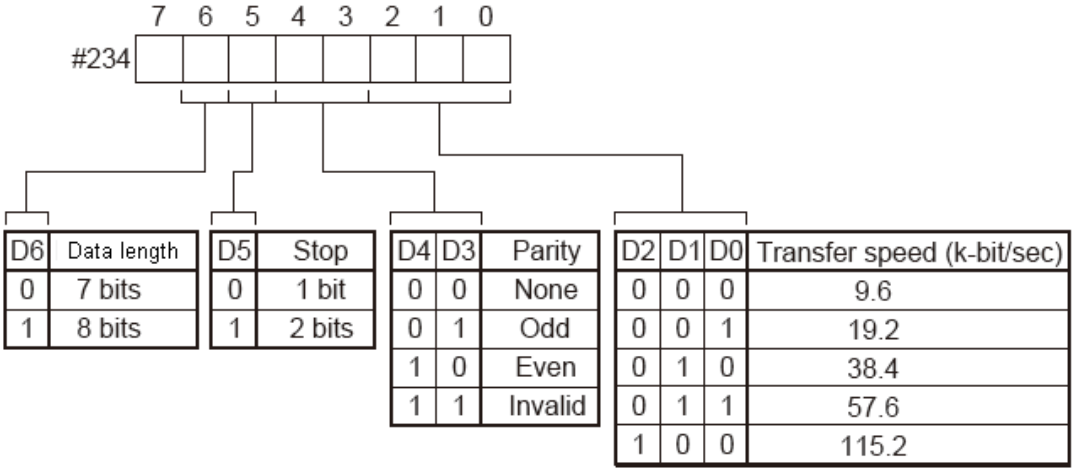


Set the station number assigned to the controller.

Default is 000 for #222, #236 and #237.

③ For the JW-311CUS/312CUS/321CUS/322CUS/331CUS/332CUS/341CUS/342CUS/352CUS/362CUS

Set the communication conditions for communication port 1 (PG/COMM1 port) to bits (D0 to D6) in #234.



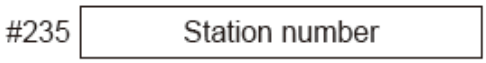
D6	Data length
0	7 bits
1	8 bits

D5	Stop
0	1 bit
1	2 bits

D4	D3	Parity
0	0	None
0	1	Odd
1	0	Even
1	1	Invalid

D2	D1	D0	Transfer speed (k-bit/sec)
0	0	0	9.6
0	0	1	19.2
0	1	0	38.4
0	1	1	57.6
1	0	0	115.2

The communication port is identical to the command mode on the JW-21CM Link Unit.
Set the station number (001 to $037_{(8)}$) in #235.



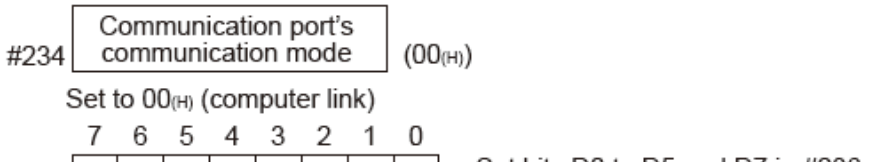
Set the station number assigned to controller.

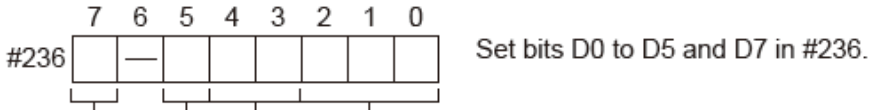
Default is 00(H) for both #234 and #235.

④ For the JW-1324K/1342K/1424K/1442K/1624K/1642K

1. When using the communication port

Set the communication port conditions in system memory #234, #236, and #237.



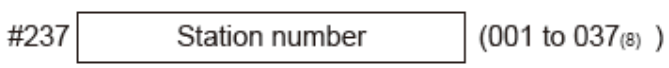


D7	Data length
0	7 bits
1	8 bits

D5	Stop
0	1 bit
1	2 bits

D4	D3	Parity
0	0	None
0	1	Odd
1	0	Even

D2	D1	D0	Transfer speed (k-bit/sec)
0	0	1	9.6
0	0	0	19.2
1	1	1	38.4

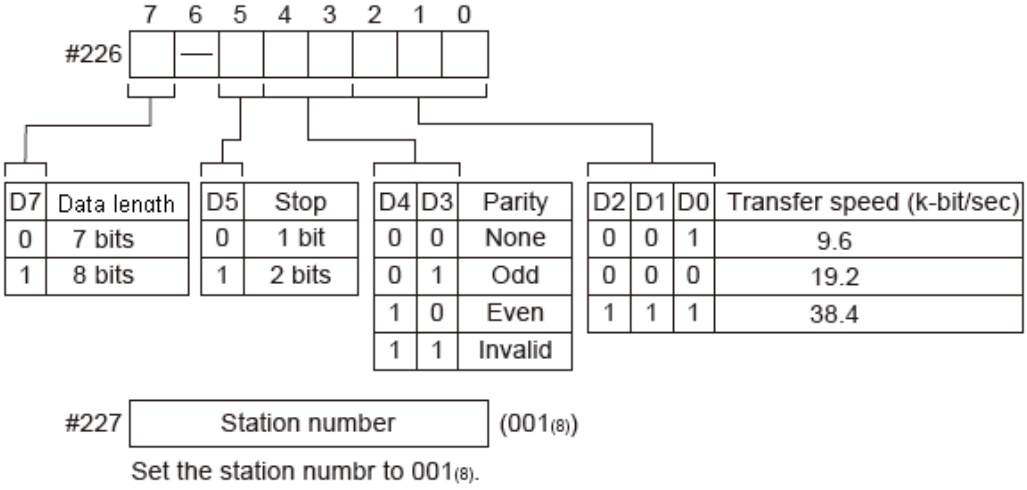


Set the station number assigned to the controller.

Default is 000 for #234, #236 and #237.

2. When using the MMI port

Set the conditions in system memory #226 and #227. Set D0 to D5 bit in #226.
When the MMI port is used, the controller and JW10 are connected 1:1.



D7	Data length
0	7 bits
1	8 bits

D5	Stop
0	1 bit
1	2 bits

D4	D3	Parity
0	0	None
0	1	Odd
1	0	Even
1	1	Invalid

D2	D1	D0	Transfer speed (k-bit/sec)
0	0	1	9.6
0	0	0	19.2
1	1	1	38.4

Default is 000 for #226 and #227.

⑤ For the JW-21CM or JW-10CM

Set the switches (SW0 to 4, 7) on the PLC module as follows.

Switch	Setting detail	Setting value
SW0	Command mode	4
SW1	Station number (lower)	01 to $37_{(8)}$
SW2	Station number (upper)	
SW3-1	Disabled	OFF
SW3-2	4 line system	ON
SW3-3	Disabled	OFF
SW3-4	Odd parity (OFF), Even parity (ON)	OFF or ON
SW4	Baud rate (k-bit/s) 19.2(0), 9.6(1)	0 or 1
SW7	Termination resistance	ON

⑥ For the Z-331J/332J

Set the switches (SW0 to 4, 7) on the board as follows.

Switch	Setting detail	Setting value
SW0	Computer link	4
SW1	Station number (lower)	01 to $37_{(8)}$
SW2	Station number (upper)	
SW3-1	Disabled	OFF
SW3-2	Only 2 line system is usable	OFF
SW3-3	Disabled	OFF
SW3-4	Odd parity (OFF), Even parity (ON)	OFF or ON
SW4	Baud rate (k-bit/s) 19.2(0), 9.6(1)	0 or 1
SW7	Termination resistance	ON

(2) Memory used

The result write start memory address used by the controller is within the range below.

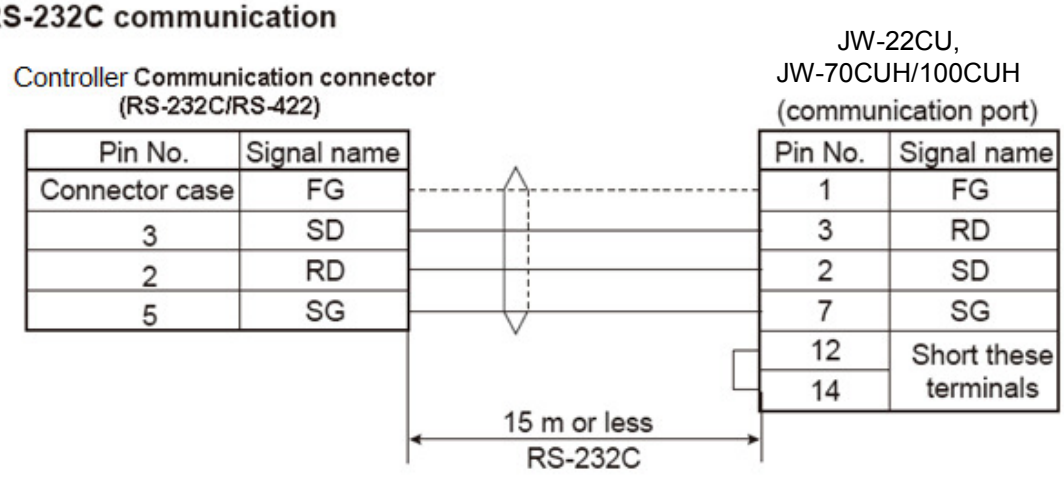
Memory	Setting range (address)
Register	09000 to 99776

(3) Wiring

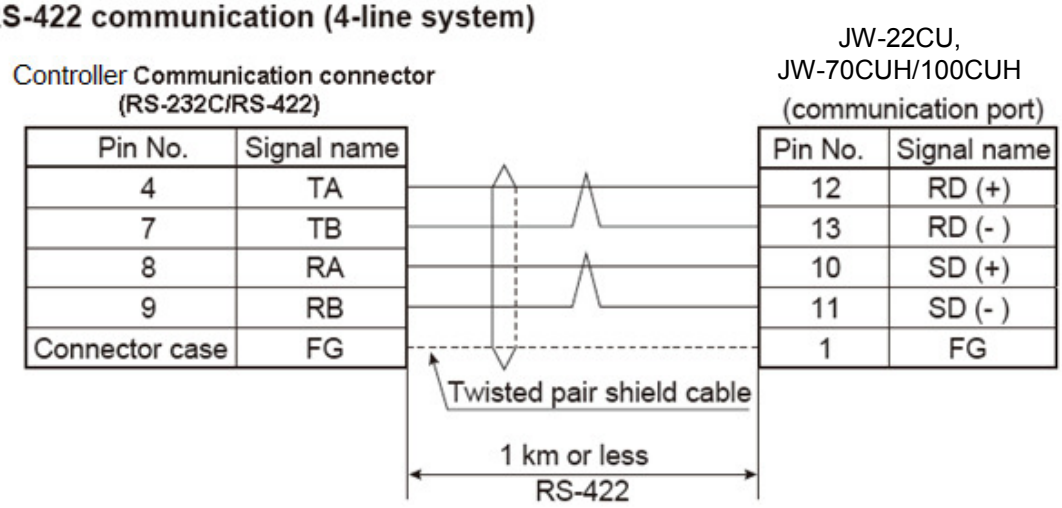
The figure below shows wiring example of the communication connector (serial interface connector) on the controller.

① For the JW-22CU, JW-70CUH/100CUH

1. RS-232C communication

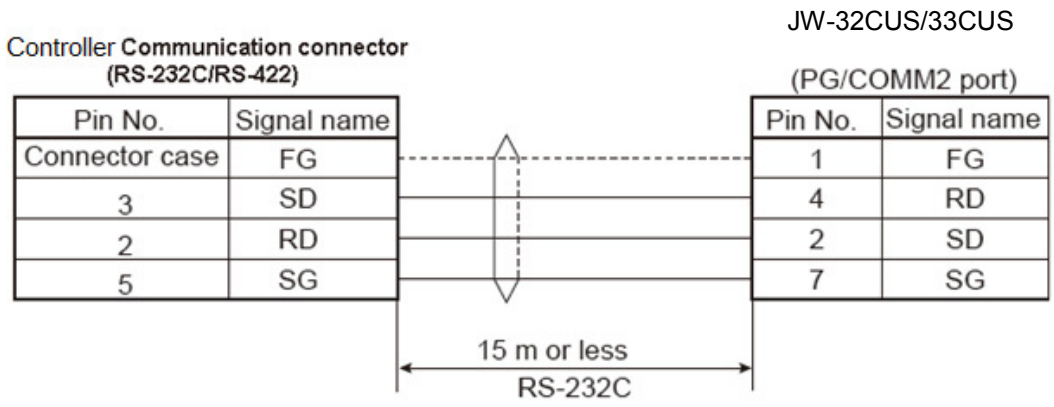


2. RS-422 communication (4-line system)

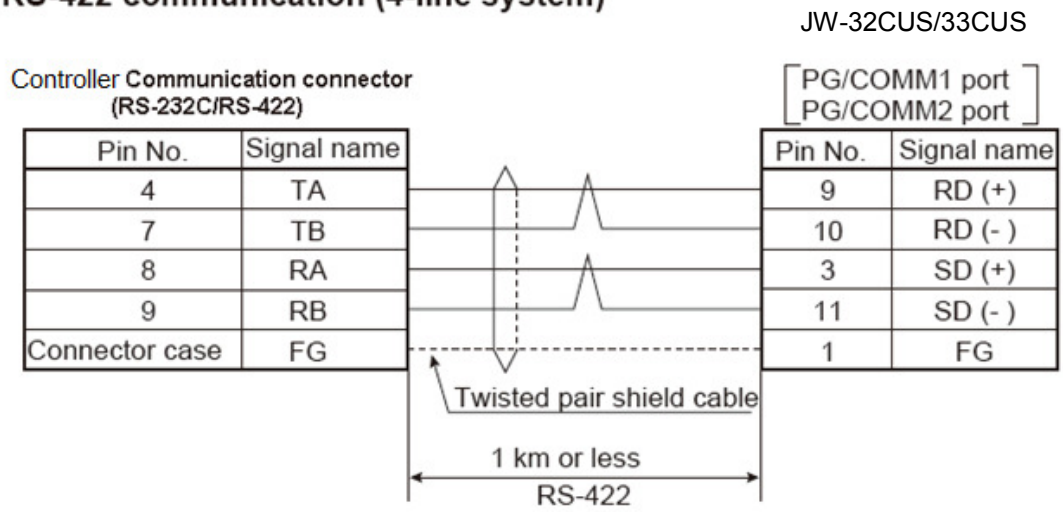


② For the JW-32CUS/33CUS

1. RS-232C communication



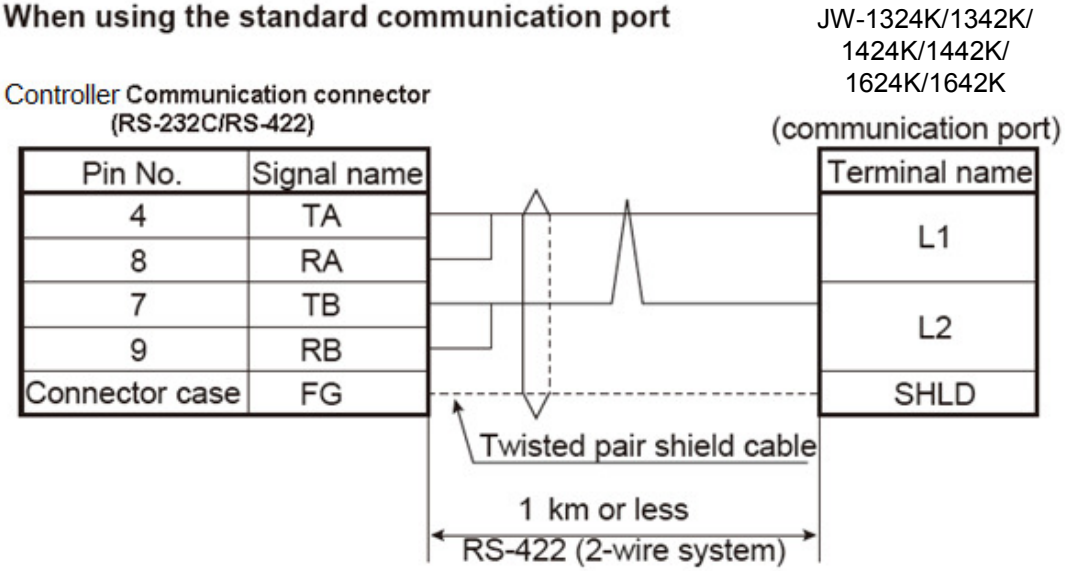
2. RS-422 communication (4-line system)



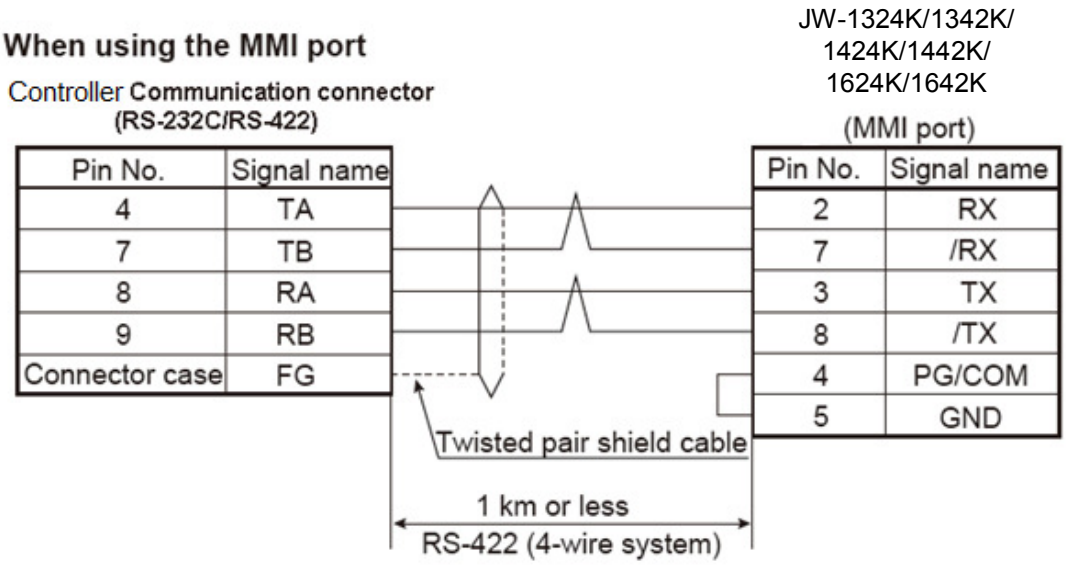
③ For the JW-1324K/1342K/1424K/1442K/1624K/1642K

Only use these models when connecting to an RS-422 device. When you use the standard communication port on these models, the assumption is a 2-line RS-422 system.
When you use the MMI port, the connection will be 4-line RS-422 system.

1. When using the standard communication port

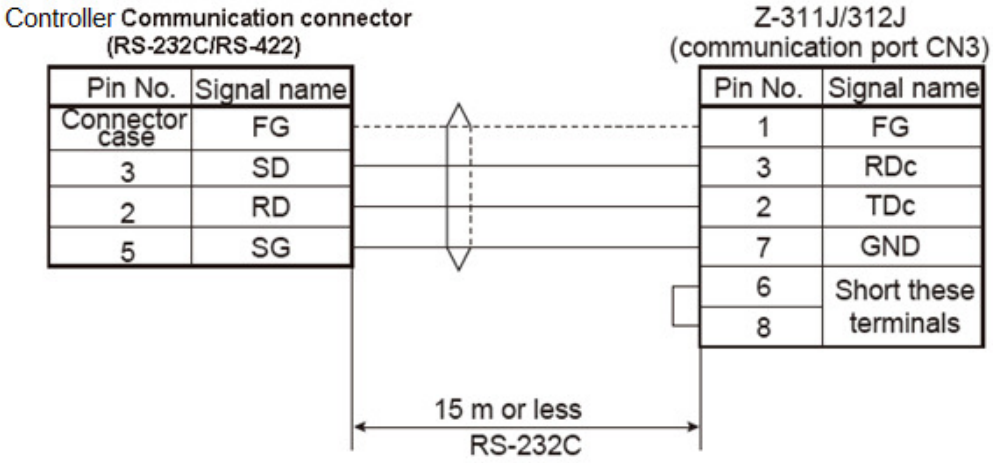


2. When using the MMI port

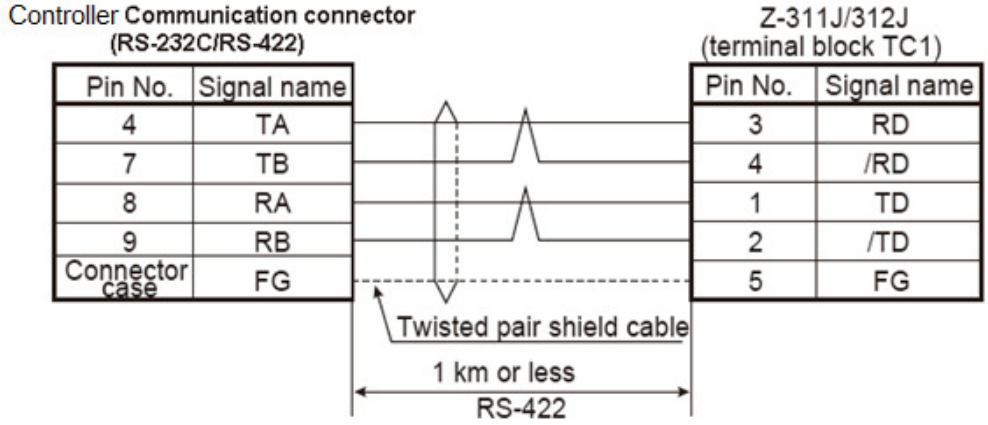


④ For the Z-311J/312J

1. RS-232C communication

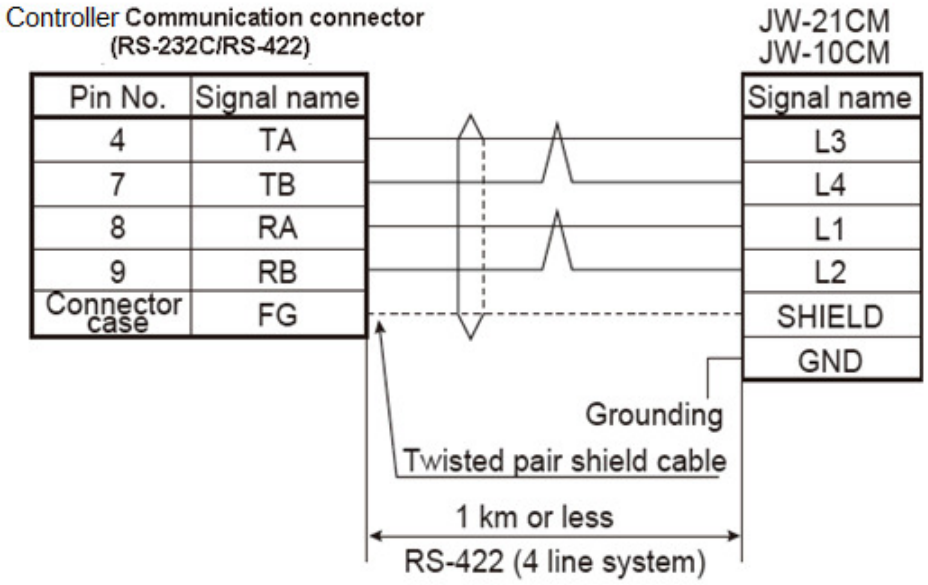


2. RS-422 communication (4-line system)



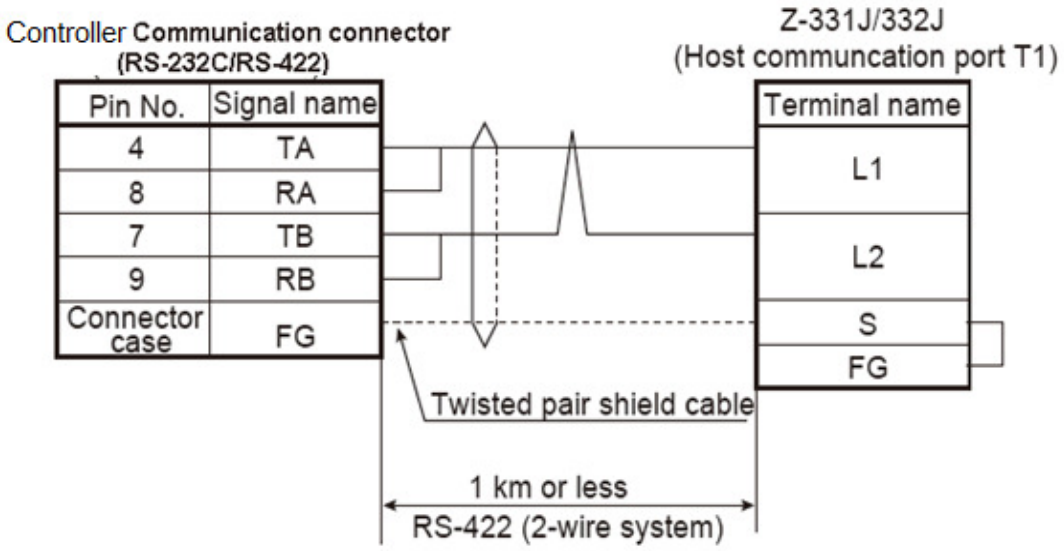
⑤ For the JW-21CM or JW-10CM

RS-422 communication (4-line system)



⑥ For the Z-331J/332J

RS-422 communication (2-line system)



[3] Connection method for the Mitsubishi PLC

● Connectable models

1. A-series computer link modules
   - AJ71C24-Sx (AnA, AnN)
     If the CPU is an AnA series and link unit version is S6 or newer, the connection can be set.
   - A1SJ71C24(A1S)
     The A1SJ71C24-R2 does not have station number switch, therefore the number for this is fixed to 00.
   - A0J72C24S1(A0J2) ・ AJ71UC24 ・ A1SJ71UC24
2. QnA-series
   - AJ71QC24 ・ A1SJ71QC24
3. FX-series
   - FX2/2C (V3.3 or newer) * ・ FXON(V1.20 or newer) * ・ FX1S/1N/1NC *
   - FX2N/2NC * ・ FX3U/3UC

   * FW series is not compatible with QW command.
4. Q series
   - QJ71C24N-R2 ・ QJ71C24N-R4 ・ QJ71C24 ・ QJ71C24-R2

(1) PLC module settings

① For the unit AJ71C24-Sx

Items		Setting detail
Transfer control procedure MODE (RS-232C)		Format 1 -> 1
Station number		00 to 31
Baud rate (k-bit/s)		19.2, 9.6
Parity		None, Odd, Even
Transfer code	Data bit	7, 8 bit (ASCII)
	Stop bit	1, 2 bits
Checksum		Yes
Write during RUN		Enable

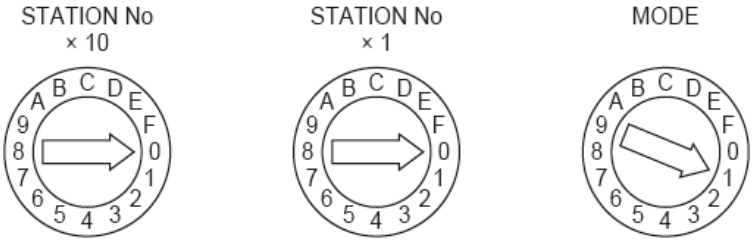
● **Switch setting**

[Example]

When setting an RS-232C device to

station number 00, transfer speed 19.2 k-bit/sec., even parity, data 7 bits, and 2 stop bits.

- 3 rotary dip switches



- Dip switch

SW11 to 13	SW14 to 24
OFF	ON

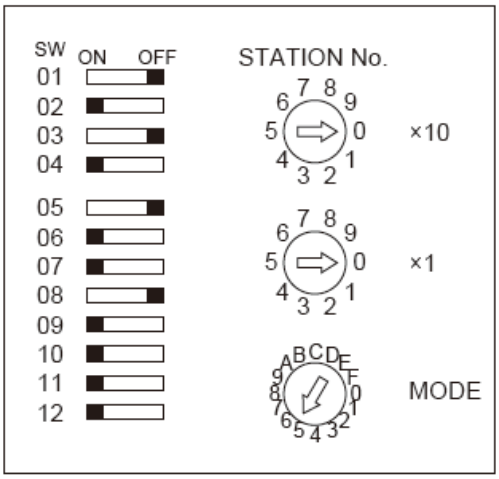
② **For the unit A1SJ71UC24-R4**

● **Switch setting**

[Example]

When setting RS-422, device to

transfer speed 19.2 k-bit/sec., even parity, and 2 stop bits.



(2) Memory used

For a memory used for the controller, set result write start address within the ranges below.

Memory	Setting range (address)
D (Data register)	0 to 9999 / 0 to 999900

[Note]

To write data from the controller to Mitsubishi PLC, use write commands WW/QW.

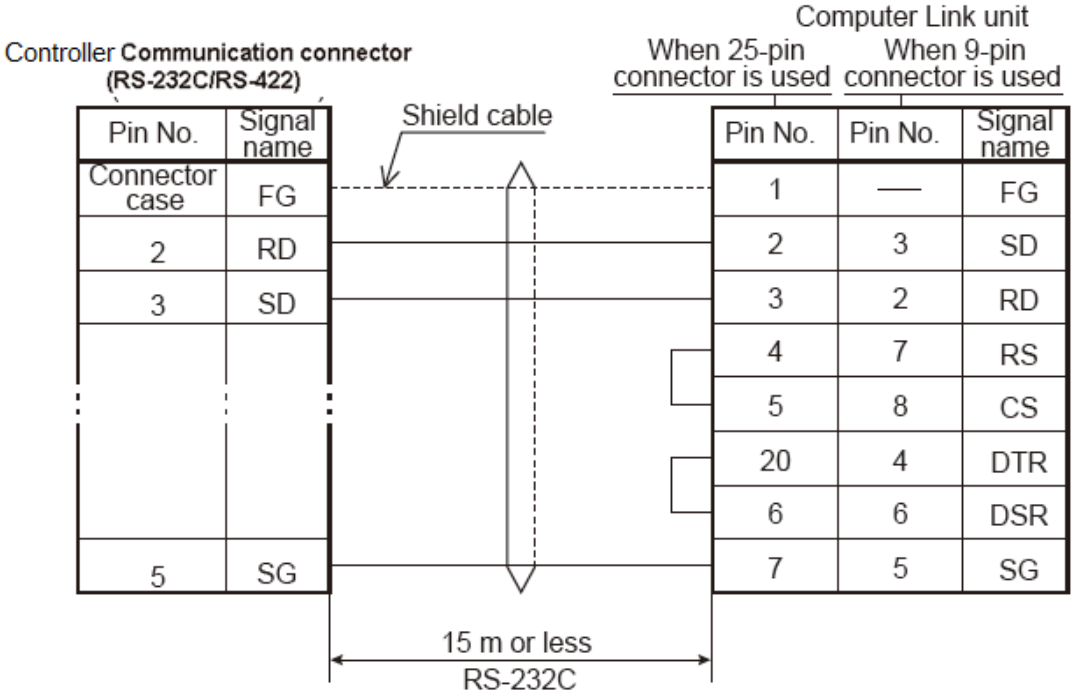
Writing range for write commands WW/QW are limited to D0000 to D1023/D000000 to D008191.

Thus, arrange such that the size of all the data to write becomes within these limitations.

(3) Wiring

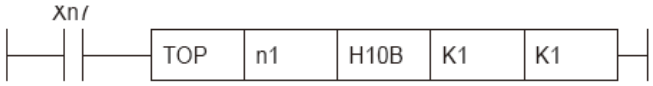
The figure below shows a wiring example for the controller communication connector (serial interface connector) on a computer link unit.

① For RS-232C communication

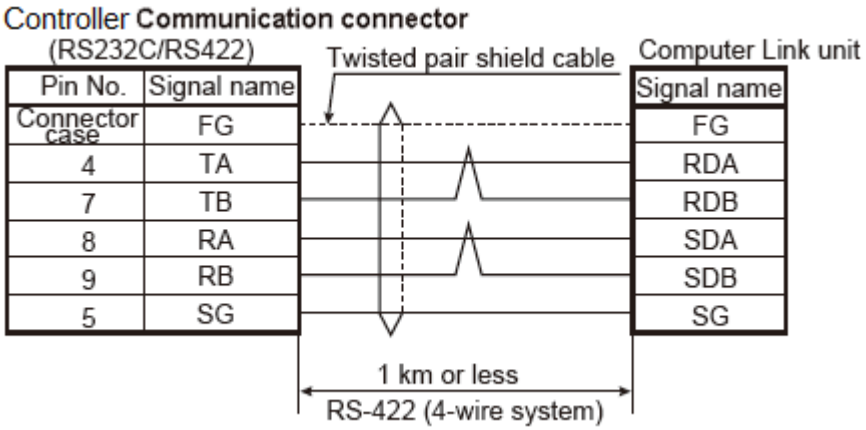


Remarks

- Include the following sequence in your program for RS-232C communication "Without a CD terminal" in the CD terminal check function.
  For details, see the manual for the Mitsubishi computer link unit.

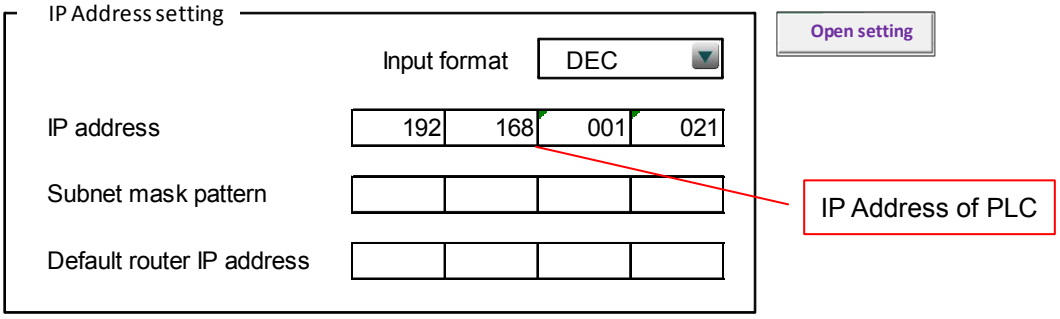


② For RS-422 communication



Setting Example of Mitsubishi PLC (GX Developer: when utilizing Ether Net port of CPU)

1. Start application, Mitsubishi MELSOFT GX Works 2, on PC.
   Start up menu -> “MELSOFT application” -> “GX Works2” -> “GX Works2”.
2. Select “Online” on menu bar and then “Read from PC”.
3. Touch “OK” button on the pop up window for “PLC Series ”with ”QCPU (Q mode)” displayed.
4. Touch “OK” button on the window for “Destination setting Connection 1”.
5. Touch “Execute” button on the window for “On line data setting”.
6. “Read from PC” pop up window will appear.
   Touch “Close” button after the reading is finished.
7. Touch “Close” button on the window for “On line data setting”.
8. Open “Q parameter setting” screen:
   Double click “Parameter” and then “PC Parameter” on the Project view.
9. Select “Built-in Ethernet port setting” tab and the following screen will appear.
   a. Setting of IP address
      Set the IP address of the PLC.



   b. Touch “Open setting” button.
      “Built-in Ethernet port setting” will pop up. Set the following items:

IP Address/Port No. Input Format: DEC

	Protocol	Open Systm	TCP Connection	Host Station Port No.	Destination IP Address	Destination Port No.
1	UDP	MC Protocol		5000		
2	TCP	MELSOFTConnection				
3	TCP	MELSOFTConnection				
4	TCP	MELSOFTConnection				
5	TCP	MELSOFTConnection				
6	TCP	MELSOFTConnection				
7	TCP	MELSOFTConnection				
8	TCP	MELSOFTConnection				
9	TCP	MELSOFTConnection				
10	TCP	MELSOFTConnection				
11	TCP	MELSOFTConnection				
12	TCP	MELSOFTConnection				
13	TCP	MELSOFTConnection				

Set these

      - Protocol
        Select the protocol the same as that set for the controller.
      - Open System
        In this example, select “MC Protocol” because UPD is set for the controller.
      - Host Station Port No.
        Set the port no. the same as that set for the controller.
        In this example, set IP Address/Port No. Input Format to “DEC” and set to “5000”.
   c. Touch “設定終了” or “Setting finished” button.
   d. Touch “設定終了” or “Setting finished” button on “Q parameter setting” screen.
   e. Save the project on MELSOFT Series GX Works2 screen.

[4] Connection method for the Yokogawa PLC

● **Connectable models**

PC Link Modules: F3LC11-1F、F3LC12-1F

(1) PLC module settings

Item	Setting detail
Data length (bit)	7, 8
Parity	None, Odd, Even
Stop bit	1, 2
Checksum	Yes
Final character (CR)	Yes
Protect function	No
Security function	No
Baud rate (k-bit/sec)	115.2, 57.6, 38.4, 19.2, 9.6, 4.8, 2.4
PC Link	Use

(2) Memory used

For a memory used for the device, set result write start address within the ranges below.

Memory	Setting range (address)
D (Data register)	1 to 16384

[5] Connection method for the Omron PLC

- **Connectable models**

Link Unit

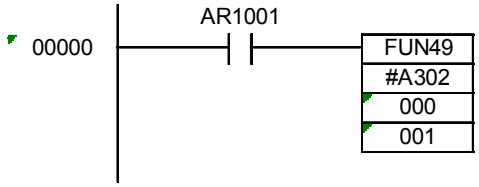
1. C500-LK203 (C1000H)
2. C200-LK201 (C200H RS-232C)
3. C200-LK202 (C200H RS-422)
4. CV CPU Link Port (CV100, CVM1)
5. CV500-LK201 (CV1000, CVM1)
6. CS1W-SCU21

Note:
Set the operation mode of the PLC to “Monitor Mode” when turning on the power according to the following information.
Computer link error will occur, if otherwise.

The operation mode setting of a PCL:

Connected Tool of PLC	Initial Mode Setting Switch of Memory Unit		
	OFF		ON
	Monitor Mode Set Bit of System Set (FUN49) command		
	0	1 ※1	
Other than programming console	Program Mode	Monitor Mode	Run Mode
No tools	Run Mode	Monitor Mode	Run Mode
Programming console	Set Mode for Programming console ※2		

※1: Add a ladder program like as follows at address 00000::



※2: In case of a programming console, set to Monitor mode with the switch.
See the operation manual of Omron’s PLC for details.

(1) PLC module settings

Item		Setting detail
Communication mode		Upper link (C mode command)
Station No.		00 - 31 ※
Baud rate (k-bit/sec)		19.2, 9.6
Command level		1
Parity		Odd, Even
Transfer code	Data bit	7 (ASCII)
	Stop bit	2
1:1/1: N protocol		1: N protocol
Synchronize switch		Internal synchronize
CTS switch		0 V (normally ON)
5V supply switch		OFF

※: This is the station number when CV500-LK201 is connected

For communication port 1: 00 (fixed) and for communication port 2: arbitrary (00 - 31).

(2) Memory used

For a memory used for the controller, set result write start address within the ranges below.

Memory	Setting range (address)
DM (Data register)	0 to 999

Note:

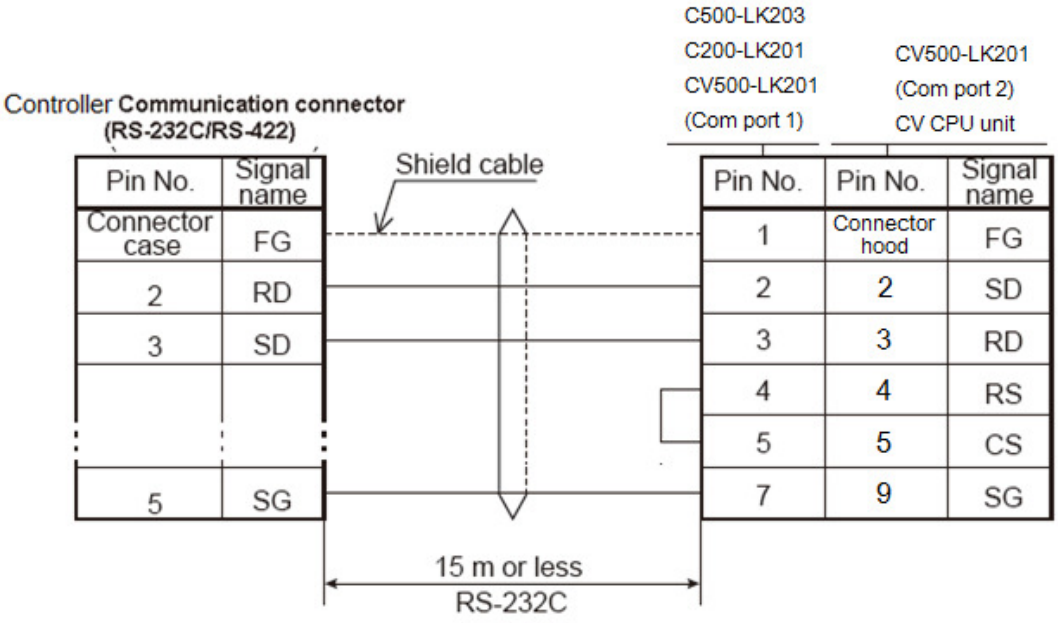
This device uses “DM area write” command of C mode command.

For the limitation of address setting, see the operation manual of Omron’s upper link.

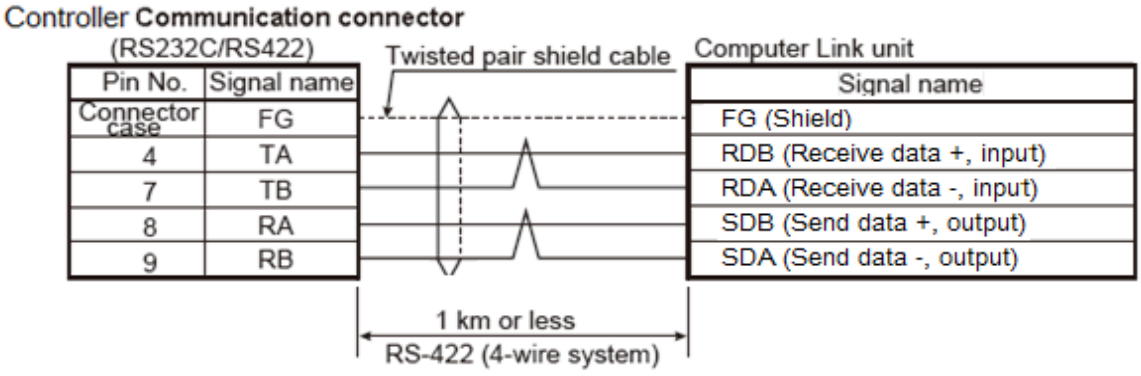
(3) Wiring

The figure below shows a wiring example for controller communication connector (serial interface connector).

① For RS-232C communication



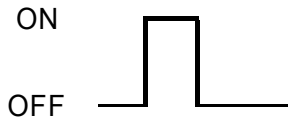
② For RS-422 communication



- Upper link mode supports only RS-422 (4-wire system).
- Depending on the connected device, the polarity (+ or -) of SDA/SDB and RDA/RDB is reversed. Be sure to check the specified polarity before connection.

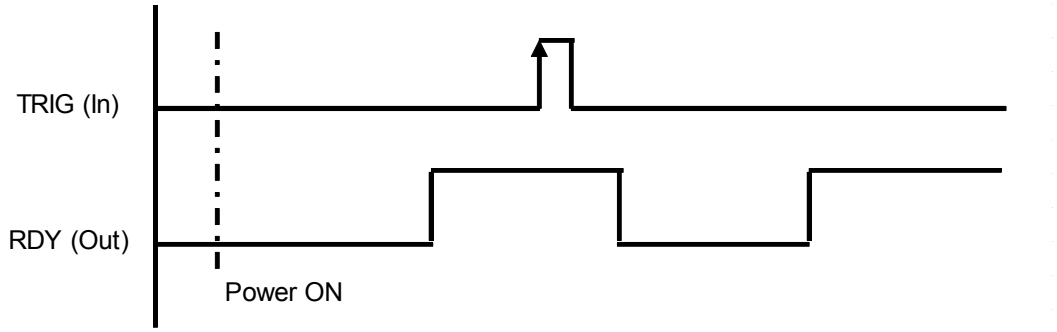
Section 8: Parallel Interface

This section describes input and output timing when the controller communicates with external equipment using the parallel I/O terminal or the dedicated I/O terminal.
The figure on the right shows the signal timing chart.
(The "ON" condition in the figure in the right refers to the state when the transistor is conducting.)



[1] Signal timings when booting up the controller

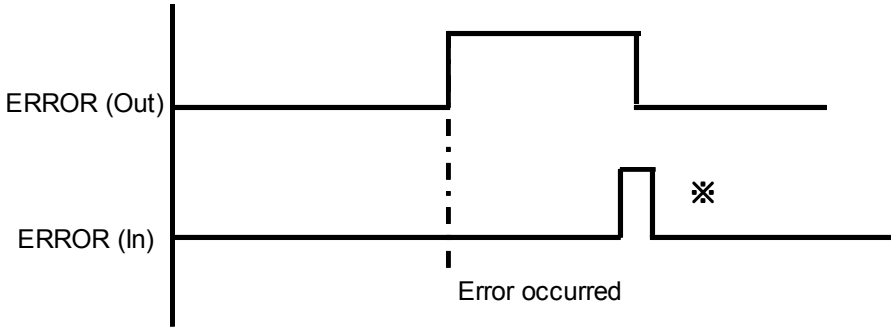
(1) Initial trigger after power on.



Identifies a Rising signal

- The signal will go from OFF to ON in a few tens of μsec.
- TRIG and CSTO signals are recognized at their rise timing when RDY signal goes on.

(2) Error and Reset (ERROR/RESET)



※ Error (Out) is output when an error occurred.
The output is reset when RESET (In) signal is received or Error Confirm button is touched.

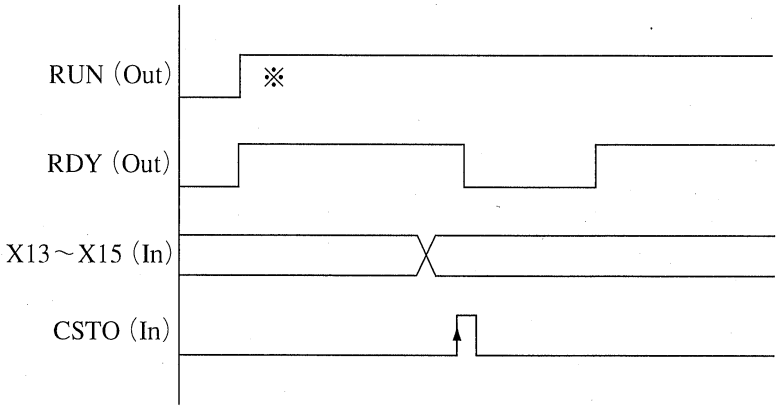
[2] Command input

X15	X14	X13	X12	X11	X10	X9	X8	X7	X6	X5	X4	X3	X2	X1	X0
Command			Argument												

List of command codes

X15	X14	X13	Function	Argument
OFF	OFF	OFF	Object Type change	Object Type (0 to 199)
ON	OFF	OFF	Reset Number of Inspection	Trigger No. (0, 1)

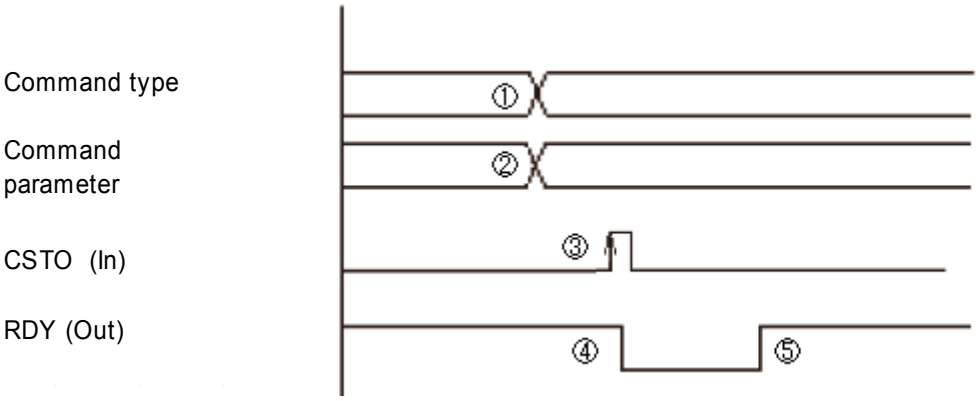
(1) Change object type number (1 Trigger mode)



※ Condition to accept commands: Run mode

Note: Make the CSTO ON time to 20 ms or more.

[Example] Change object type to 25 by parallel interface command:



① Set the "Object type number change" command in X15 to X13:
X15: 0 (OFF), X14: 0 (OFF), X13: 0 (OFF)

② Set the new object type number, 25, in X12 to X0.
- 25 (decimal) =11001 (binary). So, enter 0000000011001.
  X12 to X5: 0 (OFF)
  X4: 1 (ON)
  X3: 1 (ON)
  X2: 0 (OFF)
  X1: 0 (OFF)
  X0: 1 (ON)

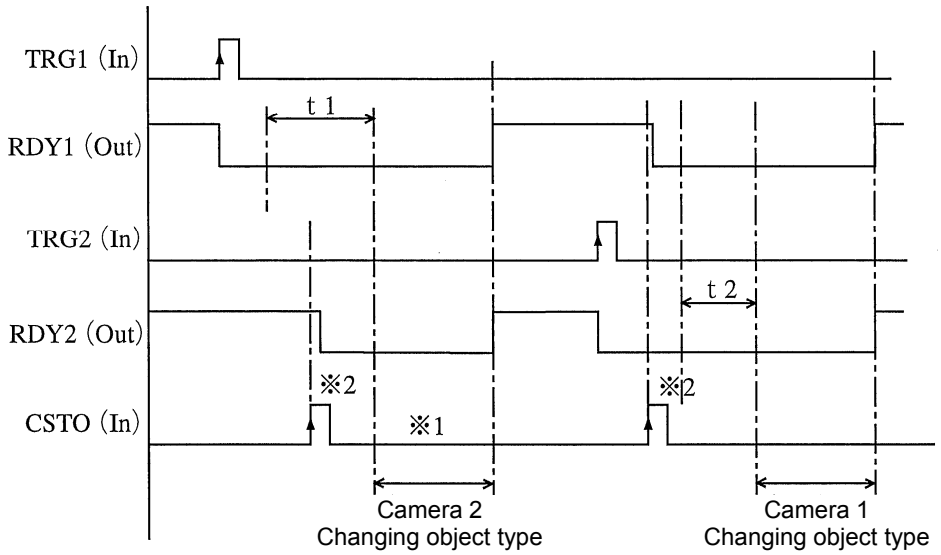
③ Turn on the CSTO input.

④ RDY goes OFF and the device starts changing the object type.

⑤ When the system completes the object type number change to 25, RDY will go on.

Note: The execute time of object type number change command depends on the settings.

(2) Change object type number (2 Trigger mode)

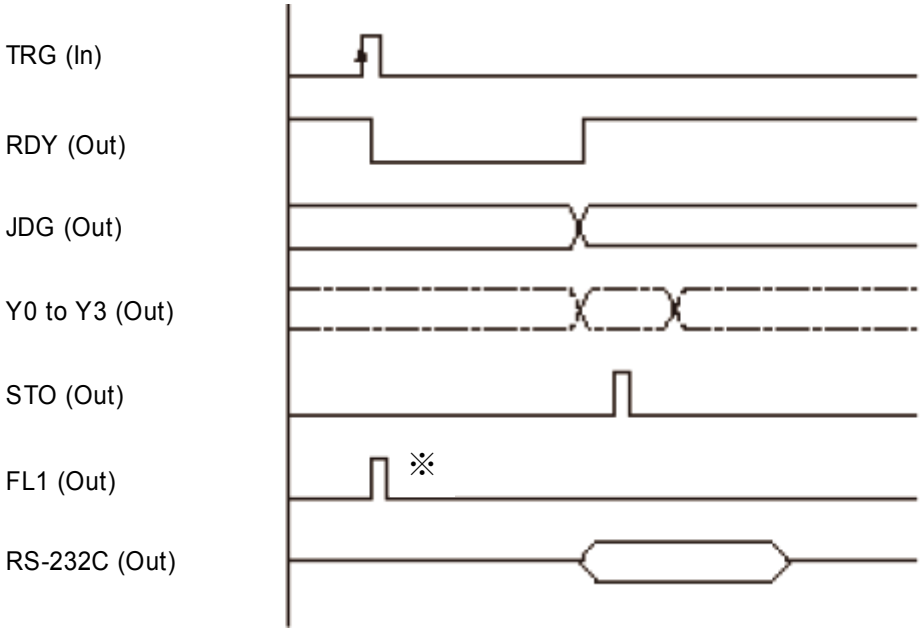


t1: Camera 1 image processing time
t2: Camera 1 image processing time

[3] External trigger input

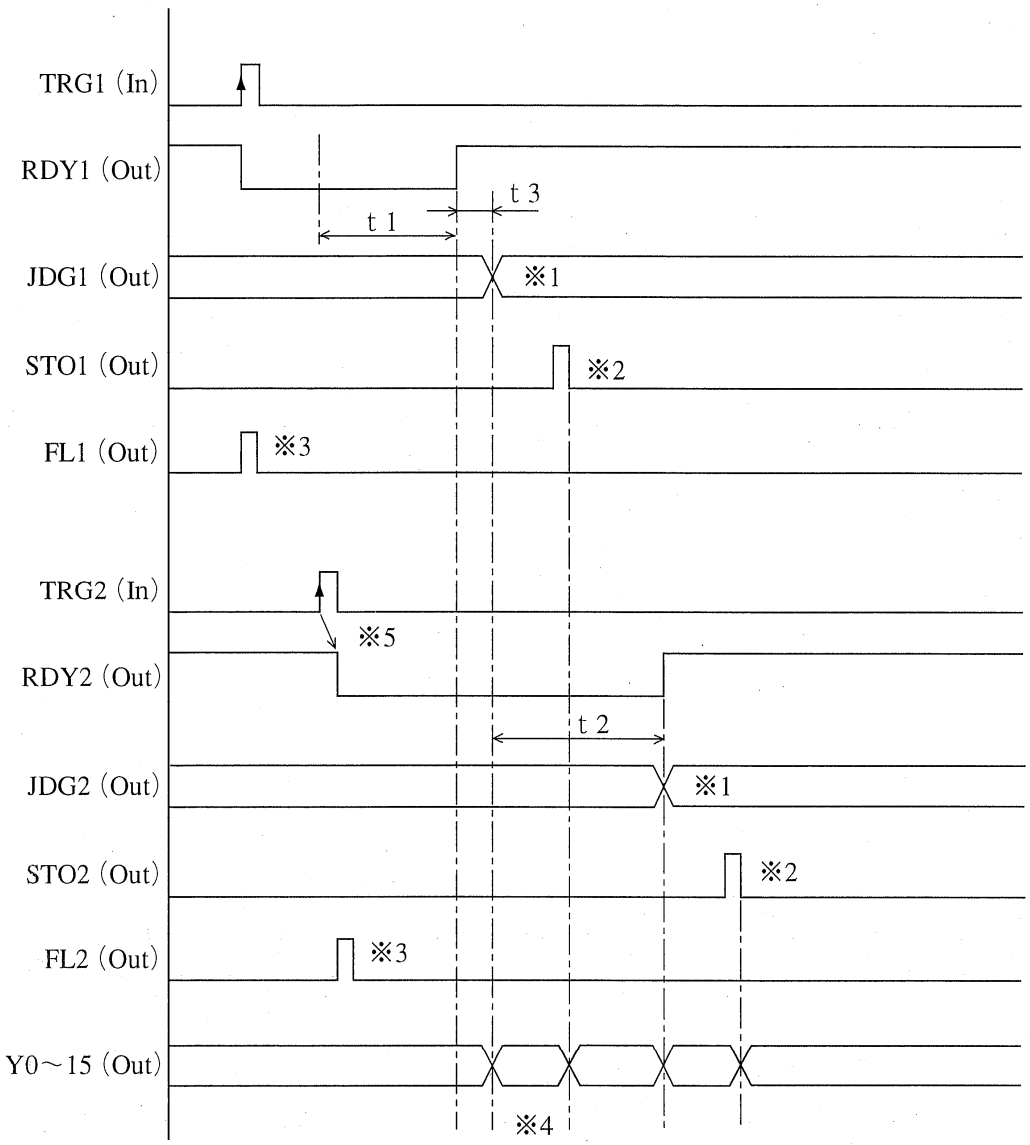
(1) General example

● **1 Trigger mode**



※ The FL1 output is used to turn on a flash light. (Refer to the (3) FL output timing)

● **2 Trigger mode**



t1: Camera 1 image processing time
t2: Camera 1 image processing time
t3: RDY1 is output faster than JDG1. So please use STO for result reading.

※1: The recognition of Total judgment (JDG) can be done upon STO signal ON.
※2: The STO goes ON after JDG signal is output with certain delay time.
※3: The FL1 output is used to turn on a flash light.
※4: The Y0 to Y15 output are set for each object type.
(See 4-4-22 Output setting [5] [Parallel I/O] button for the setting procedure.)
In 2 trigger mode, do not use the same output terminal by object types with different trigger.
※5: The RDY2 may have maximum 3mS delay different from RDY1 because of the Photocoupler used.

It is possible to trigger each camera independently when the RDY1 and RDY2 signals are ON.
Please calculate the trigger timing according to the following formula, for safe.

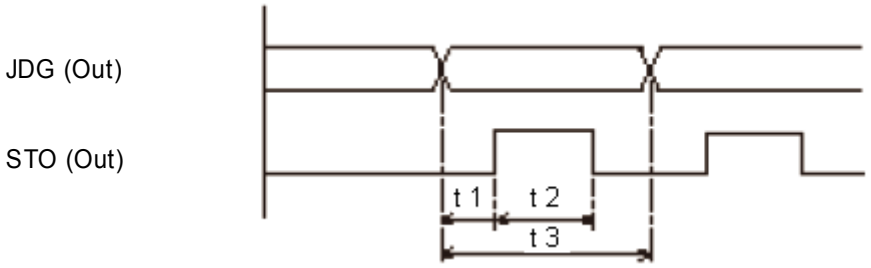
(Camera 1 Capture Time) + (Camera 2 Capture Time) + t1 + t2 + t3

Simple calculation method: Utilize the inspection time displayed on the screen

(Camera 1 inspection time) + (Camera 2 inspection time) + 5 ms

(2) STO output timing

The relationship between the JDG (total judgment) and STO (output timing) after the trigger input is shown in the figure below. The output time can be adjusted.



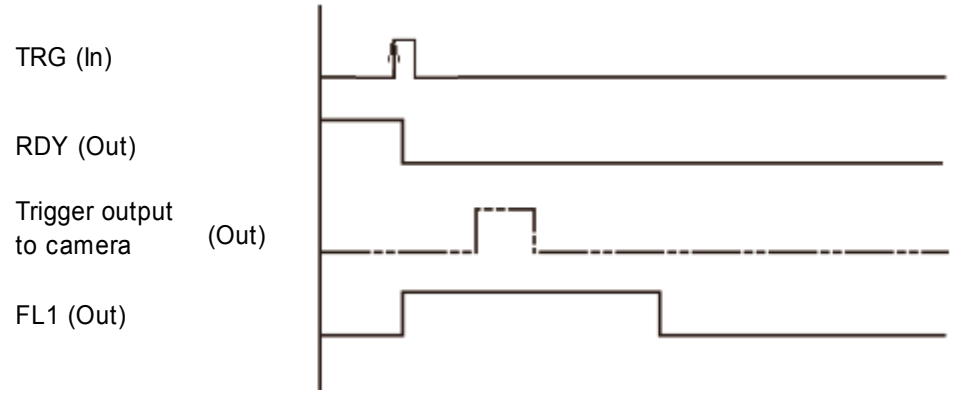
t 1: Output rising time (40 to 1000000 µsec)
t 2: Output time (40 to 1000000 µsec)
t 3: Output cycle time (40 to 1000000 µsec)

! Memo

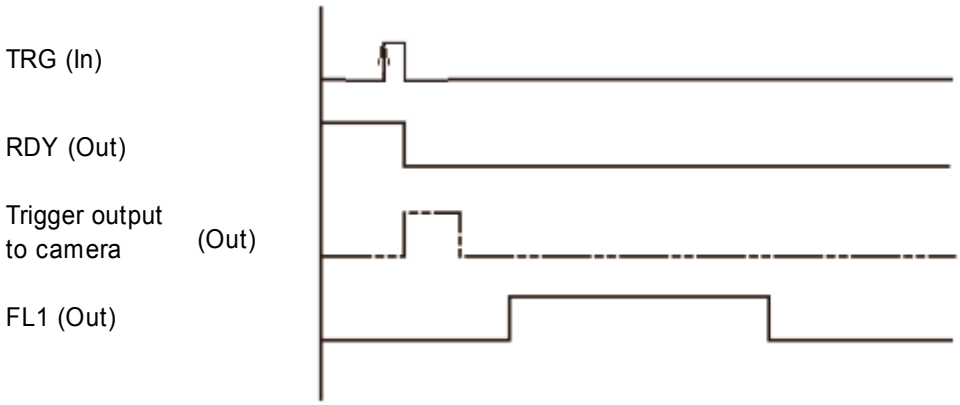
The controller outputs data at set interval and turns on STO at each data output.

(3) FL (Light strobe) output timing

・When the output timing is "Before starting image capture":



・When the output timing is "After started image capture":



! Reference

For details, see page 4-21

Section 9: CC-Link

This section describes about the communication between the controller (IV-S300M or IV-S310M) and Mitsubishi's PLC via CC-Link.

Note: This function is not available with IV-S300J.

9-1 CC-Link

The controller can be used as a remote device station of CC-Link Ver1.10.

The following functions can be realized by using CC-Link connection:

① Command control

② Data output

③ I/O control

[Note]

- As the nature of CC-Link, signal change may not be identified when it changes in high speed.
- The scan interval must be set by taking setting of connected device and the signal change time into account because it is affected by the setting of this device and other devices within the network.
- The scan interval of this device is 10 msec.

9-2 Specifications

[1] Setting Items of the controller

Setting Item	Set Range	Default Value
Station No.	01 to 64	01
Baud Rate	156kbps, 625kbps, 2.5Mbps, 5Mbps, 10Mbps	10Mbps
Number of Occupied Stations	2, 3, 4	4

[2] Remote Output/Remote Input

(1) Address Range

	2 Occupied Stations	3 Occupied Stations	4 Occupied Stations
RY	RY00 to RY3F	RY00 to RY5F	RY00 to RY7F
RX	RX00 to RX3F	RX00 to RX5F	RX00 to RX7F

(2) Address Format

RYdx, RXdx

- d: Decimal, 1 digit
- x: Hexadecimal, 1 digit

(3) RY Setting

Address	Signal Name	Remarks
RY00	TRG1	Functions as TRG1 input.
RY01	TRG2	Functions as TRG2 input.
RY02	RST	Functions as RST input.
RY03	CSTO	Functions as CSTO input. The command is executed at the rising edge (OFF→ON).
RY04 to RYnF	(Reserved)	

(4) RX Setting

Address	Signal Name	Remarks
RX00	RDY1	Functions as RDY1 output.
RX01	STO1	Functions as STO1 output.
RX02	JDG1	Functions as JDG1 output.
RX03	(Reserved)	
RX04	RDY2	Functions as RDY2 output.
RX05	STO2	Functions as STO2 output.
RX06	JDG2	Functions as JDG2 output.
RX07	(Reserved)	
RX08	(Reserved)	
RX09	RUN	Functions as RUN output.
RX0A	ERR	Functions as ERR output.
RX0B	CFIN	Turns ON after processed a command. Turns OFF when CSTO is made OFF.
RX0C to RX0F	(Reserved)	
RX10	Y00	Functions as Y00 output.
RX11	Y01	Functions as Y01 output.
RX12	Y02	Functions as Y02 output.
RX13	Y03	Functions as Y03 output.
RX14	Y04	Functions as Y04 output.
RX15	Y05	Functions as Y05 output.
RX16	Y06	Functions as Y06 output.
RX17	Y07	Functions as Y07 output.
RX18	Y08	Functions as Y08 output.
RX19	Y09	Functions as Y09 output.
RX1A	Y10	Functions as Y10 output.
RX1B	Y11	Functions as Y11 output.
RX1C	Y12	Functions as Y12 output.
RX1D	Y13	Functions as Y13 output.
RX1E	Y14	Functions as Y14 output.
RX1F	Y15	Functions as Y15 output.
RX20 to RXmF	(Reserved)	
RXn0 to RXnA	(Reserved)	
RXnB	RemoteReady	Functions as RemoteReady signal.
RXnC to RXnF	(Reserved)	

[3] Remote Register

(1) Address Range

	2 Occupied Stations	3 Occupied Stations	4 Occupied Stations
RWr	RWr00 to RWr07	RWr00 to RWr11	RWr00 to RWr15
RWw	RWw00 to RWw07	RWw00 to RWw11	RWw00 to RWw15

(2) Address Format

RWrdd, RWwdd

- d: Decimal, 2 digits

(3) RWw Setting

・When number of occupied stations is 4.

Address	Name	Remarks
RWw00	Command Number	Write Command Number
RWw01	Command Argument 1	Write Command Argument 1
RWw02	Command Argument 2	Write Command Argument 2
RWw03	Command Argument 3	Write Command Argument 3
RWw04	Command Argument 4	Write Command Argument 4
RWw05	Command Argument 5	Write Command Argument 5
RWw06	Command Argument 6	Write Command Argument 6
RWw07	Command Argument 7	Write Command Argument 7
RWw08	Command Argument 8	Write Command Argument 8
RWw09	Command Argument 9	Write Command Argument 9
RWw10	Command Argument 10	Write Command Argument 10
RWw11	Command Argument 11	Write Command Argument 11
RWw12	Command Argument 12	Write Command Argument 12
RWw13	Command Argument 13	Write Command Argument 13
RWw14	Command Argument 14	Write Command Argument 14
RWw15	Command Argument 15	Write Command Argument 15

(4) RWr Setting

・When number of occupied stations is 4.

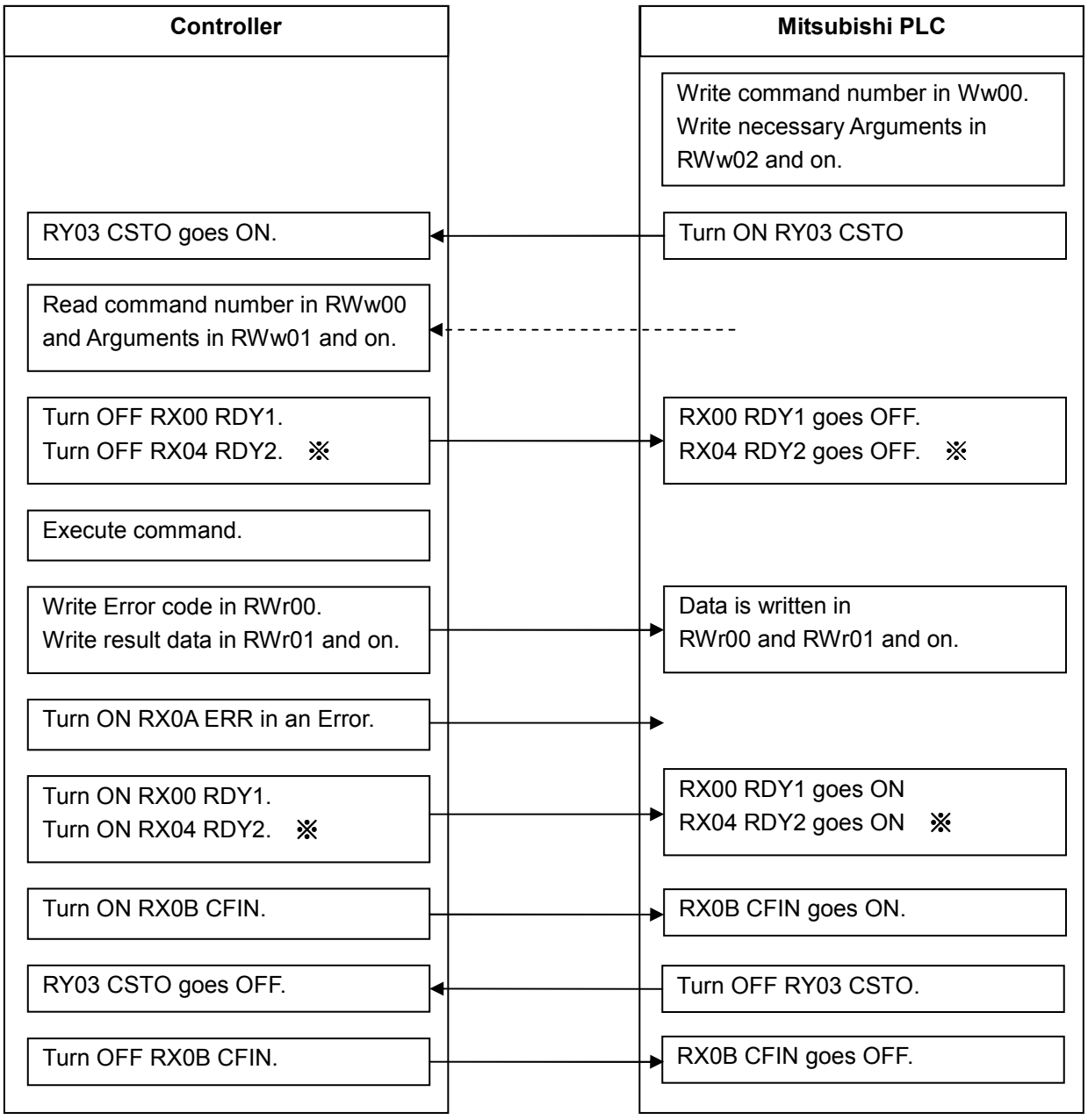
Address	Name	Remarks
RWr00	Command Result	Command execution result is written.
RWr01	Command Data 1	Output data 1 of the command is written.
RWr02	Command Data 2	Output data 2 of the command is written.
RWr03	Command Data 3	Output data 3 of the command is written.
RWr04	Command Data 4	Output data 4 of the command is written.
RWr05	Command Data 5	Output data 5 of the command is written.
RWr06	Command Data 6	Output data 6 of the command is written.
RWr07	Command Data 7	Output data 7 of the command is written.
RWr08	Command Data 8	Output data 8 of the command is written.
RWr09	Command Data 9	Output data 9 of the command is written.
RWr10	Command Data 10	Output data 10 of the command is written.
RWr11	Command Data 11	Output data 11 of the command is written.
RWr12	Command Data 12	Output data 12 of the command is written.
RWr13	Command Data 13	Output data 13 of the command is written.
RWr14	Command Data 14	Output data 14 of the command is written.
RWr15	Command Data 15	Output data 15 of the command is written.

9-3 Command Control

[1] General

The controller executes the command as assigned by the remote register, RWw00, when the CSTO signal for input/output register is turned ON.

The PLC checks that CFIN signal is ON and then turn OFF CSTO signal after the command is executed by the controller.

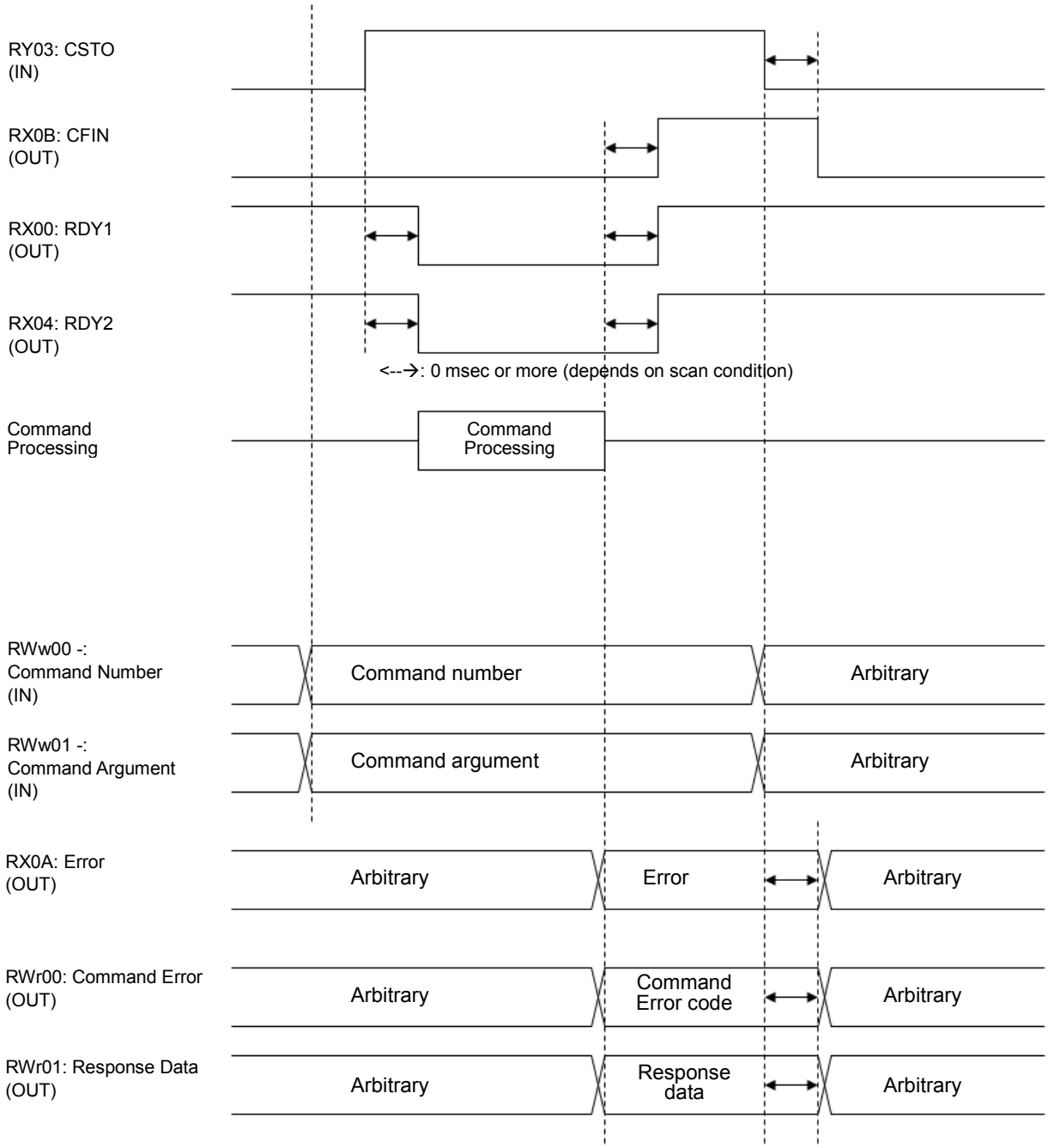


※: As to RDY1/RDY2 signal, the bit of CC-Link may not turn ON/OFF.
Use CFIN signal for handshaking.

[Note]

- As the nature of CC-Link, signal change may not be identified when it changes in high speed.
- The scan interval must be set by taking setting of connected device and the signal change time into account because it is affected by the setting of this device and other devices within the network.
- The scan interval of this device is 10 msec.

[2] Timing Chart



[Note]

As to RDY1/RDY2 signal, the bit of CC-Link may not turn ON/OFF.
Use CFIN signal for handshaking.

[3] Error Code

	Error Code (Hex)	Error	Description
1	00	Executed successfully	Executed command successfully.
2	10	Failed	Failed in command execution.
3	11	Unacceptable Command	Assigned command cannot be executed in the current mode.
4	12	Data range error.	Assigned data value is out of range.
5	13	Short of memory	Going to write data exceeding the assigned memory size.
6	14	Invalid command number	Assigned command does not exist.
7	30	Failed in saving setting	Failed in saving setting.
8	32	Failed in clock read	Failed in clock read.
9	33	Failed in clock write	Failed in clock write.
10	34	Variable out of range	Assigned variable is out of range.
11	35	Executing error	Command cannot be executed because executing other process.
12	36	No output result	No output result.
13	37	Object type not found	Assigned object type is not registered.
14	38	Object type number out of range	Assigned object type number is out of range.
15	39	Trigger number out of range	Assigned trigger number is out of range.
16	40	Failed in snap shot	Failed in snap shot.
17	60	Variable number out of range	Assigned variable number is out of range.
18	61	Variable out of range	Assigned variable value is out of range.

[4] Command List

No	Command	Command number	Argument	Response	Executable Mode
		RWw 00	RWw 01 -	RWr 001 -	
1	Object type number Read	1	—	Object type No.	Run
2	Object type number Write	2	Trigger No. Object type No.	—	Run
3	Inspection times Reset	4	Trigger No.	—	Run
4	Save setting	5	—	—	Run
5	Save snap shot image to USB flash drive	7	—	—	Run/SET
6	Variable Read	8	Variable No.	Value	Run
7	Variable Write	9	Variable No. Value	—	Run
8	Date/Time Read	10	—	Date/Time	Run/SET
9	Date/Time Write	11	Date/Time	—	Run/SET
10	Output data Read	12	Trigger No.	Output data	Run
11	OCV module Write string	20	Trigger No. Module No. Block No. Write position Write size String data	—	Run
12	OCV module Write string (Date offset)	21	Command number Trigger number Module number Block number Year offset Month offset Day offset	—	Run
13	Code Reader module Clear stored data	30	—	—	Run
14	Code Reader module Write data	31	Command number Write position Write size Data 1 to 13 to write	—	Run
15	Code Reader module Reflect stored data	32	Command number Trigger number Module number	—	Run

[5] Command Detail

(1) Object type number Read

Send

Address	Content	Remarks
RWw00	Command number	1

Receive

Address	Content	Remarks
RWr00	Error Code	
RWr01	Object type number1 (Trigger 1)	Object type number (000 to 199) of Trigger 1 is stored. When in 2 Trigger mode, (000 to 099) is stored.
RWr002	Object type number2 (Trigger 2)	Object type number (100 to 199) of Trigger 2 is stored. When in 1 Trigger mode, always 0.

(2) Object type number Write

Send

Address	Content	Remarks
RWw00	Command number	2
RWw01	Object type number	Assign object type number (0 to 199).

Receive

Address	Content	Remarks
RWr00	Error Code	

(3) Inspection times Reset

Send

Address	Content	Remarks
RWw00	Command number	4
RWw01	Trigger number	Assign the trigger number to reset inspection times. 0: Trigger 1, 1: Trigger 2

Receive

Address	Content	Remarks
RWr00	Error Code	

(4) Save Setting

Only the setting of the object type currently displayed on the screen is saved.

Send

Address	Content	Remarks
RWw00	Command number	5

Receive

Address	Content	Remarks
RWr00	Error Code	

(5) Save snap shot image to USB memory

Send

Address	Content	Remarks
RWw00	Command number	7

Receive

Address	Content	Remarks
RWr00	Error Code	

(6) Variable Read

Send

Address	Content	Remarks
RWw00	Command number	8
RWw01	Trigger number	Assign the Trigger number. 0: Trigger 1, 1: Trigger 2
RWw02	Variable number	Assign the Variable number (00 to 31).

Receive

Address	Content	Remarks
RWr00	Error Code	
RWr01	Variable	Variable value is stored. (The effective number of digits to be set by the controller) Variable is 2 word data and a number x 1000 is stored.
RWr02		

(7) Variable Write

Write a value to a variable.

Send

Address	Content	Remarks
RWw00	Command number	9
RWw01	Trigger number	Assign Trigger number 0: Trigger 1, 1: Trigger 2
RWw02	Variable number	Assign Variable number (00 to 31).
RWr03	Variable value	Assign a variable value. (The effective number of digits to be set by the controller) Variable is 2 word data and a number x 1000 is stored.
RWw04		

Receive

Address	Content	Remarks
RWr00	Error Code	

(8) Date/Time Read

Read Date/Time setting.

Send

Address	Content	Remarks
RWw000	Command number	10

Receive

Address	Content	Remarks
RWr00	Error Code	
RWr01	Year	Year (2000 to 2099) is stored.
RWr02	Month	Month (1 to 12) is stored
RWr03	Day	Day (1 to 31) is stored.
RWr04	Hour	Hour (0 to 23) is stored.
RWr05	Minute	Minute (0 to 59) is stored.
RWr06	Second	Second (0 to 59) is stored

(9) Date/Time Write

Write Date/Time.

Send

Address	Content	Remarks
RWw00	Command number.	11
RWw01	Year	Assign the Year (2000 to 2099).
RWw02	Month	Assign the Month (1 to 12).
RWw03	Day	Assign the Day (1 to 31).
RWw04	Hour	Assign the Hour (0 to 23)
RWw05	Minute	Assign the Minute (0 to 59)
RWw06	Sec	Assign the Second (0 to 59)

Receive

Address	Content	Remarks
RWr00	Error Code	

(10) Output data Read

Read the latest output data. (See 9-4 for the detail)

Send

Address	Content	Remarks
RWw00	Command number	12
RWw01	Trigger number	Assign the Trigger number to write Object type number. 0: Trigger 1, 1: Trigger 2

Receive

● When 1 Trigger is selected

Address	Content	Remarks
RWr00	Error Code	Error Code is stored
RWr01	Output data	Output data is stored.
:	:	:
:	:	:
RWr15	Output data	Output data is stored.

[Note]

1: This is the example when number of occupied stations is 4.
The maximum address number changes depending on the setting for the number of occupied stations.

2: When the output data exceeds the maximum address number, the data are sent by multiple sending.

● When 2 Trigger is selected

Address	Content	Remarks
RWr00	Error code	Trigger 1 Error Code is stored
RWr01	Output data	Trigger 1 Output data is stored.
:		
RWr07	Output data	Trigger 1 Error Code is stored
RWr08	Error code	Trigger 2 Error Code is stored
RWr09	Output data	Trigger 2 Output data is stored.
:		
RWr15	Output data	Trigger 2 Output Code is stored

[Note]

1: This is the example when number of occupied stations is 4.
The maximum address number changes depending on the setting for the number of occupied stations.

2: When the output data exceeds the maximum address number, the data are sent by multiple
sending.

(11) OCV module - Write string

Write set string for the OCV module.

Send

Address	Content	Remarks
RWw00	Command number	20
RWw01	Trigger number	Assign the Trigger number. 0: Trigger 1, 1: Trigger 2
RWw02	Module number	Assign the module number (0 to 127)
RWw03	Block number	Assign the block number (0 to 7)
RWw04	Write position	Assign the start byte to write (0 -) of the assigned block number
RWw05	Write size	Assign the byte size of the string (1 -)
RWw06	String data 1	1st byte
:	:	
RWw15	String data 10	10th byte

Receive

Address	Content	Remarks
RWr00	Error Code	

[Note]

1: String type must be “Fixed” or “Variable”.
2: Assign 1 byte data to 1 address for string data.
3: Assign string data by ASCII or Shift-JIS code.
4: When sending 2-byte code Shift-JIS, send it in the order of
Upper byte and then lower byte.
Example: For sending “日” (0x93 0xFA), send “0x93” and then “0xFA”.
5: Assign “NULL” (0) at the end of a string.
6: Write size includes the “NULL” (0) at the end of a string.
Example: When writing 4 characters, assign “5” (=4+1).
7: The string is not stored in the USB flash drive during executing this command.
Execute setting-save command, command number 5, after executing this command, if necessary

Example: When writing “1234ABCD” to Block 1 of Module005 (Trigger number 1)

Send

Address	Content	Data	Data (Decimal)	
RWw00	Command number	20	20	0x14
RWw01	Trigger number	0	0	0x00
RWw02	Module number	5	5	0x05
RWw03	Block number	1	1	0x01
RWw04	Write position	0	0	0x00
RWw05	Write size	9	9	0x09
RWw06	String data 1	1	49	0x31
RWw07	String data 2	2	50	0x32
RWw08	String data 3	3	51	0x33
RWw09	String data 4	4	52	0x34
RWw10	String data 5	A	65	0x41
RWw11	String data 6	B	66	0x42
RWw12	String data 7	C	67	0x43
RWw13	String data 8	D	68	0x44
RWw14	String data 9	NULL	0	0x00
RWw15	String data 10			

Example: When writing “製造” to Block 0 of Module003 (Trigger number 1)

Send

Address	Content	Data	Data (Decimal)	
RWw00	Command number	20	20	0x14
RWw01	Trigger number	0	0	0x00
RWw02	Module number	3	3	0x03
RWw03	Block number	0	0	0x00
RWw04	Write position	0	0	0x00
RWw05	Write size	5	5	0x05
RWw06	String data 1	製	144	0x90
RWw07	String data 2		187	0xBB
RWw08	String data 3	造	145	0x91
RWw09	String data 4		162	0xA2
RWw10	String data 5	NULL	0	0x00
RWw11	String data 6			
RWw12	String data 7			
RWw13	String data 8			
RWw14	String data 9			
RWw15	String data 10			

(12) OCV module - Write string (Date offset)

Write the date offset value of set string of the OCV module.

Send

Address	Content	Remarks
RWw00	Command number	21
RWw01	Trigger number	Assign the Trigger number. 0: Trigger 1, 1: Trigger 2
RWw02	Module number	Assign the module number (0 to 127)
RWw03	Block number	Assign the block number (0 to 7)
RWw04	Year offset	Assign the offset for year (-999 to 999)
RWw05	Month offset	Assign the offset for month (-999 to 999)
RWw06	Day offset	Assign the offset for date (-999 to 999)

Receive

Address	Content	Remarks
RWr00	Error Code	

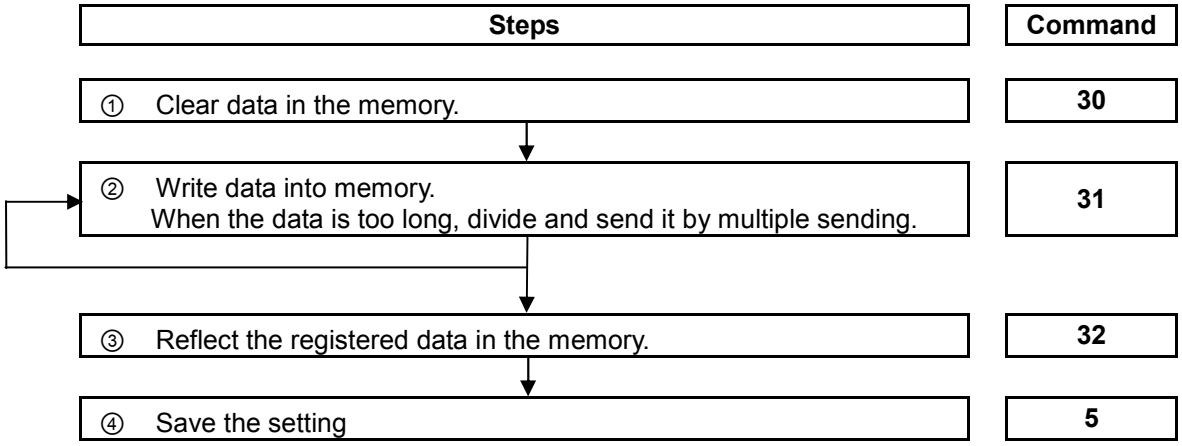
[Note]

1: String type must be “Date”.

2: The string is not stored in the USB flash drive during executing this command. Execute setting save command, command number 5, after executing this command, if necessary

(13) Code Reader module

Write the registered data for code reader module according to the following steps:



① Clear data in a memory.

Send

Address	Content	Remarks
RWw00	Command number	30

Receive

Address	Content	Remarks
RWr00	Error Code	

② Write data into memory.

When the data is too long, divide and send it by multiple sending.

Send

Address	Content	Remarks
RWw00	Command number	31
RWw01	Write position	Assign byte to start writing (1 ～)
RWw02	Write size	Assign number of bytes to write (1 ～)
RWw03	Data 1 to store	1st byte
:	:	:
RWw15	Data 13 to store	13th byte

Receive

Address	Content	Remarks
RWr00	Error Code	

[Note]

1: Assign 1 byte data to 1 address for the data to store.
3: Assign data to store by ASCII or Shift-JIS code.
4: When sending 2-byte code Shift-JIS, send it in the order of
Upper byte and then lower byte.
Example: For sending "日" (0x93 0xFA), send "0x93" and then "0xFA".
5: Assign "NULL" (0) at the end of a string.
6: Write size includes the "NULL" (0) at the end of a string.
Example: When writing 4 characters, assign "5" (=4+1).
7: Add FNC1 (0x1D) at the top when an application identifier (AI) is required for GS1 Code.

③ Reflect the registered data in the memory.

Send

Address	Content	Remarks
RWw00	Command number	32
RWw01	Trigger number	Assign trigger number 0 or 1 (0: Trigger 1, 1: Trigger 2)
RWw02	Module number	Assign module number (0 ～ 127)

Receive

Address	Content	Remarks
RWr00	Error Code	

[Note]

1: The Stored data is not stored in the USB flash drive during executing this command. Execute setting save command, command number 5, after executing this command, if necessary

2: Add FNC1 (0x1D) at the top when an application identifier (AI) is required for GS1 Code.

9-4 Data Output

Set Data are output after the inspection has been completed.
Output format is the same as that of Command 12.

- For output setting details, see Section 4-4-22 “Output settings."

In case of 2 word (4 byte, 32 bit) data, it is output in the order of lower 1 word and then upper 1 word.

Address	Content	Remarks
RWr01	Data 1	In case of 1 word
RWr02	Data 2 (Lower 1 word)	In case of 2 word
RWr03	Data 2 (Upper 1 word)	

● When 1 Trigger is selected

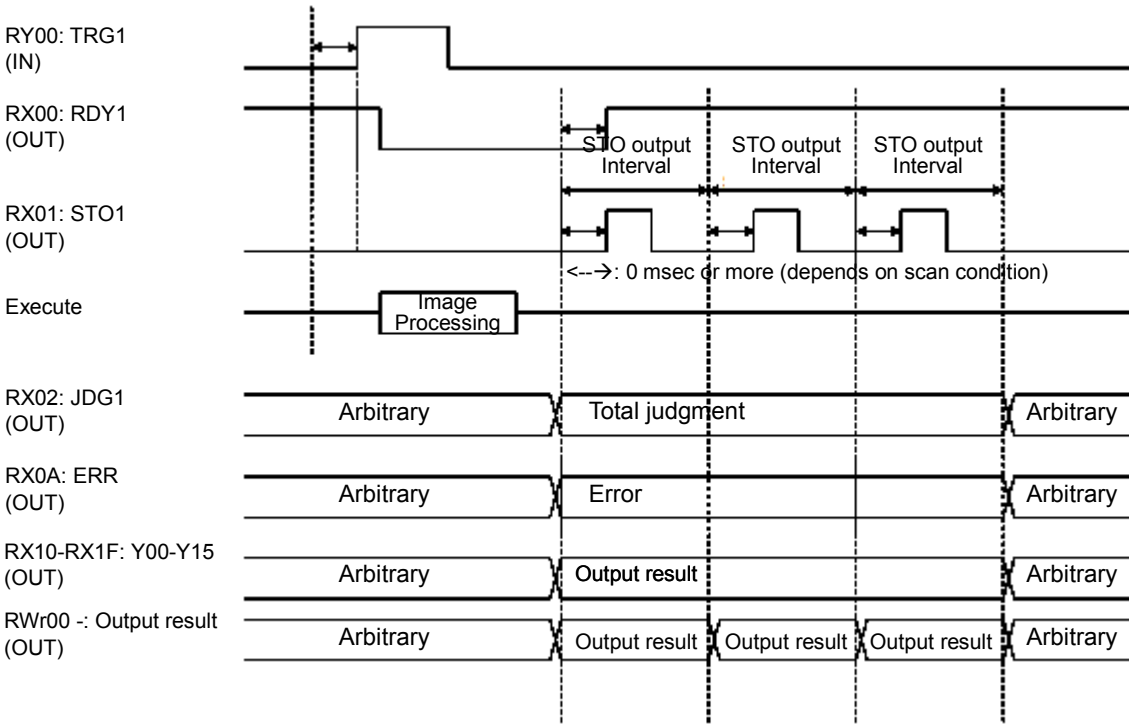
Address	Content	Remarks
RWr01	Error Code	Error Code is stored.
RWr01	Output data	Output data is stored.
:	:	:
RWr15	Output data	Output data is stored.

[Note]

1: This is the example when number of occupied stations is 4.
The maximum address changes depending on the setting for the number of occupied stations.
2: When the output data exceeds the maximum address, the data are sent by multiple sending.

When the data are sent by multiple sending, the second time and on are as follows:

Address	Content	Remarks
RWr00	Output data	Output data is stored.
:	:	:
RWr15	Output data	Output data is stored.



● **When 1 Trigger is selected (When outputting 22 of 2 word data)**

Address	Content (1ST)	Content (1ST)	Content (2ND)
RWr00	Error Code	Output data 8 (upper)	Output data 16 (upper)
RWr01	Output data 1 (lower)	Output data 9 (lower)	Output data 17 (lower)
RWr02	Output data 1 (upper)	Output data 9 (upper)	Output data 17 (upper)
RWr03	Output data 2 (lower)	Output data 10 (lower)	Output data 18 (lower)
RWr04	Output data 2(upper)	Output data 10 (upper)	Output data 18 (upper)
RWr05	Output data 3 (lower)	Output data 11 (lower)	Output data 19 (lower)
RWr06	Output data 3 (upper)	Output data 11 (upper)	Output data 19 (upper)
RWr07	Output data 4 (lower)	Output data 12 (lower)	Output data 20 (lower)
RWr08	Output data 4 (upper)	Output data 12 (upper)	Output data 20 (upper)
RWr09	Output data 5 (lower)	Output data 13 (lower)	Output data 21 (lower)
RWr10	Output data 5 (upper)	Output data 13 (upper)	Output data 21 (upper)
RWr11	Output data 6 (lower)	Output data 14 (lower)	Output data 22 (lower)
RWr12	Output data 6 (upper)	Output data 14 (upper)	Output data 22 (upper)
RWr13	Output data 7 (lower)	Output data 15 (lower)	← No change
RWr14	Output data 7 (upper)	Output data 15 (upper)	← No change
RWr15	Output data 8 (lower)	Output data 16 (lower)	← No change

[Note]
This is the example when number of occupied stations is 4.
The maximum address changes depending on the setting for the number of occupied stations.

● **When 2 Trigger is selected**

Address	Content	Remarks
RWr00	Error Code (Trigger 1)	Trigger 1 Error Code is stored
RWr01	Output data (Trigger 1)	Trigger 1 Output data is stored.
:	:	:
RWr07	Output data (Trigger 1)	Trigger 1 Output data is stored.
RWr08	Error Code (Trigger 2)	Trigger 2 Error Code is stored
RWr09	Output data (Trigger 2)	Trigger 2 Output data is stored.
:	:	:
RWr15	Output data (Trigger 2)	Trigger 2 Output data is stored.

[Note]
1: This is the example when number of occupied stations is 4.
The maximum address changes depending on the setting for the number of occupied stations.
2: When the output data exceeds the maximum address, the data are sent by multiple sending.

When the data are sent by multiple sending, the second time and on are as follows:

Address	Content	Remarks
RWr00	Output data (Trigger 1)	Trigger 1 output data is stored.
:	:	:
RWr07	Output data (Trigger 1)	Trigger 1 output data is stored.
RWr08	Output data (Trigger 2)	Trigger 2 output data is stored.
:	:	:
RWr15	Output data (Trigger 2)	Trigger 2 output data is stored.

● **When 2 Trigger is selected (When outputting 10 of 2 word data of 1 Trigger)**

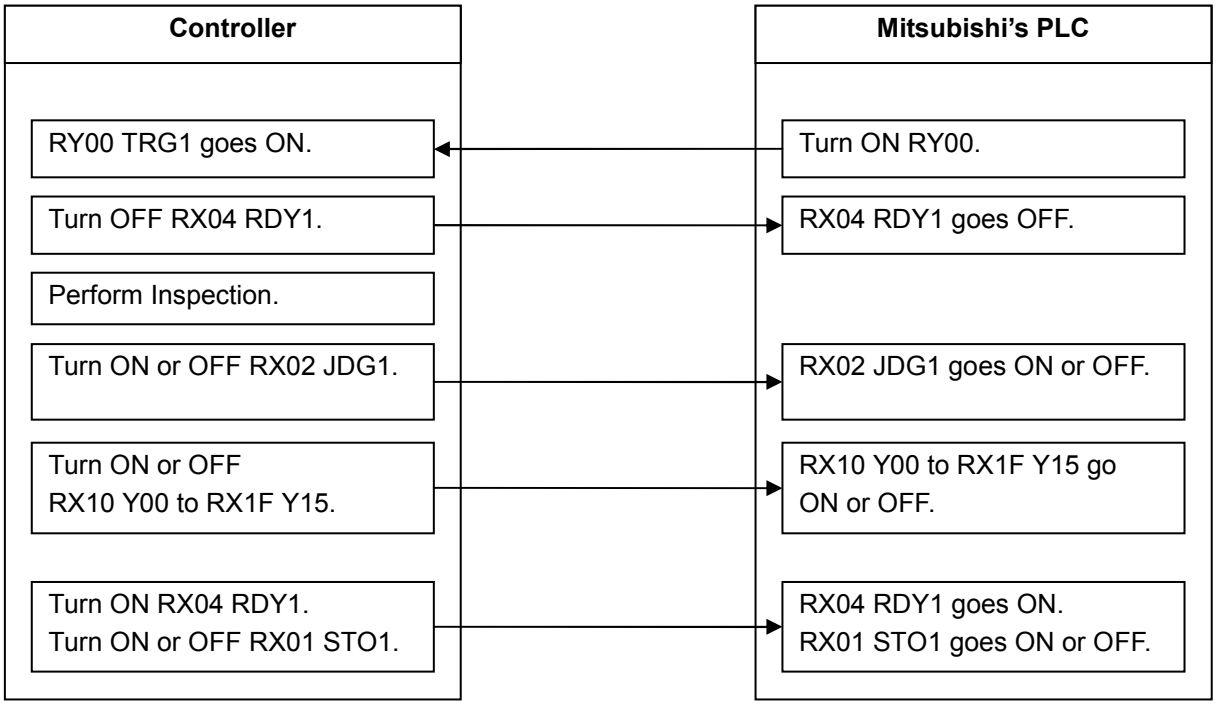
Address	Content (1ST)	Content (1ST)	Content (2ND)
RWr00	Error Code	Output data 4 (upper)	Output data 8 (upper)
RWr01	Output data 1 (lower)	Output data 5 (lower)	Output data 9 (lower)
RWr02	Output data 1 (upper)	Output data 5 (upper)	Output data 9 (upper)
RWr03	Output data 2 (lower)	Output data 6 (lower)	Output data 10 (lower)
RWr04	Output data 2(upper)	Output data 6 (upper)	Output data 10 (upper)
RWr05	Output data 3 (lower)	Output data 7 (lower)	← No change
RWr06	Output data 3 (upper)	Output data 7 (upper)	← No change
RWr07	Output data 4 (lower)	Output data 8 (lower)	← No change
RWr08	Output data of Trigger 2	Output data of Trigger 2	Output data of Trigger 2
:	:	:	:
RWr15	Output data of Trigger 2	Output data of Trigger 2	Output data of Trigger 2

[Note]
This is the example when number of occupied stations is 4.
The maximum address changes depending on the setting for the number of occupied stations.

9-5 I/O Control

Input and Output signals assigned to remote I/O can be controlled.

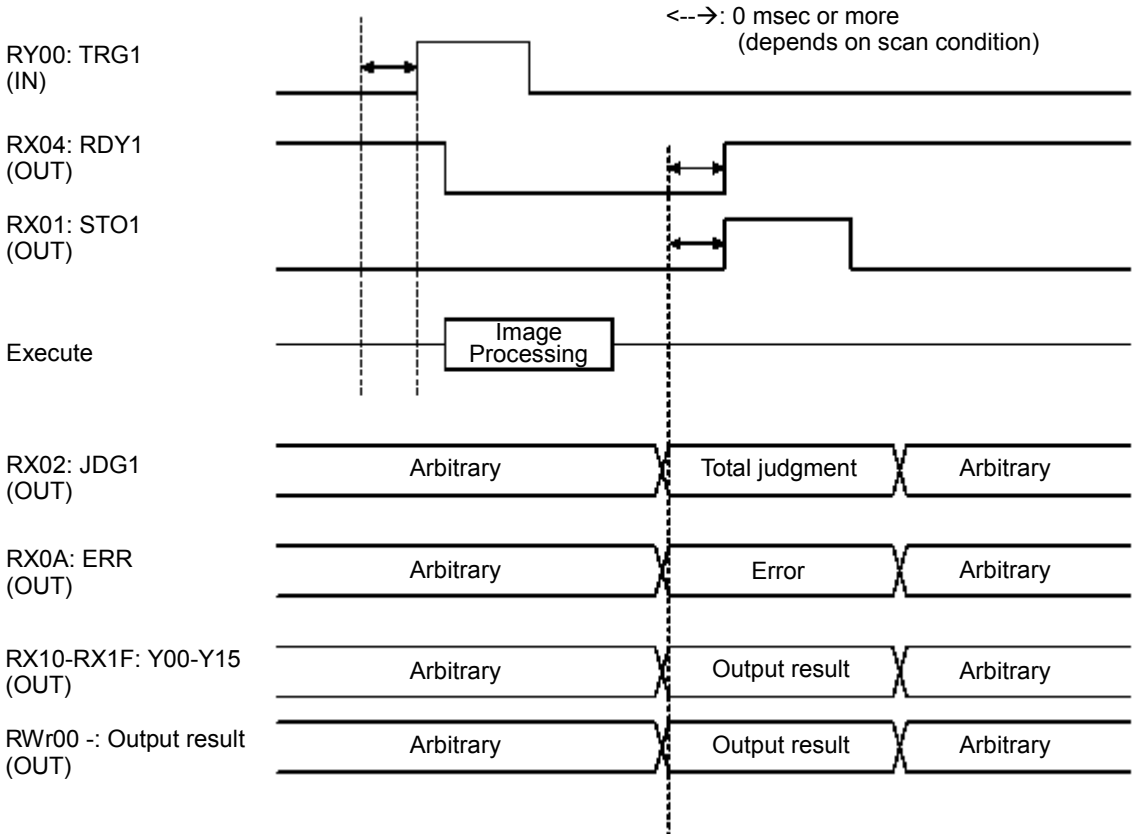
[1] Execute Inspection



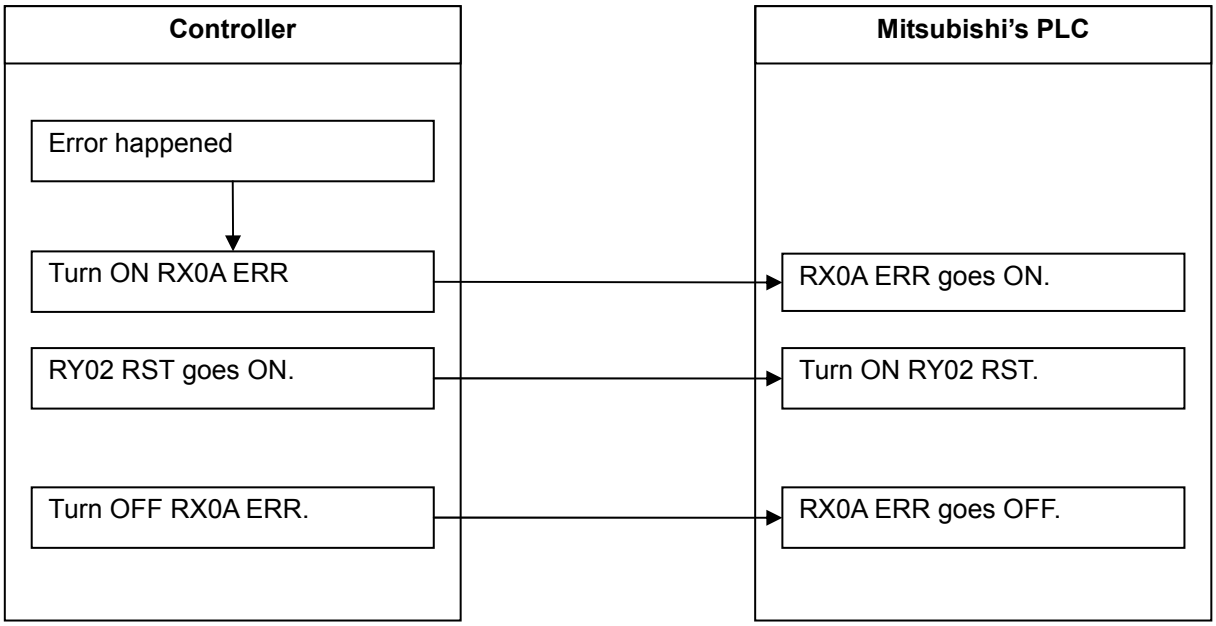
[Note]

- As the nature of CC-Link, signal change may not be identified when it changes in high speed.
- The scan interval must be set by taking setting of connected device and the signal change time into account because it is affected by the setting of this device and other devices within the network.
- The scan interval of this device is 10 msec.

・ **Time Chart (1 Trigger mode)**



[2] Error (ERR) and Reset (RST)



[Note]

- As the nature of CC-Link, signal change may not be identified when it changes in high speed.
- The scan interval must be set by taking setting of connected device and the signal change time into account because it is affected by the setting of this device and other devices within the network.
- The scan interval of this device is 10 msec.

About ERR Signal

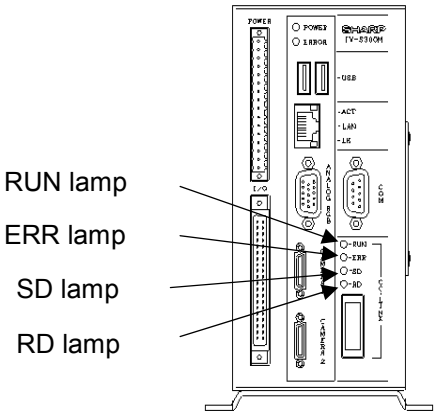
- The signal turns ON when an error happens with the controller.
- The timing to cause an error is:
  ① Hardware malfunction
  ② During image processing
  ③ Command communication
- To turn OFF the ERR signal, one of the following is required:
  ① Turn ON the signal.
  ② Close alarm screen when it is displayed.
- TRG1/2 and CSTO signals can be accepted during ERR signal is ON if RDY1/2 are ON.

About RST Signal

- The RST signal turns OFF ERR signal at its rise edge.
  However, the alarm screen does not be closed.

9-6 LED Display

The ON/OFF condition of the LED lamps (RUN, ERR, SD and RD) is as follows:



Picture of IV-S300M

○ : ON, ● : OFF, ☼ : Blinking

RUN	ERR	SD	RD	Conditions
○	☼	☼	○	Communication is normal but CRC error is happening from time to time due to noise.
○	☼	☼	○	Baud rate or station number setting after the reset has been changed. The “ERR” lamp blinks at every 0.4 sec. ※
○	☼	☼	●	- (This condition does not exist)
○	☼	●	○	Received data resulted in CRC error and cannot respond.
○	☼	●	●	- (This condition does not exist)
○	●	☼	○	Communication is normal.
○	●	☼	●	- (This condition does not exist)
○	●	●	○	No data is received by the controller.
○	●	●	●	- (This condition does not exist)
●	☼	☼	○	Polling is responding but CRC error of refresh receive signal.
●	☼	☼	●	- (This condition does not exist)
●	☼	●	○	CRC error of data received by the controller.
●	☼	●	●	- (This condition does not exist)
●	●	☼	○	Link is not started up.
●	●	☼	●	- (This condition does not exist)
●	●	●	○	No data to the controller or difficult to receive data due to noise.
●	●	●	●	No data can be received due to such as cut wire. The power is OFF or the hardware is under setting.
●	○	●	○	Improper setting of baud rate or station number.

※: The blinking of “ERR” lamp is alarming the setting change of baud rate or station number. The setting is fixed at the next reset timing.

Section 10: Errors and Responses

10-1 "Possible causes and countermeasures" for errors

If an error occurs on the controller, IV-S300J, IV-S300M or IV-S310M, the error lamp (ERR) on the main housing will light in red.
In this case, check the error log displayed on the screen and take the measures described below.

Error Message	Possible Cause	Countermeasure
Argument error of acos. Argument error of asin.	The argument is not within -1 and 1.	Change the formula such that the argument becomes within -1 and 1.
Argument error of sqrt.	The argument for sqrt is negative value.	Change the formula such that the argument becomes not a negative value.
Argument error of tan.	The argument for tan exceeded number of digits for display.	Change the formula such that the argument becomes within the display limit.
Argument is out of range.	Wrong argument to image processing library by some reason.	Initialize parameters. (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
Base PWB FPGA initialize error.	Failed in initializing FPGA of Base PCB or Extension PCB. Hardware malfunction.	Connect USB flash drive with version upgrade software installed and turn on the power to update FPGA. If the problem persists after rebooting, please ask our service agent for repair.
Battery low.	Battery voltage is low.	Replace the battery. Please ask our service agent for replacement.
Calculation overflowed.	Display digits exceeded the limit in numeric calculation.	Change the formula such that the digits does not exceed the limit.
Camera1 not connected. Camera2 not connected. Camera3 not connected. Camera4 not connected.	Tried to capture image from the camera that is not connected.	Check that the camera is connected securely. If the problem persists after rebooting, 1. Replace camera 2. Initialize parameters
Camera1 capture error. Camera2 capture error. Camera3 capture error. Camera4 capture error.	Failed in capturing image from the camera.	Check that camera is connected securely. If the problem persists after rebooting, please ask our service agent for repair.
Camera1 disconnect error. Camera2 disconnect error. Camera3 disconnect error. Camera4 disconnect error.	Communication with the camera was disconnected.	
Camera1 reconnect error. Camera2 reconnect error. Camera3 reconnect error. Camera4 reconnect error.	Communication with the camera was once disconnected.	
Camera combination error.	IV-S300C5 and other cameras are used together.	IV-S300C5 can be used with other cameras. Select the correct camera combination.
Camera incompatible with 4ch connected error.	Failed in camera connection.	Check that cameras are connected securely. If the problem persists after rebooting, 1. Replace camera 2. Initialize parameters (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
Camera initial setting error.	Wrong camera setting. Hardware malfunction.	Check that cameras are connected securely. If the problem persists after rebooting, 1. Replace camera 2. Initialize parameters (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
Camera is different.	Wrong camera setting. Hardware malfunction.	Check the camera setting and set it properly. Replace the camera, if problem persists.

Error Message	Possible Cause	Countermeasure
Camera library initialize error.	Failed in initializing camera.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
Camera not connected.	Tried to capture image from the camera that is not connected.	Check that the camera is connected securely. If the problem persists after rebooting, 1. Replace camera 2. Initialize parameters (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
Camera setting error.	Could not identify the camera.	Turn off and then on the power. Check if the camera cable is properly connected, and there is not noise generating source around the cable.
Cell size > limit.	Cell size for Defect module is out of the range.	Parameter setting might go wrong. Initialize parameters. (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
Color camera is not connected.	Color camera no. is not selected in the Color inspection module.	Set the camera properly in the module.
Color extraction color not registered.	Color for color extraction is not set.	Set the color in the module caused the error.
Color filter is not set.	Color filter for color preprocess is not set.	Check and set the color preprocess properly.
Color preprocess execution error.	Improper setting for color preprocess.	Check and set the color preprocess properly.
Communication time over.	Timeout in serial outputting.	Check the secure connection of the serial cable. Check the setting for serial communication.
Coordinate x/y axes angle error.	Angle of XY could not be detected in coordinate conversion/distortion correction.	Check that a mark near origin mark is detected.
Coordinate x/y not detected.	XY axes could not be detected in coordinate conversion/distortion correction.	
Coordinates are out of inspection area.	Inspected coordinates shifted far from the image area.	Check the parameters of the module caused the error.
Copy to camera with different resolution.	Copied module having different camera resolution.	Copy of module having different camera resolution cannot be made.
CSTO initialize error.	Failed in initializing CSTO interrupt.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
(CC-Link) Baud rate setting changed error.	Baud rate setting for CC-Link has changed from that at power up.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
(CC-Link) Communication error.	CC-Link is not connected.	Check the wiring and communication setting.
(CC-Link)Connection Error.		
(CC-Link) CRC error.	Error detected in CRC of CC-Link.	Turn off the power and check wiring: Proper connection of the connector, no cut cables, attachment of terminal resistance, no noise on the communication line, etc. If the problem persists after rebooting, please ask our service agent for repair.
(CC-Link) Channel carrier error.	Carrier could not be detected within the time limit. Carrier: Signal level change on transmission line of CC-Link.	
(CC-Link) Time over.	Refresh data could not be received. Disconnected line or shut down of master station.	
(CC-Link) Invalid baud rate error.	Wrong setting of baud rate for CC-Link.	Set correct baud rate for CC-Link.
(CC-Link) Invalid station number error.	Wrong setting of station no. for CC-Link.	Set correct station no. for CC-Link.
(CC-Link) Not set.	CC-Link is set to "Disable" when outputting results.	Set the output destination. When using CC-Link, check the setting. When not to use CC-Link, set to other.
(CC-Link) Station number changed error.	Station no. setting for CC-Link has changed from that at power up.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.

Error Message	Possible Cause	Countermeasure
Data collector data set error.	Wrong inspection data for sending.	Stop the inspection and once display the setting screen. Then, retry inspection on Run screen. If the problem persists, turn off and then on the power.
Data collector data create error.	Failed in creating inspection data for sending.	
Data collector receive error.	Failed in receiving response data.	Check the secure connection of Ethernet cable between the controller and a PC and that the port numbers are correct.
Data collector send error.	Failed in sending inspection data.	
Data collector communication error.	Failed in data collector communication.	
Detection failed because of same points.	Exactly the same coordinates are set in the setting condition.	Check and set the coordinates properly.
Dictionary copy error.	Failed in copying dictionary.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
Dictionary read error.	Failed in reading dictionary data.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
DicImage checksum error.		
Dictionary buffer allocate error.	Failed in the initialization of dictionary management.	
Dictionary read error.	Failed in reading dictionary.	Turn off and then on the power. If the problem persists after rebooting,
Dictionary save error.	Failed in saving dictionary.	
Display buffer create error.	Short of memory space. Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
DMA1 initialize error.	Malfunction of ch1 for capturing.	Turn off and then on the power. If the problem persists after rebooting,
DMA2 initialize error.	Malfunction of ch2 for capturing.	
Ethernet initial setting error.	Wrong Ethernet setting. Device cannot be identified. Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
Ethernet setting error.	Wrong Ethernet setting by some reason.	The parameter may went wrong. Initialize the parameters. If the problem persists after initializing, please ask our service agent for repair.
Extension PWB FPGA initialize error.	Failed in initializing FPGA of Base PCB or Extension PCB. Hardware malfunction.	Connect USB flash drive with version upgrade software installed and turn on the power to update FPGA. If the problem persists after rebooting, please ask our service agent for repair.
Failed in attitude angle detection.	Angle could not be detected.	Check that noise does not exist in the captured image.
Failed in Auto detection of binary-threshold.	Binary threshold value could not be judged properly.	In case of a workpiece tough for auto binarization, set to manual binarization.
Failed in circle center detection.	Wrong setting of extract color for color preprocessing.	Once clear the extract color setting and redo the setting.
Failed in generalization Hough conversion.	Failed in Hough conversion by some reason.	Turn off and then on the power. If the problem persists after rebooting, delete the module and then add the module.
Failed in straight line detection.	A line could not be detected.	Check any noise on the captured image.
Failed in tracking boundary.	Failed in tracking boundary.	Turn off and then on the power. If the problem persists after rebooting, delete the module and then add the module.
Fan speed low error.	The rotation speed of cooling fan is low or the fan is stopped.	Check any blockage to the fan. If the problem persists after rebooting, please ask our service agent for repair.
File checksum error.	Error occurred when reading file of Object type setting, Reference image, Edge data, etc.	Parameter setting might go wrong. Initialize parameters. (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
Flash initialize error.	Malfunction of flash memory of the controller.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
Formula error.	Improper setting of Calculation module. Unstable calculation result.	Check the formula.

Error Message	Possible Cause	Countermeasure
FPGA check error.	Failed in self diagnosis of controller's FPGA.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
FPGA2 check error.	Failed in self diagnosis of controller's FPGA2.	
FPGA initialize error.	Failed in FPGA initialization. Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, reinstall the FPGA program. If the problem persists after reinstallation, please ask our service agent for repair.
FPGA read error.	Failed in FPGA (read). Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
FPGA write error.	Failed in FPGA (write). Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
Hardware replacement required error.	Hardware malfunction.	Replace the hardware.
Image plain number is abnormal.	Image processing plane size overflew by some reason.	Turn off and then on the power. If the problem persists after rebooting, delete the module and then add the module.
Image process library execution error.	Error in executing image process.	Initialize parameters. (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
Image name write to USB error.	Failed in writing to USB flash drive.	Reconnect the drive and retry copying. Change the USB flash drive.
Image write to USB error.		
Images not saved to USB remain.	Not saved images exist.	Connect USB flash drive. The images are saved automatically.
Incompatible camera connected.	Failed in identifying camera. Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, 1. Replace camera 2. Initialize parameters (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
Inspection area not registered.	Inspection area is not set.	Set the inspection area.
Inspection data overflowed.	Work buffer of image process library overflew by some reason.	Please ask our service agent for repair.
Inspection position is abnormal.	Wrong argument to image process library by some reason: Inspection area position information:	Parameter setting might go wrong. Initialize parameters. (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
Inspection shape is abnormal.	Wrong argument to image process library by some reason: Inspection area shape information:	
Intersection cannot be detected because	2 cross points could not be detected.	Change parameter such that 2 cross points can be detected.
Invalid area data.	Abnormal area information by some reason.	Set an inspection area considering the range of movement of the area.
Invalid inspection area after area rotation.	Area rotation correction has gone out of the inspection area.	Set an inspection area considering the range of movement of the area.
Invalid inspection area after XY adjust.	Position correction error in the inspection area of the reference point search.	Set an inspection area considering the range of movement of the reference point.
Invalid line data.	Start and End points of the detected line are the same.	Change the setting so that the Start and End point coordinates become different.
Invalid parameter of extract color.	Wrong setting of extract color for color preprocessing.	Once clear the extract color setting and redo the setting.
Invalid parameter of module.	Abnormal setting of camera module,	Delete the module, add the module and set the parameters.
Invalid refimage information.	Wrong data of search information.	Display the setting screen of the module caused the error and touch the judgment confirm button of Judgment screen. If the problem persists, once delete the module and then add the module.
Invalid relative mask-area.	Mask area after position correction has gone out of the inspection area.	Set an inspection area considering the range of movement of the mask area.

Error Message	Possible Cause	Countermeasure
IVS300C5 camera connection error.	2 cables of IV-S300C5 camera is connected wrongly or only 1 cable is connected.	Check proper connection the 2 cables. Connected properly and if the problem persists after rebooting, please ask our service agent for repair.
Jump to the upper module.	Jump to upper module was made.	Check the setting of the Jump module.
JPEG buffer create error.	Short of memory space. Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
Label element connection is abnormal.	Image processing plane size overflew by some reason.	
Labeling process not initialized.	Failed in labeling process by some reason.	
Labeling work area not allocated.		
Labeling work area allocation failed.	Failed in labeling process by some reason.	Turn off and then on the power. If the problem persists after rebooting, delete the module and then add the module.
Mask or pattern is not registered.	Mask pattern could not be got.	
Master data checksum error.	Checksum of search master data is different.	Turn off and then on the power. If the problem persists after rebooting, initialize parameters. (Be sure to back up of parameters) If the problem persists, please ask our service agent for repair.
Master Data copy error.	Failed in copying data for search.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
Master data read error.	Failed in reading search master data.	Turn off and then on the power. If the problem persists after rebooting, delete the module and then add the module.
Master data save error.	Failed in writing search master data.	Retry saving. If the problem persists, please ask our service agent for repair.
Module reference error.	Failed in referencing module data of a formula.	Check the correct setting of the referenced module.
Model check error.	Wrong controller data in ROM.	Turn off and then on the power. If the problem persists after rebooting, delete the module and then add the module.
No label error.	Inspection object and the background of binarized image could not be separated.	Get proper binarized image by adjusting the optical system and binarizing threshold.
No memory images.	(For remote access tool)	---
None detected in Detail search.	A candidate could not be detected in the detailed search of SF search III.	Check that noise does not exist in the captured image. Check that edge image is displayed on the SF search III setting screen. If not displayed, adjust the threshold.
None detected in Coarse search.	No candidates found in coarse search of SF search III.	Check any noise on the captured image. Check an edge image is displayed on setting screen. If it is not displayed, change the threshold setting.
None detected in Middle search.	A candidate could not be detected in the middle search stage of SF search III.	Check that noise does not exist in the captured image. Check that edge image is displayed on the SF search III setting screen. If not displayed, adjust the threshold.
Number of detected edges > limit.	Too many edges detected and exceeded memory capacity.	Check that noise does not exist in the captured image.
Number of execution of SF Search > limit.	Too many searches per object type.	Reduce the number of SF/Gray/Multiple search for an object type. Reduce the model area size.
Number of labels > limit.	Overflow of memory for saving labels due to noises on binarized image.	Get proper binarized image by adjusting the optical system and binarizing threshold.
Number of labels overflowed.	Inspection results exceeded the limit (255) in Blob or Defect module.	Get proper binarized image by adjusting the optical system and binarizing threshold. If the problem persists, narrow the inspection area so as not to exceed the limit (255).

Error Message	Possible Cause	Countermeasure
Number of models of SF Search > limit.	Too many searches per system.	Reduce the number of SF/Gray/Multiple search for the controller. Reduce the model area size.
Number of rotated ref image plane overflowed.	Image processing plane size overflew by some reason.	Turn off and then on the power. If the problem persists after rebooting, delete the module and then add the module.
Number of temporary labels overflowed.	Overflow of memory for label component data by noises on binarized image.	Get proper binarized image by adjusting the optical system and binarizing threshold.
Number of the models for an objtype > limit.	Edge data exceeded memory capacity for an object type.	Reduce the number of SF/Gray/Multiple search for an object type. Reduce the model area size.
Number of the models for the memory > limit.	Edge data exceeded memory capacity for the controller.	Reduce the number of SF/Gray/Multiple search for the controller. Reduce the model area size.
Numerical operation error.	Improper setting of Calculation module. Unstable calculation result.	Check the formula.
Invalid numeric value.		Check the formula. Check the number of "," in the formula.
Number of run overflowed.	Overflow occurred during labeling process by some reason.	Check that noise does not exist in the captured image.
Objtype chang error.	The designated object type is not registered. The parameters for when object type is switched do not exist for Serial, Ethernet or PIO.	Set the object type or set other object type.
Objtype checksum error.	Checksum object type is different.	Initialize parameters. (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
Objtype copy error.	Failed in copying object type.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
Objtype read error.	Failed in reading object type.	Retry rereading. If the problem persists, upload the back up data.
Object type when booting copy error.	Failed in copying object type to use at start up.	Retry the copying. If the problem persists, please ask our service agent for repair.
Objtype save error.	Failed in saving the object type.	Retry saving. If the problem persists, please ask our service agent for repair.
Origin point not detected.	Origin point could not be detected in automatic setting of coordinates conversion and distortion correction.	Use the calibration sheet attached to this manual and capture image such that the area of the origin mark becomes the largest.
Output plane memory full.	Image processing plane size overflew by some reason.	Turn off and then on the power. If the problem persists after rebooting, delete the module and then add the module.
Parameter buffer allocate error.	Short of memory space. Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
Parameter write to USB memory error.	Failed in file writing in USB flash drive.	Reconnect the drive and retry copying. Change the USB flash drive. If the problem persists after the above, please ask our service agent for repair.
Pattern image save error.	Failed in saving pattern image.	Retry the image saving.
PLC link error.(T1)	No response by PLC.	Check: 1. Proper serial cable connection. 2. Serial, PLC link setting of controller. 3. Setting of PLC.
PLC link error.(T2)	Failed in data communication of general output by Serial or Ethernet.	Check the wiring and communication setting of controller and PLC.
Power failure error.	Intermittent power failure was detected.	Check the power supply.
Preprocess execution error.	Wrong setting for preprocess.	Check the setting of preprocess.
Preprocess image resolution error.	The size of the image to be preprocessed is abnormal by some reason.	Turn off and then on the power. If the problem persists after rebooting, delete the module and then add the module.

Error Message	Possible Cause	Countermeasure
RAM check error.	An error occurred in the main housing memory (RAM)	Please ask our service agent for repair.
ROM check error.	An error occurred in the main housing memory (ROM)	
Refimage checksum error.	Checksum of reference image is different.	Initialize parameters. (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
Refimage copy error.	Failed in copying reference image to use at start up.	Retry the saving. If the problem persists, initialize parameters. (Be sure to back up of parameters) If the problem persists, please ask our service agent for repair.
Refimage information is not registered.	Search information data is not registered.	Display the setting screen of the module that caused the error and touch the judgment confirm button of Judgment screen. If the problem persists, once delete the module and then add the module.
Refimage read error.	Failed in reading reference image.	Retry the reading. If the problem persists, initialize parameters. (Be sure to back up of parameters) If the problem persists, please ask our service agent for repair.
Reference image number error.	Failed in reading the reference image number.	Turn off and on the power. If the problem persists, store the reference image again.
Refimage save error.	Failed in reading the reference image number.	Retry the saving. If the problem persists, please ask our service agent for repair.
RGB value is out of range.	White could not be detected.	1. Check if white object is captured. 2. Check if white only area is inspected.
RGB mean value (dark) error.	Capture image is too dark to perform White balance.	Set shutter speed, focus and/o gain to make the image bright.
RGB mean value (light) error.	Capture image is too bright to perform White balance.	Set shutter speed, focus and/o gain to make the image dark.
ROM write error.	Failed in writing system setting parameters.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
ROM capacity error.	Short of memory space.	Turn off and then on the power. If the problem persists after rebooting, delete unnecessary object type.
Search master data acquisition error.	Failed in getting data of a search module.	Update the master data of a search module by touching the judgment confirm button of Judgment screen.
Serial initial setting error.	Wrong serial setting. A device cannot be identified. Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
Serial setting error.	Wrong serial setting by some reason.	Parameter setting might go wrong. Initialize parameters. (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
SF Search buffer create error.	Short of memory space. Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
SMBUS initialize error.	Failed in expanded FPGA (read/write). Failed in the initialization of SMBUS access. Failed in SMBUS (read). Hardware malfunction.	
SMBUS read error.	Failed in SMBUS (read).	
System sum check error.	Failed in writing parameters for system	Turn off and then on the power.
System checksum error.	Checksum of system setting is different.	Initialize parameters.
System read error.	Failed in reading the system setting.	Retry rereading. If the problem persists, upload the back up data.
System save error.	Failed in saving the system setting.	Retry saving. If the problem persists, upload the back up data.
Time library initialize error.	Failed in initializing time management.	Turn off and then on the power.
TRG initialize error.	Failed in initializing TRG interrupt.	Turn off and then on the power.

Error Message	Possible Cause	Countermeasure
USB memory copy error.	Failed in copying file from USB flash drive.	Reconnect the drive and retry copying. Change the USB flash drive. If the problem persists after the above, please ask our service agent for repair.
USB capacity error.	Short of USB flash drive memory space.	Delete unnecessary filed from USB flash drive.
USB memory is not connected.	Failed in connection with USB flash drive.	Reconnect the drive and retry copying. Change the USB flash drive. If the problem persists after the above,
USB memory folder check error.	Failed in creating a file in USB flash drive.	
USB memory read error.	Failed in reading from USB flash drive.	
WDT System reset detect.	Reset by WDT was detected. Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, please ask our service agent for repair.
White balance image capture error.	Failed in capturing image that is under white balance processing. Hardware malfunction.	Turn off and then on the power. If the problem persists after rebooting, 1. Replace camera 2. Initialize parameters (Be sure to back up parameters) If the problem persists, please ask our service agent for repair.
White balance RGB setting error.	Abnormal value after white balance processing.	1. Retry white balance processing. 2. Check if white object is captured. 3. Check if white only area is inspected.
Work memory full.	Too many edges detected and exceeded memory capacity.	Check that noise does not exist in the captured image.
Zero division error.	Division by 0 happened during calculation.	Check the formula such that division by 0 does not happen.
2 lines are the same.	The same line is selected in the setting.	Check the setting and set it properly.
2 lines are parallel.	Parallel lines are selected in the setting.	Check the setting and set it properly.
9 dots coul not be detected.	Minimum 9 dots for doing automatic coordinates conversion and distortion correction could not be detected.	Check that marks could be detected. Adjust the threshold, etc.

10-2 Maintenance

[1] Daily checks

Check the following items daily.

(1) Operation check

Confirm the inspection values on the operation screen, and switch the monitor screen between still and live to confirm that the images are displayed properly.

(2) Items to check

- Check the brightness of the lights.
- Check whether the image on the monitor is clearly focused, and the iris setting is appropriate.
- Check for poor insulation on the cable sheath and loose connectors.
- Carefully wipe dust off the lenses using a dry, soft cloth.
- If there is dust or smearing on the camera CCD element, wipe it off gently and slowly using a new, clean cotton swab soaked isopropyl alcohol. Wipe in only in one direction. Do not use the same cotton swab to clean multiple cameras.

■ Cleaning procedures

① Install a lens (mirror barrel) on the camera.
② Close the iris on the lens to the extreme limit.
③ Point the lens at a light source and check on the monitor to make sure that there are no spots in the image.
(If the iris is still open, even a bit, spots may not appear on the monitor screen.
Therefore, you might have to adjust the iris.)

(3) Items to check when the number of faulty inspections and/or wrong judgments increases

- Brightness level of the lighting, and the condition of the lamps.
- Whether the target workpieces are within the inspection area.
- Whether there are any loose or disconnected cables.
- Whether there is dust or dirt on the lens.
- Whether the focus or iris adjustments have been changed from the original setting.
- Whether power is being supplied normally.
- Whether the preset parameters are still stored.
- (If any parameter has been changed from the preset value, reset all of the parameters from the beginning.)

(4) Maintenance Parts

Battery and fan are built in the controller.

- The battery backs up the date and time for the clock.
  If the controller is turned off after the battery has died, the clock date and time will need to be reset.
  Be sure to replace the battery with new one immediately when “Battery low” error message is displayed.
  The expected life of the battery varies depending on the environment;
  The life becomes shorter as the ambient temperature goes higher.
- The fan is for cooling down the controller.
  Continued use of the controller with the fan stopped may result in the malfunction of the device.
  Be sure to replace the fan with new one immediately when “Fan speed low error.” message is displayed.

Please contact our dealer for the replacement.

Section 11: Specifications

[1] Controller (IV-S300J/IV-S300M/IV-S310M)

(1) Performance Specifications

Item		Specifications
Image sampling method		Monochrome 256 gray levels (8 bits/pixel)
Image processing		Gray/color
Camera IV-S300 Series	Numbers of cameras	IV-S300J/IV-S300M: Max 2 (Note: only 1 when IV-S300C5 is connected) IV-S310M: Max 4 (Note: only 2 when IV-S300C5 is connected)
	Compatible camera	IV-S300C6/C7/CA (0.25M digital monochrome camera) IV-S300CD (1.3M digital monochrome camera) IV-S300C2 (2M digital monochrome camera) IV-S300C5 (6.5M digital monochrome camera) IV-S300C8 (0.25M digital color camera) IV-S300C3 (2M digital color camera)
	Cable	IV-R300K3 (Cable length: 3 m), IV-S300K5 (5 m)
Camera IV-200X Series	Numbers of cameras	IV-S300J/IV-S300M: Max 2 IV-S310M: Max 4
	Compatible camera	IV-S200C6 (0.25M digital monochrome camera) IV-S210C2 (2M digital monochrome camera) IV-C250C8 (0.25M digital color camera) IV-C250C3 (2M digital color camera)
	Cable	IV-S300K3 (Cable length: 3 m), IV-S300K5 (5 m), IV-S300KA (10 m)
Camera image capture time		IV-S200C6/IV-C250C8: 15.8 ms. IV-S210C2/IV-C250C3: 58.3 ms. IV-S300C2/IV-S300C3: 13.8 ms. IV-S300C6: 8.3 ms. IV-S300C7/IV-S300C8: 2.2 ms. IV-S300CA: 3.8 ms. IV-S300CD: 11.3 ms. IV-S300C5: 23.9 ms.
Number of pixels		IV-S200C6/IV-C250C8, IV-S300C6/C7/C8/CA: 512 (H) x 480 (V), approximately 0.25M pixels. IV-S300CD: 1280 (H) x 960 (V), approximately 1.3M pixels. IV-S210C2/IV-C250C3: 1600 (H) x 1200 (V), approximately 2M pixels. IV-S300C2/IV-S300C3: 1920 (H) x 1080 (V), approximately 2M pixels. IV-S300C5: 2560 (H) x 2560 (V), approximately 6.5M pixels.
Camera image capture range		Partial images can be captured (starting line and end line for capturing image can be set)
Camera image capture		Full/half (Note: only half when IV-S200C6 is connected
High-function image capture functions		HDR (high dynamic range) Shading correction Image distortion correction Image emmetropic vision correction (Includes mirror inversion)
Search precision		In units of sub pixels, ±0.05 pixels (5 points: Center and 4 corners)
Edge detection precision		In units of sub pixels, ±0.05 pixels
Inspection area shape		Rectangle, Circle, Ellipse, Polygon (max. 32 vertices), Rotated Rectangle, Arc
Mask area		4 areas/module
Mask area shape		Rectangle, Circle, Ellipse, Polygon (max. 32 vertices), Rotated Rectangle, Arc
Image preprocessing (image quality improvement)	Filter	**[Filter]** Defect extract, Defect extract 2, Blur correction, Top hat, Bottom hat, Smoothing (average, median), Edge emphasis, Edge extraction, Horizontal edge extraction, Vertical edge extraction, Maximum value, Minimum value (of designated direction), Binarization, Block Binarization, Mirroring **[Intensity conversion]** Contrast enhancement, Change linearity, Gamma correction +, Gamma correction -, Mid-level emphasis, Intensity averaging, Smoothing (averaging), Shading correction, B/W inversion
	Calculation	Addition, Subtraction, Absolute difference, Max value, Min value, Average, AND, OR, XOR, XNOR, NAND, NOR
Color preprocessing	Color filter	Red, Green, Blue, Luminance
	Color extraction	Hue, Saturation, Luminance RGB

[1] Controller (IV-S300J/IV-S300M/IV-S310M) (Continued)

(1) Performance Specifications (Continued)

Item		Specifications
Denoising		Dilate, Erode, Area filter, Feret diameter filter, Main angle filter, Circularity filter
Numbers of modules that can be stored		128 modules/object type
Module	Trigger	1 trigger mode and 2 trigger mode #1 External trigger (external input terminal, USB mouse, RS-232C/422, Ethernet, CC-Link) Note: CC-Link is not available with IV-S300J. CCD triggering (binary, color filter: when a color camera is used)
	Capture	Shutter speed, Stored reference image Image capture setting (gain/offset, image capture area, trigger wait time) When a monochrome camera is used: High-function image capturing Capture mode (normal/average/HDR) When a color camera is used: White balance
	SF search III	Number of detection, Coordinates XY, AngleΘ, Matching degree, Deviation
	Gray Search	Number of detection, Coordinates XY, AngleΘ, Matching degree, Deviation
	Multiple Search	Number of detection, Group number, Element number, Coordinates XY, AngleΘ, Deviation X/Y/Θ, Matching score
	Area	White or black area size (number of pixels)
	Blob	Number of labels (max 255), Total area size, Area size, Perimeter, Feret diameter, Gravity center, Center, Main axis angle, Deviation, Intensity, Rotated circumscribed rectangular, Circumscribed circle, Circularity
	Point	Numbers of points, Average intensity, Maximum intensity, Minimum intensity, Intensity difference, Intensity deviation
	Defect inspection	Number of labels (max 255), Total area size, Area size, Perimeter, Feret diameter, Gravity center, Center, Main axis angle, Deviation
	Color Inspection	Average intensity (RGB・HSL), Maximum intensity (RGB・HSL), Minimum intensity (RGB・HSL), Intensity difference, Intensity deviation
	Edge	Coordinates, Deviation, Detection, Number of labels, Relative angle
	Shift edge	- Edge position: Number of labels, Coordinates, Distance, Average distance, Detection, Angle - Edge width (light)/(dark): Number of labels, Width, Average width, Detection, Start point coordinates, End point coordinates, Average start point distance, Average end point distance - Defect: Number of defects, Defect position, Defect deviation, Defect height, Defect width, Defect area, Start point coordinates, End point coordinates, Circle center, Circle radius, Ellipse center, Ellipse radius, Ellipse angle
	Pitch	Numbers of pitches, Light/Dark width, Pitch height, Start point coordinates, End point coordinates Light/Dark angle, Light/Dark distance angle
	Shape	- Line: Number of labels, Center coordinates, Angle, Start/End points coordinates - Circle: Center coordinates, Deviation X/Y, Radius, Circularity, Detection - Corner: Number of labels, Coordinates, Angle, Deviation X/Y
	Distance & Angle	- Center point, Circle center, Gravity center, Cross point of 2 lines, Cross point (circle/line), Cross point (2 circles): Coordinates XY, Deviation X/Y - Line pass thru 2 points, Perpendicular line (point/line) Start point X/Y, End point X/Y, Start point deviation X/Y, End point deviation X/Y - Distance (2 points), Distance X/Y, Distance (point/line): Distance - Angle (3 points), Horizontal angle (2 points), Vertical angle (2 points): AngleΘ, Relative angle

[1] Controller (IV-S300J/IV-S300M/IV-S310M) (Continued)

(1) Performance Specifications (Continued)

Item		Specifications
Module	Numeric calculations	Number of digits below decimal point, Operation (10 types), Functions (33 types), Constants, Variables
	Filter	Filters (28 types), Calculations between images (12 types)
	Jump	Judgment method (AND/OR), 7 conditions, Jump condition: Matched, Unmatched, Unconditionally, Manually
	Position correction	Correction X, Correction Y, Correction X/Y, Area rotation, Correction XY + Area rotation, Image rotation
	OCV	Character recognition and verification of maximum 64 characters and 5 lines Matching score of a character, Recognition score, Stability, Storable Dictionary: 1,000 images (Maximum number of character kind: 200, Maximum number of same character: 20) Extraction method: Binarization and Gray search. Supports calendar function and code.
Data output	Data output timing	At each trigger, OK or NG
	Destination	Ethernet, RS-232C/RS-422, Parallel, CC-Link Note: CC-Link is not available with IV-S300J.
	Image output timing	At each trigger, OK, NG, OK + Number of NGs set or NG + Number of OKs set
	Image output Destination	Ethernet/USB flash drive
PLC link (compatible PLC)		Sharp (JW series), Mitsubishi (A, Q, and FX series), Yokogawa, Omron
Number of preset object types		Max. 200 object types
Number of reference images		IV-S300J/IV-S300M: Max. 400 (as the total of 2 cameras) IV-S310M: Max. 800 (as the total of 4 cameras)
Number of images in image memory		Mono 0.25M cameras: IV-S300J/IV-S300M 1022 images, IV-S310M 1016 images Mono 2M cameras: IV-S300J/IV-S300M 126 images, IV-S310M 120 images Mono 6.5M camera: IV-S300J/IV-S300M 30 images, IV-S310M 28 images Color 0.25M cameras: IV-S300J/IV-S300M 338 images, IV-S310M 322 images Color 2M cameras: IV-S300J/IV-S300M 39 images, IV-S310M 33 images
Operation screens		Inspection results, Judgment results, Module details, Parallel I/O, Variables, Error logs, Statistics, Custom
Number of screens displayed at one time		Max. 6 screens
Overwrite during operation		Judgment criteria setting (upper and lower limits)
Other functions		Snapshot function, Password function, Retry function, PC monitor.
Display language		Japanese/English/Korean
Inspection start input	External trigger	External input terminal, USB mouse, RS-232C/RS-422, Ethernet, CC-Link Note: CC-Link is not available with IV-S300J.
	Internal trigger	CCD trigger
External memory		Compatible with USB flash drive (FAT32), HDD (FAT32)/SSD (FAT32)
Parameter storage	Parameter	Inspection images, reference images, and setting details
	Destination	Operator selectable: Main flash memory or an USB flash drive
Calendar and timer		Year, Month, Day, Hour, Minute, Second (Backed up by the built in battery) #2

#1: In 2 Trigger mode, image capture with channel independent trigger is possible.
With IV-S300J and IV-S300M, only 2 systems for Camera 1 and Camera 2.

#2: The battery service life is approximately 5 years under normal temperature (25˚C) use.
The clock precision is maximum ±3 minutes/month.

[1] Controller (IV-S300J/IV-S300M/IV-S310M) (Continued)

(2) Function Specifications (Control, External Interface) and Operating Environment

Item		Specifications			
External Interface	Ethernet (1port)	10BASE-T/100BASE-TX/1000BASE-T (TCP/IPv4) x 1			
	Camera I/F	SDR Connector PoCL/Sharp's unique switching IV-S300J/IV-S300M: 2, IV-310M: 4			
	USB host connector	IV-S300J: USB3.0 x 2 IV-S300M/310M: USB3.0 x 1, USB2.0 x 1			
	Serial I/F (9-pin D-sub)	RS-232C or RS-422 (2 line system/4 line system) (2.4 to 115.2 kbps) x 1 #3			
	CC-Link I/F (5 pin)	Remote device station (Ver1.10 compatible, Number of occupied stations: 2 - 4 Note: CC-Link is not available with IV-S300J.			
	Connector terminal block (16 terminals)	Ground FG Power +24V input Power +0V input		1 pin each	
		Camera inspection start (Camera 1+2)	TRG1	1 pin	Interrupt input 12V/24V DC, 7 mA
		Camera inspection start (Camera 3+4)	TRG2	1 pin	
		Input common	COM	1 pin	
		Trigger input ready (Camera 1+2)	RDY1	1 pin	High-speed output 12V/24V DC, Max. 20mA NPN open collector output
		Output result strobe (Camera 1+2)	STO1	1 pin	
		Total judgment (Camera 1+2)	JDG1	1 pin	
		Flash (Camera 1+2)	FL1	1 pin	
		Trigger input ready (Camera 3+4)	RDY2	1 pin	
		Output result strobe (Camera 3+4)	STO2	1 pin	
		Total judgment (Camera 3+4)	JDG2	1 pin	
		Flash (Camera 3+4)	FL2	1 pin	
		Output common	COM(-)	1 pin	
	I/O Connector (40 pins)	General purpose inputs	X0 to X15	16 pins	12V/24V DC, 7mA Sink and source are available
		Command input	CST0	1 pin	
		Reset	RST	1 pin	
		Input common	COM	1 pin	
		General purpose inputs	Y0 to Y15	16 pins	High-speed output 12V/24V DC, Max. 20mA NPN open collector output
		Running	RUN	1 pin	
		Error	ERR	1 pin	
		Output common	COM(-)	1 pin	

Item	Specifications
Operation input	USB mouse (Sold separately)
Image output	Analog RGB (SVGA)
Power voltage / current	24 VDC (±10%) IV-S300J: 0.84 A (Maximum load with two cameras connected) IV-S300M: 1.5 A (Maximum load with two cameras connected) IV-S310M: 1.7 A (Maximum load with four cameras connected)
Operating ambient	0 to 45°C, 35 to 85%RH (non condensing)
Storage ambient	-20 to +70°C, 35 to 85%RH (non condensing)
Operating atmosphere	No corrosive gases, no excessive dust
Noise proof	±1000Vp-p (1 µs, 100ns) (Apply noise to 24VDC power line with a noise simulator)
Static electricity resistance	± 8 kV (during operation), ±20 kV (packed)
Vibration proof	Duplex vibration width: 0.15 mm (10 to 58Hz), 9.8 m/s^2 (58 to 150Hz) Number of sweeps: 15 times (120 minutes: 1 octave/minute), 3 directions (X Y, and Z)
Shock proof	147m/s^2 (X, Y, Z, ± directions 3 times each: total of 18 times)
External dimensions (mm) (excluding protrusions)	IV-S300J/IV-S300M: W80 x H160 x D125 IV-S310M: W95 x H160 x D131
Weight	IV-S300J/IV-S300M: Approximately 1.5 kg IV-S310M: Approximately 1.7 kg
Accessories	IV-S300M/310M: D-sub connector x 1, 16-pin connector x 1, 40-pin connector x 1 IV-S300J: 16-pin connector x 1 Main housing attachment bracket x 2, Attachment screws x 4, Instruction manual (English) x 1

#3: The same data are output at the same time.
RS232C and RS422 are switched by the setting of the controller.

[2] Camera (Sold separately)

(1) IV-S300C2: 2M CMOS digital monochrome camera

Item	Specifications
Lens mount	C mount
Image capture element	Global shutter, monochrome CMOS sensor
Number of pixels	Approximately 2,000,000 pixels (1920 x 1080)
Image element size	2/3 inch
Pixel size	5.5 µm x 5.5 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/50,000 to 1/70 (20 µs to 14.3 ms)
Synchronization method	Internally synchronized
Image transfer time	14.3 ms (full mode)
Power voltage / power consumption	12 VDC (±10%) / 2.6W (Supplied from controller)
Operating environment	0 to 40°C, 20 to 80%RH (no corrosive gases, no excessive dust, non condensing)
Vibration proof	98 m/s^2 (10G), 20 to 200 Hz, Sweep time: 2 hours
Shock proof	147m/s^2 (X, Y, Z, ± directions 3 times each: Total of 18 times
External dimensions (mm)	29 W x 29 H x 41 D (excluding protrusions)
Weight	Approximately 50 g (excluding lens)
External I/F	One connector (Camera link SDR connector)
Accessories	Operating manual (Japanese) x 1

(2) IV-S300C3: 2M CMOS digital color camera

Item	Specifications
Lens mount	C mount
Image capture element	Global shutter, color CMOS sensor
Number of pixels	Approximately 2,000,000 pixels (1920 x 1080)
Image element size	2/3 inch
Pixel size	5.5 µm x 5.5 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/50,000 to 1/70 (20 µs to 14.3 ms)
Synchronization method	Internally synchronized
Image transfer time	14.3 ms (full mode)
Power voltage / power consumption	12 VDC (±10%) / 2.6W (Supplied from controller)
Operating environment	0 to 40°C, 20 to 80%RH (no corrosive gases, no excessive dust, non condensing)
Vibration proof	98 m/s^2 (10G), 20 to 200 Hz, Sweep time: 2 hours
Shock proof	147m/s^2 (X, Y, Z, ± directions 3 times each: Total of 18 times
External dimensions (mm)	29 W x 29 H x 41 D (excluding protrusions)
Weight	Approximately 50 g (excluding lens)
External I/F	One connector (Camera link SDR connector)
Accessories	Operating manual (Japanese) x 1

[2] Camera (Sold separately) (continued)

(3) IV-S300C5: 6.5M CMOS digital monochrome camera

Item	Specifications
Lens mount	C mount
Image capture element	Global shutter, monochrome CMOS sensor
Number of pixels	Approximately 6,500,000 pixels (2560 x 2560)
Image element size	1/1 inch
Pixel size	5 µm x 5 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/100,000 to 1/5 (10 µs to 0.2 s)
Synchronization method	Internally synchronized (internal clock)
Image transfer time	25 ms (full mode)
Power voltage / power consumption	12 VDC (±10%) / 3.36W (Supplied from controller)
Operating environment	0 to 40°C, 10 to 90%RH (no corrosive gases, no excessive dust, non condensing)
External dimensions (mm)	W40 x H40 x D40 (excluding protrusions)
Weight	Approximately 100 g (excluding lens)
External I/F	Two connectors (Camera link SDR connector)
Accessories	Operating manual (Japanese) x 1 Cable identification label x 1

(4) IV-S300C6: 0.25M CCD digital monochrome camera

Item	Specifications
Lens mount	C mount
Image capture element	Progressive scan type monochrome CCD sensor
Number of pixels	Approximately 250,000 pixels (512 x 480)
Image element size	1/3 inch
Pixel size	7.4 µm x 7.4 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/100,000 to 1/120 (10 µs to 8.3 ms)
Synchronization method	Internally synchronized
Image transfer time	8.3 ms (full mode)
Power voltage / power consumption	12 VDC (±10%) / 2.5W (Supplied from controller)
Operating environment	0 to 40°C, 20 to 80%RH (no corrosive gases, no excessive dust, non condensing)
Vibration proof	98 m/s^2 (10G), 20 to 200 Hz, Sweep time: 2 hours
Shock proof	490m/s^2 (X, Y, Z, ± directions 1 time each: Total of 6 times
External dimensions (mm)	29 W x 29 H x 41 D (excluding protrusions)
Weight	Approximately 50 g (excluding the lens)
External I/F	One connector (Camera link SDR connector)
Accessories	Operating manual (Japanese) x 1

[2] Camera (Sold separately) (continued)

(5) IV-S300C7: 0.25M CMOS digital monochrome camera

Item	Specifications
Lens mount	C mount
Image capture element	Global shutter, monochrome CMOS sensor
Number of pixels	Approximately 250,000 pixels (512 x 480)
Image element size	1/4 inch
Pixel size	5.5 µm x 5.5 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/50,000 to 1/500 (20 µs to 2 ms)
Synchronization method	Internally synchronized
Image transfer time	25 ms (full mode)
Power voltage / power consumption	12 VDC (±10%) / 2.4W (Supplied from controller)
Operating environment	0 to 40°C, 20 to 80%RH (no corrosive gases, no excessive dust, non condensing)
Vibration proof	98 m/s^2 (10G), 20 to 200 Hz, Sweep time: 2 hours
Shock proof	147m/s^2 (X, Y, Z, ± directions 3 times each: Total of 18 times
External dimensions (mm)	29 W x 29 H x 41 D
Weight	Approximately 50 g (excluding the lens)
External I/F	One connector (RJ-45)
Accessories	Operating manual (Japanese) x 1

(6) IV-S300C8: 0.25M CMOS digital color camera

Item	Specifications
Lens mount	C mount
Image capture element	Global shutter, color CMOS sensor
Number of pixels	Approximately 250,000 pixels (512 x 480)
Image element size	1/4 inch
Pixel size	5.5 µm x 5.5 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/50,000 to 1/500 (20 µs to 2 ms)
Synchronization method	Internally synchronized
Image transfer time	2 ms (full mode)
Power voltage / power consumption	12 VDC (±10%) / 2.4W (Supplied from controller)
Operating environment	0 to 40°C, 20 to 80%RH (no corrosive gases, no excessive dust, non condensing)
Vibration proof	98 m/s^2 (10G), 20 to 200 Hz, Sweep time: 2 hours
Shock proof	147m/s^2 (X, Y, Z, ± directions 3 times each: Total of 18 times
External dimensions (mm)	29 W x 29 H x 41 D
Weight	Approximately 50 g (excluding lens)
External I/F	One connector (Camera link SDR connector)
Accessories	Operating manual (Japanese) x 1

[2] Camera (Sold separately) (continued)

(7) IV-S300CA: 0.25M CMOS digital monochrome camera

Item	Specifications
Lens mount	C mount
Image capture element	Global shutter, monochrome CMOS sensor
Number of pixels	Approximately 250,000 pixels (512 x 480)
Image element size	1/4 inch
Pixel size	4.8 µm x 4.8 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/10,000 to 1/250 (100 µs to 4 ms)
Synchronization method	Internally synchronized
Image transfer time	3.8 ms (full mode)
Power voltage / power consumption	12 VDC (±10%) / 2W (Supplied from controller)
Operating environment	0 to 40°C, 20 to 80%RH (no corrosive gases, no excessive dust, non condensing)
Vibration proof	98 m/s^2 (10G), 20 to 200 Hz, Sweep time: 2 hours
Shock proof	490m/s^2 (X, Y, Z, ± directions 1 time each: Total of 6 times
External dimensions (mm)	29 W x 29 H x 41 D (excluding protrusions)
Weight	Approximately 50 g (excluding the lens)
External I/F	One connector (Camera link SDR connector)
Accessories	Operating manual (Japanese) x 1

(8) IV-S300CD: 0.25M CMOS digital monochrome camera

Item	Specifications
Lens mount	C mount
Image capture element	Global shutter, monochrome CMOS sensor
Number of pixels	Approximately 1,300,000 pixels (1280 x 960)
Image element size	1/2 inch
Pixel size	4.8 µm x 4.8 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/10,000 to 1/80 (100 µs to 12.5 ms)
Synchronization method	Internally synchronized
Image transfer time	12 ms (full mode)
Power voltage / power consumption	12 VDC (±10%) / 2W (Supplied from controller)
Operating environment	0 to 40°C, 20 to 80%RH (no corrosive gases, no excessive dust, non condensing)
Vibration proof	98 m/s^2 (10G), 20 to 200 Hz, Sweep time: 2 hours
Shock proof	490m/s^2 (X, Y, Z, ± directions 1 time each: Total of 6 times
External dimensions (mm)	29 W x 29 H x 41 D (excluding protrusions)
Weight	Approximately 50 g (excluding the lens)
External I/F	One connector (Camera link SDR connector)
Accessories	Operating manual (Japanese) x 1

[2] Camera (Sold separately) (continued)

(9) IV-S200C6: 0.25M CCD digital monochrome camera

Item	Specifications
Lens mount	C mount
Image capture element	Interline transfer method, monochrome CCD
Number of pixels	Approximately 250,000 pixels (512 x 480)
Image element size	1/3 inch
Pixel size	7.4 µm x 7.4 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/20,000 to 1/1(50 µs to 1 sec)
Synchronization method	Internally synchronized
Image transfer time	16 ms (full mode), 8 ms (half mode)
Power voltage / power consumption	12 VDC (±10%) / 3.6W (Supplied from controller)
Operating environment	0 to 45°C (no corrosive gases, no excessive dust, non condensing)
Vibration proof	Duplex vibration width: 2 mm (10 to 150 Hz), 147 m/s^2 Sweep time: 2 hours (1 octave/min), in X/Y/Z axis
Shock proof	147m/s^2 (X, Y, Z, ± directions 3 times each: Total of 18 times
External dimensions (mm)	W30 x H30 x D47 (excluding protrusions)
Weight	Approximately 55 g (excluding the lens)
External I/F	One connector (Camera link SDR connector)
Accessories	Operating manual (Japanese) x 1 Camera mounting bracket x 1 Mounting screw x 4

(10) IV-S210C2: 0.25M CCD digital monochrome camera

Item	Specifications
Lens mount	C mount
Image capture element	Interline transfer method, monochrome CCD
Number of pixels	Approximately 2,000,000 pixels (1600 x 1200)
Image element size	1/1.8 inch
Pixel size	4.4 µm x 4.4 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/14,000 to 1/2 (72 µs to 0.5 s)
Synchronization method	Internally synchronized (Internal and external clock)
Image transfer time	60 ms (full mode)
Power voltage / power consumption	12 VDC (±10%) / 1.7W (Supplied from controller)
Operating environment	0 to 40°C (no corrosive gases, no excessive dust, non condensing)
External dimensions (mm)	W30 x H30 x D47 (excluding protrusions)
Weight	Approximately 55 g (excluding the lens)
External I/F	One connector (Camera link SDR connector)
Accessories	Operating manual (Japanese) x 1 Camera mounting bracket x 1 Mounting screw x 4

[2] Camera (Sold separately) (continued)

(11) IV-C250C3: 0.25M CCD digital color camera

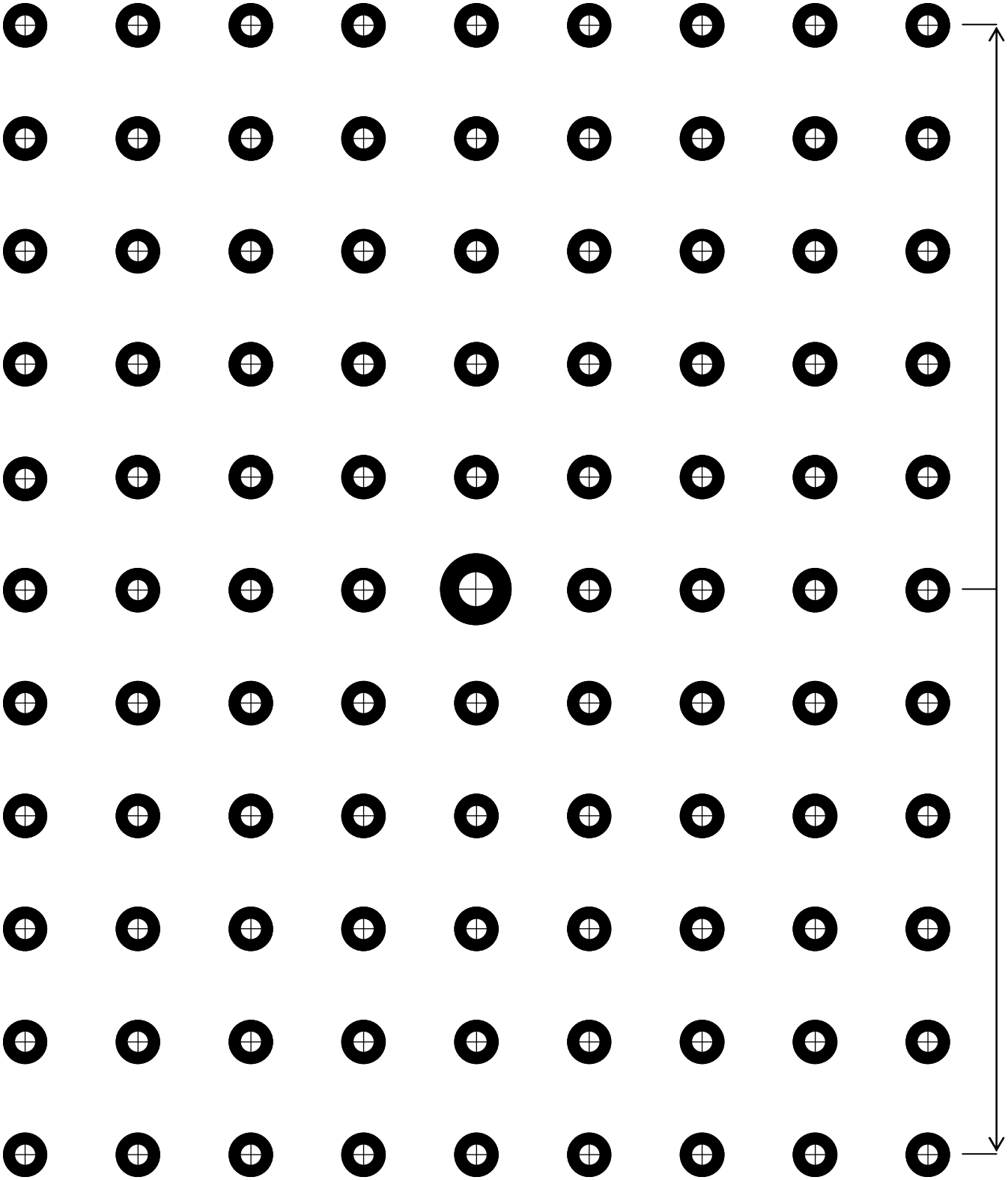
Item	Specifications
Lens mount	C mount
Image capture element	Interline transfer method, color CCD
Number of pixels	Approximately 2,000,000 pixels (1600 x 1200)
Image element size	1/1.8 inch
Pixel size	4.4 µm x 4.4 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/14,000 to 1/2 (72 µs to 0.5 s)
Synchronization method	Internally synchronized (Internal and external clock)
Image transfer time	57.9 ms (full mode)
Power voltage / power consumption	12 VDC (±10%) / 1.7W (Supplied from controller)
Operating environment	0 to 40°C (no corrosive gases, no excessive dust, non condensing)
Vibration proof	Duplex vibration width: 2 mm (10 to 150 Hz), 147 m/s^2 Sweep time: 2 hours (1 octave/min), in X/Y/Z axis
Shock proof	147m/s^2 (X, Y, Z, ± directions 3 times each: Total of 18 times
External dimensions (mm)	W30 x H30 x D47 (excluding protrusions)
Weight	Approximately 80 g (excluding the lens)
External I/F	One connector (Camera link SDR connector)
Accessories	Operating manual (Japanese) x 1 Camera mounting bracket x 1 Mounting screw x 4

(12) IV-C250C8: 0.25M CCD digital color camera

Item	Specifications
Lens mount	C mount
Image capture element	Interline transfer method, color CCD
Number of pixels	Approximately 250,000 pixels (512 x 480)
Image element size	1/3 inch
Pixel size	7.4 µm x 7.4 µm
Shutter method	Random shutter
Shutter speed (sec.)	1/20,000 to 1/1(50 µs to 1 sec)
Synchronization method	Internally synchronized
Image transfer time	15.6 ms (full mode)
Power voltage / power consumption	12 VDC (±10%) / 1.3W (Supplied from controller)
Operating environment	0 to 45°C (no corrosive gases, no excessive dust, non condensing)
Vibration proof	Duplex vibration width: 2 mm (10 to 150 Hz), 147 m/s^2 Sweep time: 2 hours (1 octave/min), in X/Y/Z axis
Shock proof	147m/s^2 (X, Y, Z, ± directions 3 times each: Total of 18 times
External dimensions (mm)	W30 x H30 x D47 (excluding protrusions)
Weight	Approximately 80 g (excluding the lens)
External I/F	One connector (Camera link SDR connector)
Accessories	Operating manual (Japanese) x 1 Camera mounting bracket x 1 Mounting screw x 4

Calibration Sheet

This is the sheet to be used when setting the coordinate transformation. See page 4-17.



Limited Warranty

SHARP CORPORATION ("SHARP") warrants to the first consumer purchaser that this SHARP brand product (the "Device"), will be free from defective workmanship and materials, and agrees that it will, at its option, either repair the defect or replace the defective part with a new or remanufactured equivalent at no charge to the purchaser for parts for the period of one (1) year from the purchase date, not including costs for removing or installing parts.

This warranty does not apply to any appearance items of the Device nor to the consumables nor to any Device the exterior of which has been damaged or defaced, which has been subjected to improper voltage or other misuse, abnormal service or handling, or which has been altered or modified in design or construction.

ALL IMPLIED WARRANTIES INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE ARE LIMITED TO ONE (1) YEAR FROM THE PUCHASE DATE.

Neither the sales personnel of the seller nor any other person is authorized to make any warranties other than those described herein, or to extend the duration of any warranties beyond the time period described herein on behalf of SHARP.

The warranties described herein shall be the sole and exclusive warranties granted by SHARP and shall be the sole and exclusive remedy available to the purchaser.

Correction of defects, in the manner and for the period of time described herein, shall constitute complete fulfillment of all liabilities and responsibilities of SHARP to the purchaser with respect to the Device, and shall constitute full satisfaction of all claims, whether based on contract, negligence, strict liability or otherwise.

In no event shall SHARP be liable, or in any way responsible, for any damages or defects in the Device which were caused by repairs or attempted repairs performed by anyone other than an authorized servicer. Nor shall SHARP be liable or in any way responsible for any incidental or consequential economic or property damage.

Sharp Corporation
Business Solutions BU
Manufacturing Systems Business Unit
4-1-33 Atobehonmachi, Yao-shi, Osaka 581-8581, Japan
PHONE: +81-72-991-0682

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