Panasonic®

MACHINE VISION SYSTEM
IMAGECHECKER®
PV200
User's Manual

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Before Reading This Manual

Thank you for purchasing the IMAGECHECKER PV200.

This manual describes information on the hardware such as how to install and wire and the software such as how to set the functions. Read this User’s Manual carefully before use.

Safety Precautions

To ensure that you use this product correctly, read this User’s Manual thoroughly before use. Make sure that you fully understand the product and information on safe.

WARNING

Critical situations that could lead to user’s death or serious injury are assumed by mishandling of the product:

- Do not use this product in areas with inflammable gas. It could lead to an explosion.
- Exposing this product to excessive heat or open flames could lead to damage to the lithium battery or other electronic parts.
- Do not store a lens in the locations subject to direct sunlight. It could lead to smoke generation.
- Do not look at the sun through a lens. It could lead to blindness.
- Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.

CAUTION

Critical situations that could lead to user’s injury or only property damage are assumed by mishandling of the product:

- Do not dismantle or remodel the product. It could lead to excessive exothermic heat or smoke generation.
- Do not touch the terminal while turning on electricity. It could lead to an electric shock.
- Do not allow foreign matters such as liquid, flammable materials, metals to go into the inside of the product. It could lead to excessive exothermic heat or smoke generation.
- Do not bend the cables forcibly, place a heavy object on them or bring them close to a thermal appliance. It could lead to an electric shock or smoke generation.
- To prevent excessive exothermic heat or smoke generation, use this product at the values less than the maximum of the characteristics and performance that are assured in these specifications.
- Use the external devices to function the emergency stop and interlock circuit.
- Connect the wires or connectors securely. The loose connection could lead to excessive exothermic heat or smoke generation.
- Do not undertake construction (such as connection and disconnection) while the power supply is on. It could lead to an electric shock.

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Precautions before Use

Installation Environment

Avoid installing and operating the PV200 in the following locations:

- Location with direct sunlight or environmental temperatures that exceed a range of the "operating ambient temperature" for each product.
- Locations with a relative humidity exceeding a range of the "operating ambient humidity" for each product or with a condensing due to a sharp temperature change.
- Locations with an atmosphere containing corrosive gases or flammable gases.
- Locations subject the main unit to direct vibration or impact.
- Locations with a lot of fine particles, iron filings or salt.
- Locations where the product can become wet with water, oil or chemicals.
- Locations with an atmosphere likely to contain organic solvents (such as benzene, paint thinner, and alcohol) or strongly alkaline materials (such as ammonia and caustic soda).
- Locations where a load applies onto the unit.
- Locations near the devices that generate large switching surges, high-voltage wires and devices, power-driven lines and devices, and transmitting devices, such as radios.

Static Electricity

- In dry environment, high voltages of static electricity might be generated. When you touch the product, you should always discharge the accumulated static electricity through your body by touching a grounded metal surface.

Cleaning

- Never use thinners or similar solvents, as they may dissolve the board and lead to colors to run.

Power Supply Unit and Power Sequence

- Use an insulated power supply with a built-in protection circuit. Applying an abnormal voltage might damage the internal circuit. If you use a power supply unit without a protection circuit, supply power through a protective device such as a fuse.
- Consider the power supply sequence so that the power supply unit for the PV200 can be turned off before the one for the input/output is turned off.
  If you turn the input/output power off before turning off PV200, the device will detect a change in the input signal level and may malfunction.

Before Turning on the PV200

- Pay attentions to the followings when turning on the PV200 for the first time:
  - Confirm no wiring waste or especially any conductive substance is on the printed circuit board.
  - Confirm that the power wiring, input/output wiring and power supply voltage are correct.
  - Confirm that the fixing and terminal screws are securely tightened.

General Cautions

- Use the keypad, camera, camera cables, monitor and a monitor cable of the product numbers specified by Panasonic Electric Works SUNX Co., Ltd. A breakdown, damage or destruction by using any other than the specified will not be covered by our guarantee.
- Do not change or set items that should not be as described in the manuals or the specifications. Breakdown, damage or destruction resulting from changing or setting them will not be covered by our guarantee.
- Do not perform a test of insulation resistance or withstand voltage between the power source or input/output signals and the metallic part of connectors or camera cases.
- To avoid loss of data by accident, also save the setting data stored in PV200 into a PC or an external storage media.

List of Menu Options

Language selecting window (Displayed only at the first startup after delivery)

Language selecting window ▶p.32
- Language — Japanese / English / Simplified Chinese / Korean / Traditional Chinese
- Do not show this window at the next start-up.

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- Save Setting Data
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F1
(Select Window)

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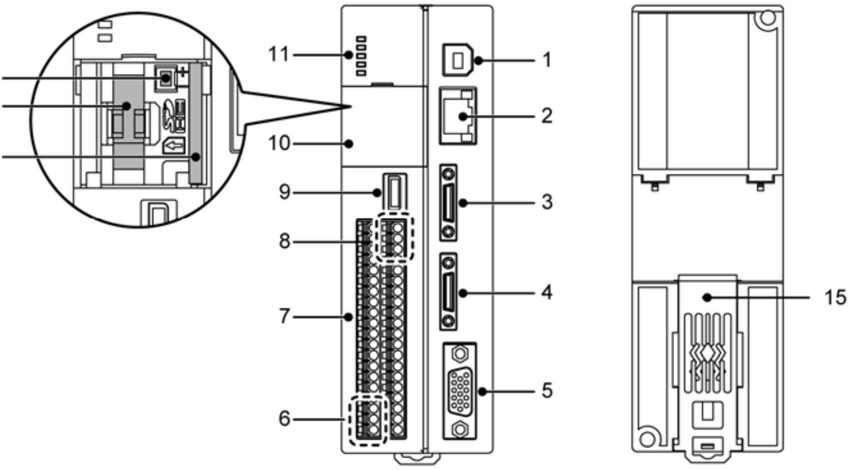
Chapter 1

Names and Descriptions

1.1 PV200



1	**USB Port**	USB 2.0 supported. (Exclusive for PVWIN200 communication)
2	**Ethernet Port**	Connects an Ethernet cable. When connecting an Ethernet cable, either one of two LEDs lights. (The LED to light and the color varies depending on baud rate.)
3	**CAMERA 0 Connect Port**	Connects a camera 0.
4	**CAMERA 1 Connect Port**	Connects a camera 1.
5	**MONITOR**	Analog RGB output terminal. (Connects a monitor.)
6	**Power Input Terminal**	Supply a voltage of 24 V DC (capacity: 3 A or more). The power terminal is located on the input terminal block.
7	**I/O Terminal Block**	An external input terminal.
8	**COM Port**	Connects to an external device via RS-232C. The COM port terminal is located on the output terminal block.
9	**Keypad Connector**	Connects a keypad (ANPVP03 / ANPVP10).
10	**Cover**	Cover to protect a SD memory card and backup battery. Data can be saved in a SD memory card even when the cover is open by default.
11	**Operating LEDs**	Displays the status of the following signals and communication ports. POWER / READY / ERROR / COM / SD
12	**Battery connector**	Connects a backup battery.
13	**Battery holder**	Attaches the battery retaining the following information. See the next page and attach the battery before use. - Built-in calendar - Type No. and Layout No. when turning off the power - Status of keypad operation
14	**SD Memory Card Slot**	Complies with SD memory card (SDHC) with up to 32 GB of memory. During accessing to a SD memory card, the LED above the slot flashes.
15	**DIN rail attachment lever (one-touch hook)**	To attach to DIN rail with a single touch.

Conformity to the EMC Directive

PV200 complies with the EMC standards in the following EMC Directive:

- EMC Directive(2004/108/EC)
- EN 61000-6-4: 2007
- EN 61000-6-2: 2005

▶ Note

Note the following compatibility conditions;

- No USB port must be used.
- Ferrite cores (equivalent products to RFC-5 produced by Kitagawa Industries. Co., Ltd.) must be attached to the both ends of a monitor cable.

Connecting Backup Battery

1. **Cut the power of PV200.**

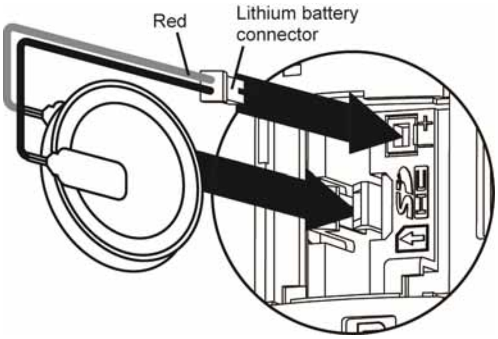
2. **Open the cover on the front side.**

   A battery is initially installed in the holder.

3. **Connect the connector of the battery with the connector of PV200.**

   ▶ Note

   Make sure not to connect   in the wrong orientation.



4. **Put the cover back in place.**

▶ Note

- Backup battery life is approximately 10 years at 25 °C of ambient temperature. If the battery is running out, a message saying “Change Battery!” appears in the information display area. Replace with a new one then. (Battery product No.: AFPX-BATT)
- To replace the battery, before the procedure described above, turn on the power of PV200 a minute or more and replace it in two minutes after turning off the power.
- Even if the battery has run out, type data and environment data are not discarded. The data discarded when the battery has run out is as follows.
  - Built-in calendar
  - Type No. and Layout No. when turning off the power
  - Status of keypad operation

Rebooting PV200

You can reboot PV200 without turning off the power.

1. **Hold down the F1, F2, F3 and SHIFT keys at the same time for 5 seconds or more.**

   PV200 is rebooted.

1.2 Camera

1.2.1 Camera Type and Precautions for Use

Camera Type

Three types of cameras listed below are provided. Choose to use them depending on your usage.

	4-Mega Gray Camera (ANPVC1470)	2-Mega Gray Camera (ANPVC1210)	2-Mega Color Camera (ANPVC2260)	0.3-Mega Quad-speed Color Camera (ANPVC2040)	0.3-Mega Quad-speed Gray Camera (ANPVC1040)
Number of Pixels	2 million pixels	2 million pixels		300 thousand pixels	
Image transfer Time	Approximately 63 ms	Approximately 34 ms*		Approximately 9 ms	
Dimension	44 x 44 x 54mm	29 x 29 x 58 mm			
CCD Size	2/3 inch	1 /1.8 inch		1/3 inch	
Pixel Size	3.45x3.45 µm	4.4 x 4.4 µm		7.4 x 7.4 µm	

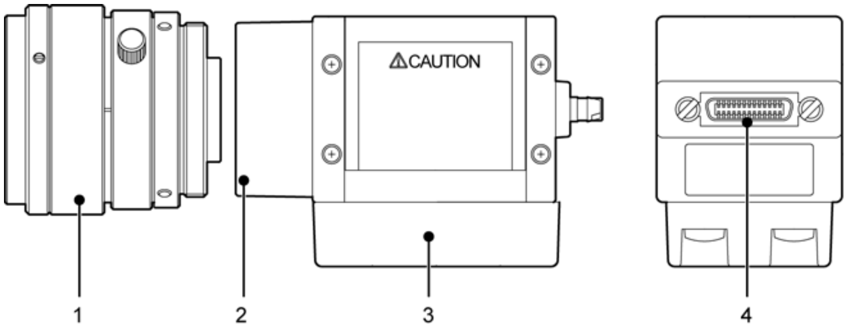
* When a 2-Mega color camera is connected together with another 2-Mega color camera or 0.3-Mega Quad-speed camera, the image transfer time of 2-Mega color camera is approximately 40 ms.

Precautions for Use

- Use only the camera and the camera cable with the proper product numbers specified by Panasonic Electric Works SUNX Co., Ltd.
- Do not bend the camera cables forcibly or apply load to the connector joints.
- Do not touch the CCD element or the lens surface of the camera. Attach the lens cap to keep off dust when not in use.
- When inserting/removing the cable into/from the connector, be sure to hold it by its plug to prevent excess force applying on the cable.
- Do not touch the terminals inside the connector of cameras and camera cables and take care not to allow foreign objects to come into the connectors.

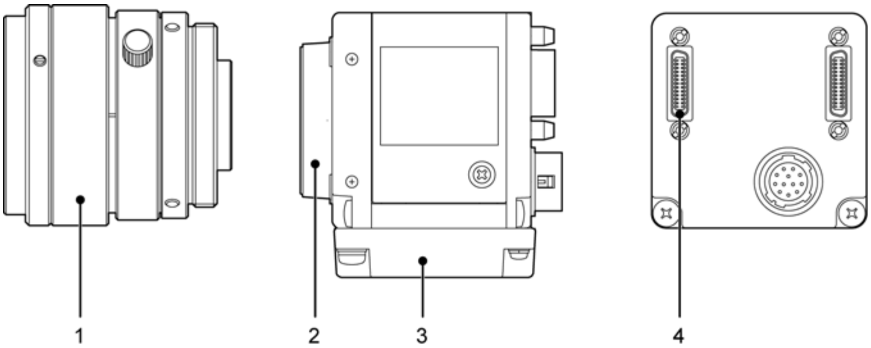
1.2.2 Names and Descriptions

Product No.:
0.3-Mega Quad-speed Gray Camera (ANPVC1040), 0.3-Mega Quad-speed Color Camera (ANPVC2040), 2-Mega Gray Camera (ANPVC1210), 2-Mega Color Camera (ANPVC2260)



1	**Lens**	Attach a C-mount lens with adapter rings as necessary.
2	**Lens fixture**	C-mount
3	**Mounting Plate**	Insulation type plate. The plate can be attached to four sides of a camera.
4	**Cable connector**	Connects a camera cable. Connect the connector labeled the product number of the cable to a camera.

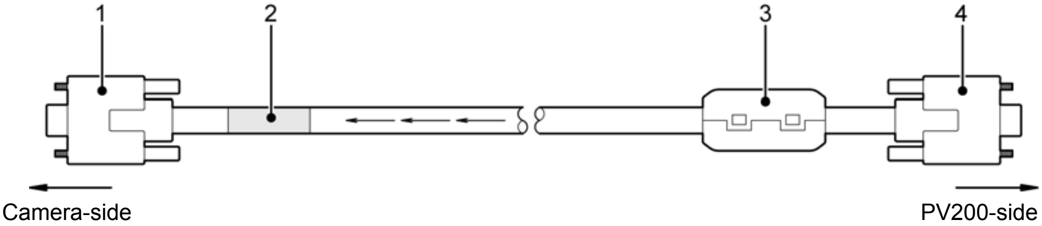
Product No.:
4-Mega Gray Camera (ANPVC1470)



1	**Lens**	Attach a C-mount lens with adapter rings as necessary.
2	**Lens fixture**	C-mount
3	**Mounting Plate**	Insulation type plate. The plate can be attached to the bottom and top sides of a camera. (The positions to screw the plate differ between the bottom and top sides.) For attaching the plate on the side of a camera, attach separately sold camera attachment brackets ANPVH005) to the camera in advance.
4	**Cable connector**	Connect a camera cable to the connector D.OUT1. Connect the connector labeled the product number of the cable to a camera.

1.2.3 Camera Cable

Product No.: ANPVC81XX, ANPVC81XXR (XX=03, 05, 10)



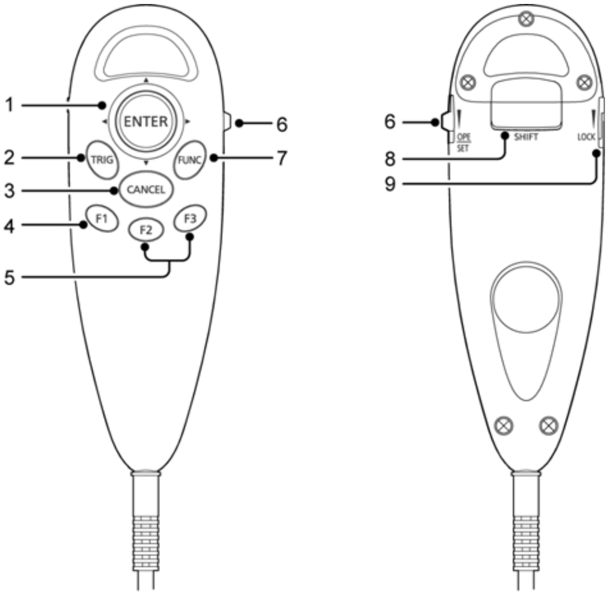
1	**Camera-side connector**	Connects to a camera.
2	**Product number label**	The label indicates product number of the camera cable.
3	**Ferrite core**	Attach this whenever you use the product. (ZCAT2035-0930A produced by TDK)
4	**PV200-side connector**	Connect the CAMERA connector of PV200.

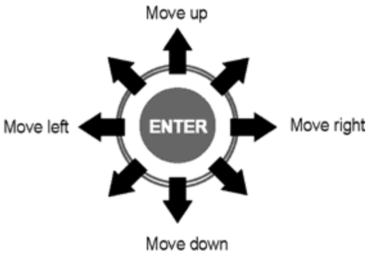
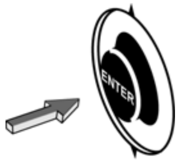
▶ Note

The camera cable has directionality. Be sure to connect the cable at the connector with a product number sticker to the camera, and the connector with a ferrite core to the PV200.

1.3 Keypad

Typical operations of the keypad are described below.



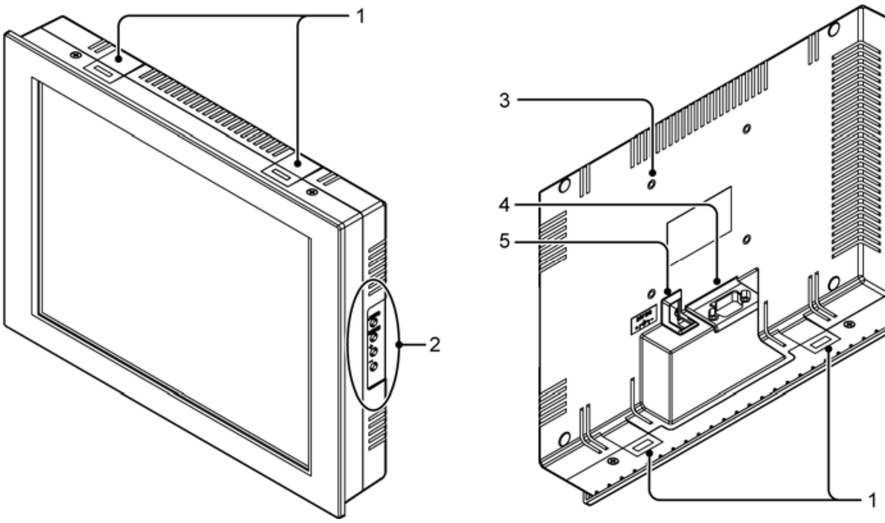
1	**ENTER key**	Cursor Operation To select the menu, input letters and move the start and end points of areas. 
		Determination Operation To determine the settings or select menu. 
2	**TRIG Key (TRIGGER)**	To start an inspection or run a test.
3	**CANCEL Key**	To return to the previous window or operation while setting.
4	**F1 Key**	To display the image menu.
5	**F2, F3 Key**	Use these keys when key guide is displayed in the bottom of the window.
6	**OPE/SET Switch**	To switch windows between SETUP menu and RUN menu. This is a snap type switch and the window switches every time you snap it.
7	**FUNC Key (FUNCTION)**	To display pop-up menu. Pressing the key two seconds or more captures the screen. (Print Screen)
8	**SHIFT Key**	Use when green SHIFT sign is shown on the screen. Mainly, to make the cursor move faster combining with cursor operation.
9	**LOCK Switch**	To lock or disable the 1 - 8 keys by setting in “LOCK” side. The switch prevents undesired operation of the keys by mistake.

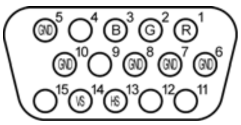
▶ Note

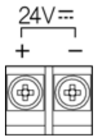
The operation from the keypad may be off on the PV200. Refer to page 343 for details.

1.4 XGA Monitor

Product No.: ANPVM11021



<table>
<tr><td>1</td><td><b>Mounting hole
for mounting bracket</b></td><td>Attach the included mounting brackets.</td></tr>
<tr><td>2</td><td><b>Adjustment volume</b></td><td>The following adjustments are available.
<table>
<tr><td>BRIGHT</td><td>Brightness</td><td>Adjusts the brightness.
(Brightness: approx. 20 to 100%)</td></tr>
<tr><td>V-POS.</td><td>Vertical Position</td><td>Adjusts the screen vertical position (in 16 lines).</td></tr>
<tr><td>H-POS.</td><td>Horizontal Position</td><td>Adjusts the screen horizontal position (in 16 pixels).</td></tr>
<tr><td>PHASE</td><td>Phase</td><td>Adjusts the screen flickering.</td></tr>
<tr><td>CONT.</td><td>Contrast</td><td>Adjusts the contrast.</td></tr>
</table></td></tr>
<tr><td>3</td><td><b>Mounting hole
VESA mount</b></td><td>4-M4 (depth: 7mm), 75 x 75 mm</td></tr>
<tr><td>4</td><td><b>RGB input connector</b></td><td>A connector for RGB signal input. To connect to the monitor with the VGA monitor cable -ANMX8331X. (Connector: Mini D-sub, 15 pins, female)


<table>
<tr><td>R</td><td>Image signal: Red</td></tr>
<tr><td>G</td><td>Image signal: Green</td></tr>
<tr><td>B</td><td>Image signal: Blue</td></tr>
<tr><td>GND</td><td>Signal ground</td></tr>
<tr><td>HS</td><td>Horizontal synchronizing signal</td></tr>
<tr><td>VS</td><td>Vertical synchronizing signal</td></tr>
</table></td></tr>
<tr><td>5</td><td><b>Power terminal</b></td><td>Acceptable input voltage: 24V DC

</td></tr>
</table>

▶ Note

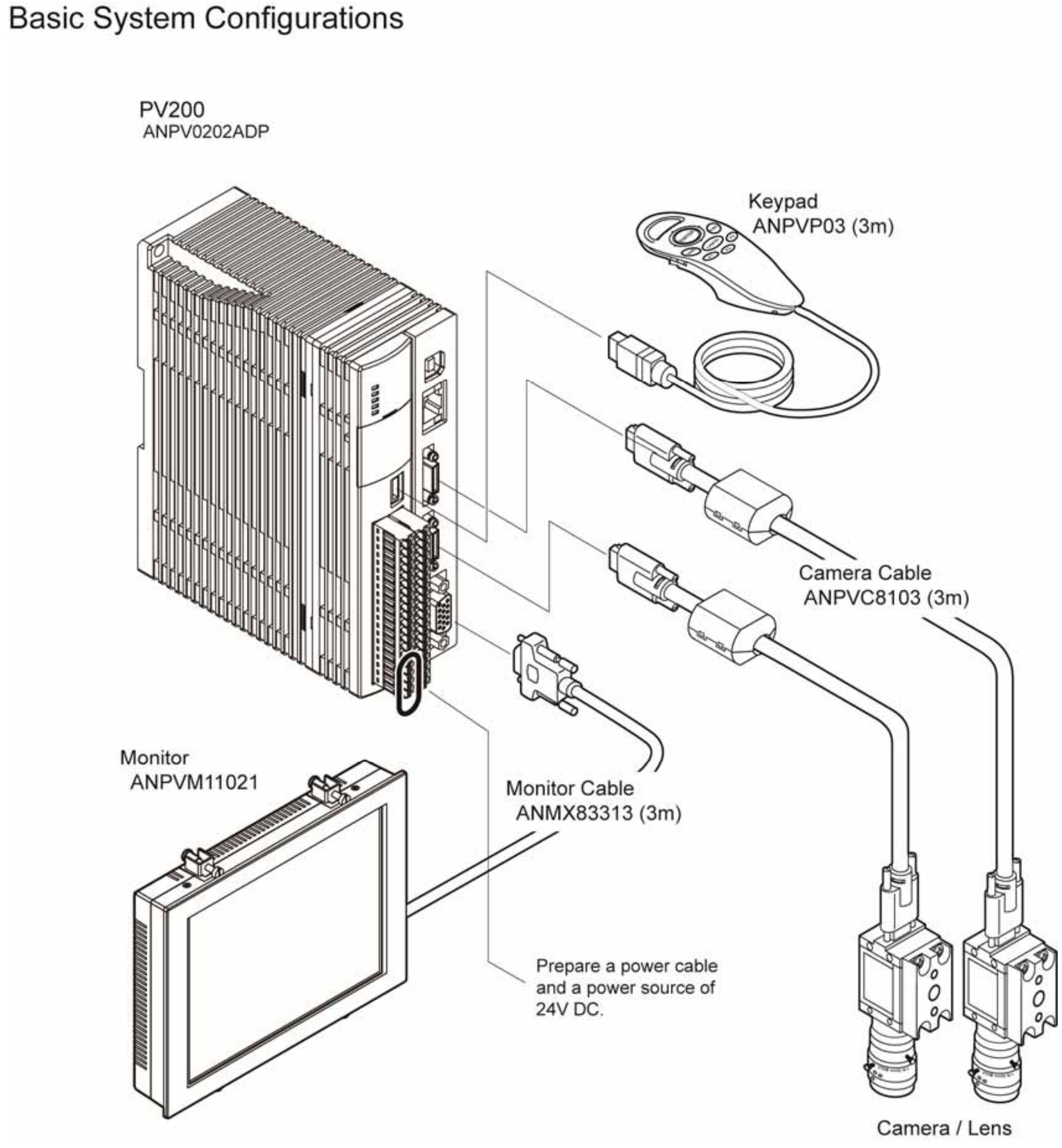
For the information of 15-inch monitor: ANPVM21522, refer to the instruction manual included with the product.

Chapter 2

Installation and Wiring

2.1 Basic System Configurations

An example of basic system configuration when connecting two cameras



2.2 PV200 Installation

2.2.1 Mounting Arrangement

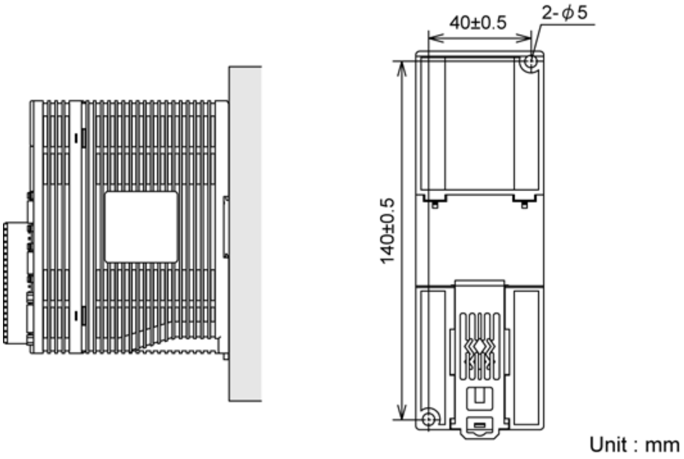
There are the two ways to mount the PV200, by using screws or by hooking on the DIN rail.

▶ Note

Before mounting PV200, attach a backup battery to it. Refer to page 11on how to attach the battery.

Back Side Mount

Mount PV200 using two mounting holes (ϕ5). Use M4 screws (length of 10 mm or more) to mount.

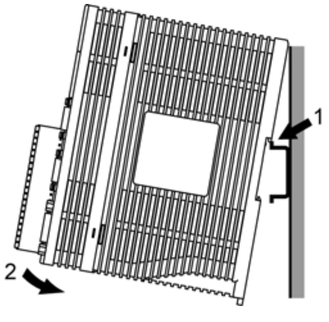


Mounting PV200 on the DIN rail

PV200 can be mounted on or removed from a 35 mm wide DIN rail (DIN EN50022) with a single easy operation.

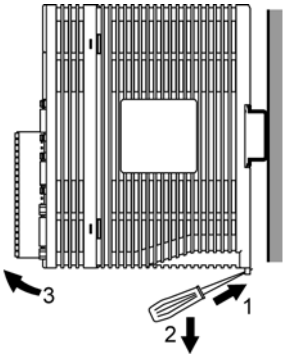
- Mounting

1. **Hook PV200 onto the DIN rail.**
2. **Press the lower part of PV200 to fit it into position.**



- Removing

1. **Insert the slot-head screwdriver into the mounting lever.**
2. **Press the mounting lever downward.**
3. **Lift and detach PV200.**

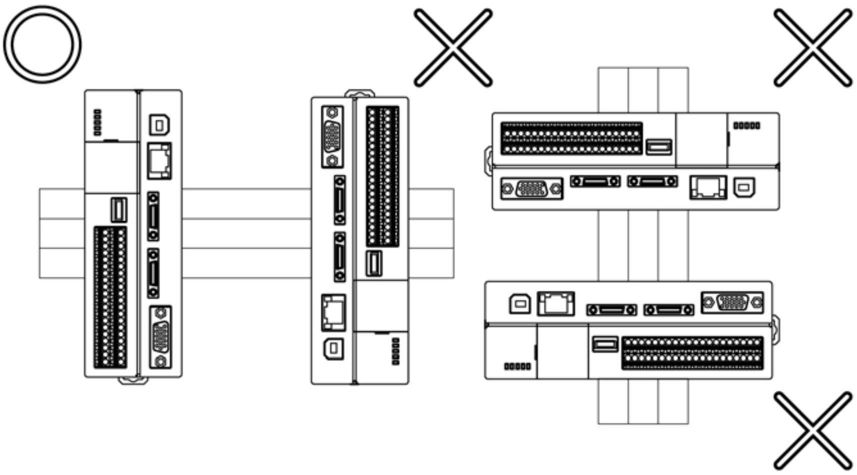


2.2.2 Note on Mounting

Mounting Direction

Install PV200 in the correct direction (see the figures below) for heat radiation. Do not mount it sideways or upside down.

Correct **Wrong**

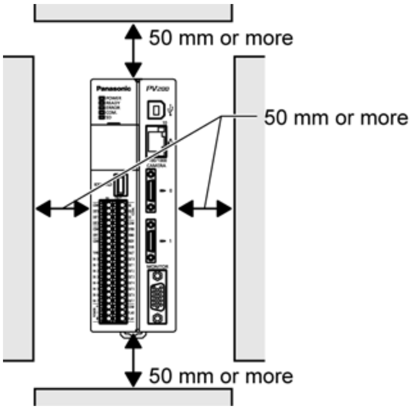


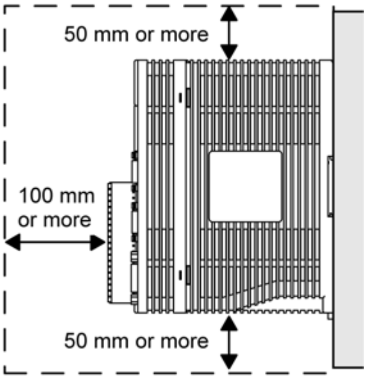
About Mounting Space

Keep more than 50 mm of space around PV200 for ventilation. In addition, to wire cables safely, keep more than 100 mm of space in front of PV200.

Note

When installing another PV200 next to it, keep more than 50mm of space between PV200s.





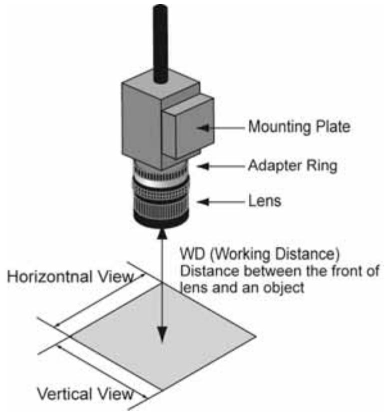
CAUTION

- Do not block the ventilators on the four sides of the unit. It might lead to a malfunction due to the internal heat retaining.
- When installing PV200 on a control board, take some measures such as attaching a cooling system (a fan motor, etc.) to lower the operation ambient temperature into the specified range (0 - 45 °C).

2.3 Mounting a Camera

2.3.1 Selecting a Lens (View Range Table)

Select a lens according to the capturing range (view range). Depending on the size of object, decide the capturing range (view range). And then, referring to the view range table of each camera, confirm the distance from the object to the camera (WD: work distance) and select a suitable lens.



▶ Note

- The values in the tables are just guidelines. Adjust them while checking an image on the actual device when you mount a camera.
- Adapter rings may be needed in some cases. When you use adapter rings, fix them between the lens and the camera.

View Range Table - 0.3-Mega Quad-speed Gray Camera: ANPVC1040 / 0.3-Mega Quad-speed Color Camera:ANPVC2040 View Range Table

View range (mm) \ Lens		ANM8850 ANM88501 f=50 mm		ANB847L f=50 mm		ANB846NL ANM88251 f=25 mm		ANB845NL ANM88161*1 f=16 mm		ANB 843L f=8.5 mm		ANB 842NL f=6 mm		Resolution µm/pixel	
Ver.	Hor.	WD	Adapter ring	WD	Adapter ring	WD	Adapter ring	WD	Adapter ring	WD	Adapter ring	WD	Adapter ring	Ver.	Hor.
1	1.3	59	177.5	48	177.5									2.1	2.1
2	2.7	73	88.5	62	88.5									4.2	4.2
3	4.0	87	59	76	59									6.3	6.3
4	5.3	101	44	90	44									8.3	8.3
5	6.7	115	35.5	104	35.5	31	17.5							10.4	10.4
7.5	10.0	150	23.5	139	23.5	49	11.5							15.6	15.6
10	13.3	186	17.5	175	17.5	66	8.5	31	5.5					20.8	20.8
12.5	16.7	221	14	210	14	84	7	42	2					26.0	26.0
15	20.0	256	11.5	245	11.5	101	5.5	53	2(*2)					31.3	31.3
20	26.7	326	8.5	315	8.5	137	2(*2)	76	2(*3)	30	1.5			41.7	41.7
30	40.0	467	5.5	456	5.5	207	2(*3)	121	1.5	54	1	32	0.5	62.5	62.5
40	53.3	608	2(*2)	597	2(*2)	277	2	166	1	78	0.5	49	0.5	83.3	83.3
50	66.7	749	2(*3)	738	2(*3)	348	1.5	211	1	102	0.5	66	0.5	104.2	104.2
75	100.0	1101	2	1090	2	524	1	323	0.5	162	0	108	0.5	156.3	156.3
100	133.3	1452	1.5	1441	1.5	700	0.5	436	0.5	221	0	150	0	208.3	208.3
150	200.0	2156	1	2145	1	1052	0.5	661	0	341	0	235	0	312.5	312.5
200	266.7	2860	0.5	2849	0.5	1403	0	886	0	461	0	319	0	416.7	416.7
250	333.3	3564	0.5	3553	0.5	1755	0	1112	0	580	0	404	0	520.8	520.8
300	400.0	4268	0.5	4257	0.5	2107	0	1337	0	700	0	488	0	625.0	625.0
350	466.7	4972	0.5	4961	0.5	2459	0	1562	0	820	0	573	0	729.2	729.2
400	533.3	5675	0	5664	0	2811	0	1787	0	939	0	657	0	833.3	833.3
450	600.0	6379	0	6368	0	3163	0	2013	0	1059	0	741	0	937.5	937.5
500	666.7	7083	0	7072	0	3515	0	2238	0	1179	0	826	0	1041.7	1041.7
600	800.0	8491	0	8480	0	4219	0	2688	0	1418	0	995	0	1250.0	1250.0
700	933.3	9898	0	9887	0	4923	0	3139	0	1657	0	1164	0	1458.3	1458.3
800	1066.7	11306	0	11295	0	5626	0	3589	0	1897	0	1333	0	1666.7	1666.7
900	1200.0	12714	0	12703	0	6330	0	4040	0	2136	0	1502	0	1875.0	1875.0
1000	1333.3	14121	0	14110	0	7034	0	4490	0	2375	0	1671	0	2083.3	2083.3

WD = The distance from the front of the lens to the object.
The values in the table are around the focal point of ∞, except as otherwise noted.
*1: WD=+4 mm *2: Lens focal position is in the closest position. *3: Lens focal position is in the middle position.

View Range Table - 2-Mega Gray Camera: ANPVC1210 / 2-Mega Color Camera:ANPVC2260

Lens View Range (mm)		ANPVL502 f=50 mm		ANPVL252 f=25 mm		ANPVL162 f=16 mm		Resolution µm / Pixel	
Ver.	Hor.	WD	Adapter ring	WD	Adapter ring	WD	Adapter ring	Ver.	Hor.
1	1.3	30	264					0.8	0.8
2	2.7	40	132					1.7	1.7
3	4.0	49	88					2.5	2.5
4	5.3	59	66					3.3	3.3
5	6.7	68	52.5					4.2	4.2
7.5	10.0	92	35					6.3	6.3
10	13.3	115	26	30	13.0			8.3	8.3
12.5	16.7	139	21	41	10.5			10.4	10.4
15	20.0	163	17.5	53	8.5			12.5	12.5
20	26.7	210	13	77	6.5			16.7	16.7
30	40.0	305	8.5	124	2(*1)	74	2(*1)	25.0	25.0
40	53.3	399	6.5	172	2(*2)	104	2	33.3	33.3
50	66.7	494	5	219	2(*3)	135	1.5	41.7	41.7
75	100.0	731	2(*4)	337	1.5	210	1	62.5	62.5
100	133.3	968	2	456	1.0	286	0.5	83.3	83.3
150	200.0	1441	1.5	693	0.5	438	0.5	125.0	125.0
200	266.7	1915	1	929	0.5	589	0	166.7	166.7
250	333.3	2388	1	1166	0.5	741	0	208.3	208.3
300	400.0	2862	0.5	1403	0	892	0	250.0	250.0
350	466.7	3335	0.5	1639	0	1044	0	291.7	291.7
400	533.3	3809	0.5	1876	0	1195	0	333.3	333.3
450	600.0	4282	0.5	2113	0	1347	0	375.0	375.0
500	666.7	4756	0.5	2350	0	1498	0	416.7	416.7
600	800.0	5703	0	2823	0	1801	0	500.0	500.0
700	933.3	6649	0	3297	0	2104	0	583.3	583.3
800	1066.7	7596	0	3770	0	2407	0	666.7	666.7
900	1200.0	8543	0	4244	0	2710	0	750.0	750.0
1000	1333.3	9490	0	4717	0	3013	0	833.3	833.3

WD = The distance from the front of the lens to the object
The values in the table are around the focal point of ∞, except as otherwise noted.

	Lens focal position
*1 :	Around 0.3
*2 :	Around 0.5
*3 :	Around 1
*4 :	Around 2

View Range Table – 4-Mega Gray Camera: ANPVC1470

Lens View Range (mm)		ANPVL502 f=50 mm		ANPVL252 f=25 mm		ANPVL162 f=16 mm		Resolution µm / Pixel	
Ver.	Hor.	WD	Adapter ring	WD	Adapter ring	WD	Adapter ring	Ver.	Hor.
1	1							0.5	0.5
2	2	35	176.5					1.0	1.0
3	3	42	118					1.5	1.5
4	4	49	88.5					2.0	2.0
5	5	56	70.5					2.4	2.4
7.5	7.5	74	47					3.7	3.7
10	10	91	35.5					4.9	4.9
12.5	12.5.	109	28.5					6.1	6.1
15	15	127	23.5	35	12			7.3	7.3
20	20	162	17.5	53	9			9.8	9.8
30	30	233	12	88	6	51	4	14.6	14.6
40	40	304	9	124	4.5	74	3	19.5	19.5
50	50	375	7	159	3.5	96	2.5	24.4	24.4
75	75	551	4.5	248	2.5	153	1.5	36.6	36.6
100	100	728	3.5	336	2	210	1	48.8	48.8
150	150	1082	2.5	513	1	323	1	73.2	73.2
200	200	1436	2	690	1	436	0.5	97.7	97.7
250	250	1790	1.5	867	0.5	549	0.5	122.1	122.1
300	300	2144	1	1044	0.5	662	0.5	146.5	146.5
350	350	2497	1	1221	0.5	776	0.5	170.9	170.9
400	400	2851	1	1398	0.5	889	0.5	195.3	195.3
450	450	3205	1	1575	0.5	1002	0.5	219.7	219.7
500	500	3559	0.5	1751	0.5	1115	0	244.1	244.1
600	600	4267	0.5	2105	0.5	1342	0	293.0	293.0
650	650	4620	0.5	2282	0.5	1455	0	317.4	317.4
700	700	4974	0.5	2459	0.5	1568	0	341.8	341.8
800	800	5682	0.5	2813	0	1795	0	390.6	390.6
900	900	6390	0.5	3167	0	2021	0	439.5	439.5
1000	1000	7097	0.5	3521	0	2248	0	488.3	488.3

WD = The distance from the front of the lens to the object
The values in the table are around the focal point of ∞.

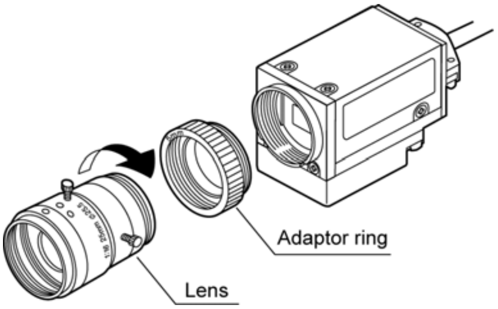
2.3.2 Mounting a Camera

1. **Attach a lens to a camera.**

Remove the camera cap and attach the selected lens.

▶ Note

Protect the CCD (image sensor) from dust. And do not touch the glass surface of CCD image sensor.



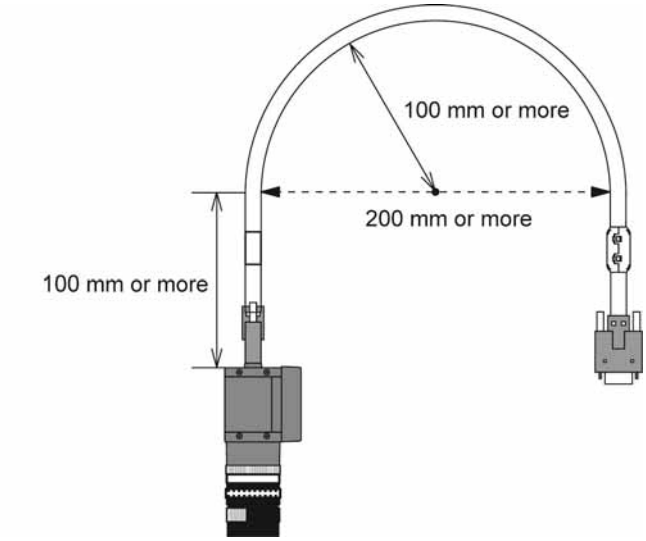
2.3.3 Note on Mounting

Mounting a Camera

- Use the mounting plate (insulation type) initially attached on the camera to mount it in an electrically insulated way.
  Without insulation, the internal circuit might be damaged because the camera case connects GND of the internal circuit if the electric potentials of the mounting point and the camera case are different.
- When you directly screw the camera without a mounting plate, do not screw into the bottom of the camera over 3 mm.
- The side of the plate mounted (the side of the face where the plate is attached before shipment) is the bottom of capturing images displayed on the screen.

Camera cables

- To prevent loading the cable, support the cable around the camera attachment and around the connector.
- Note on the followings when bending the cable.
  - Do not bend at least 100-mm part of the cable from the base of the connector of the camera.
  - The bend radius should be as below.



2.4 XGA Monitor Installation

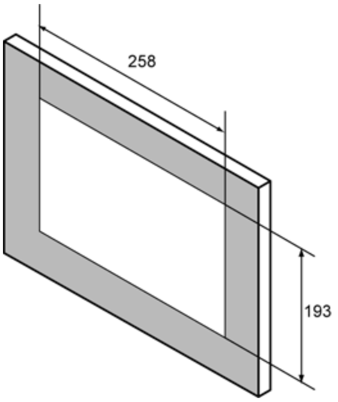
Install a XGA monitor: ANPVM11021 as below.

Note

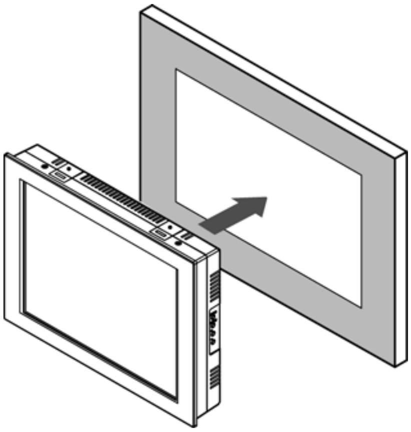
Never block the ventilation slits of the XGA monitor.

1. **Prepare a panel to attach a monitor.**

   Applicable panel thickness: 1 - 5 mm



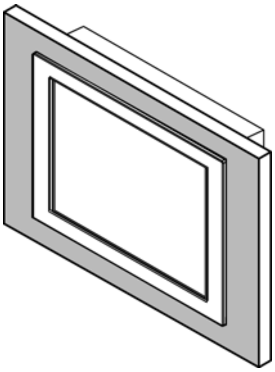
2. **Insert the monitor into the panel.**



3. **Attach the included attachment brackets to the monitor. (4 places)**

4. **Screw the attachment brackets to fix the monitor to the panel.**

   Tightening torque: 0.5 to 0.6 N/m



Note

Keep 50 mm spaces around the XGA monitor to prevent the cables from being damaged and to increase work efficiency.

2.5 Connecting Cables

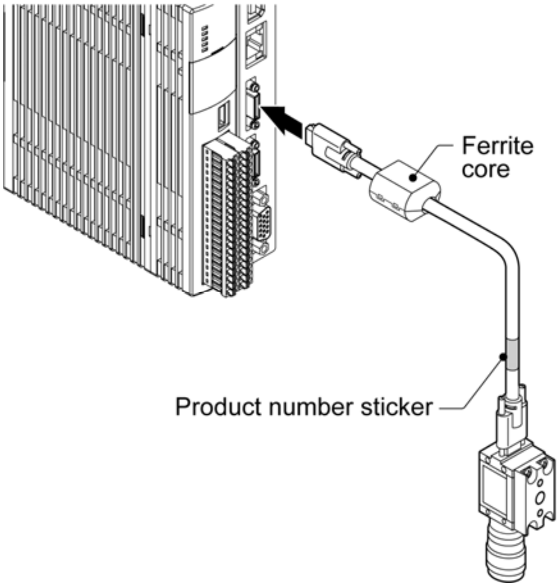
2.5.1 Connecting Peripherals

▶ Note

Be sure to turn off the power source for PV200 before connecting peripherals.

1. Connect a camera to PV200.

Connect a camera cable with a camera connector.
The camera cable has polarity. Connect the cable at the end with a product number sticker to the camera, and the end with a ferrite core to the PV200.



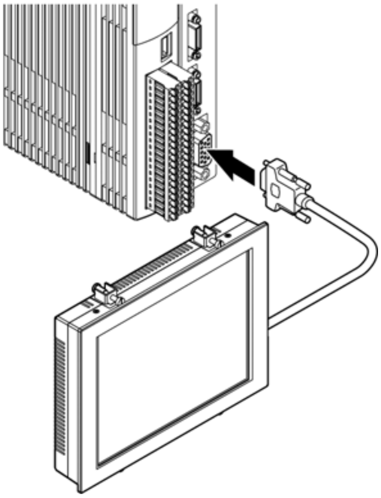
▶ Note

When you use just one camera, be sure to connect it to "CAMERA 0".

Keep the camera cable more than 100 mm away from a power cable and a power source cable.

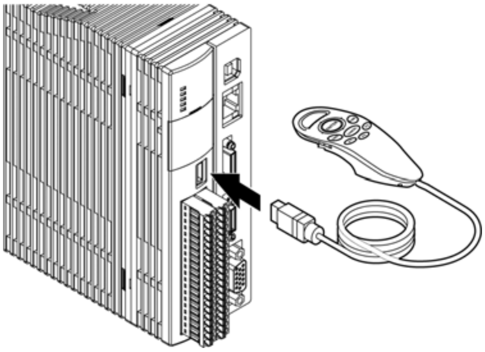
2. Connect a monitor to PV200.

Connect a monitor cable to “MONITOR” connector.



3. Connect a keypad.

Connect the designated keypad to “KEYPAD” connector.

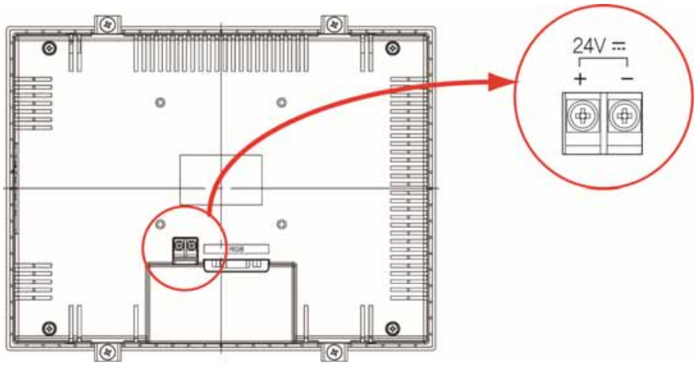


2.5.2 Connecting Power to XGA Monitor

Connect the power of 24 V DC to the terminal on the back side.

Note

Use an insulated power supply with a built-in protection circuit as a power supply device to supply 24 V DC.



Rated voltage: 24 V DC
Operating voltage range: 21.6 to 26.4 V DC
Power consumption: 0.5 A (Max. 1A)

Applicable Solderless Terminal

- Terminal screws are M3.
- Screw the terminal block with tightening torque of 0.8 Nm.
  Failure to do so might damage to the product.
- It is advisable to use solderless terminals to wire.
  Use wires of 0.5 mm^2 to 1.25 mm^2 diameter if you do not use a solderless terminal.

Manufacturer	Shape	Model No.	Applicable wire	Tightening torque
JST Mfg. Co., Ltd.	R-type	1.25-MS3	0.25 mm^2 to 1.65 mm^2	0.5 to 0.6 N/m
	A-type	1.25-B3A		
	R-type	2-MS3	1.04 to 2.63 mm^2	
	A-type	2-N3A		

2.5.3 Connecting Power to PV200

24V DC electric power is supplied through the +/- terminals on the input terminal block.
Twist the electric wires for noise reduction.

- Appropriate wire size: AWG#24 to 16, 0.2 to 1.5 mm^2
- Uncovered wire length: 10 mm

Note

Do not supply power until every connection has completed.

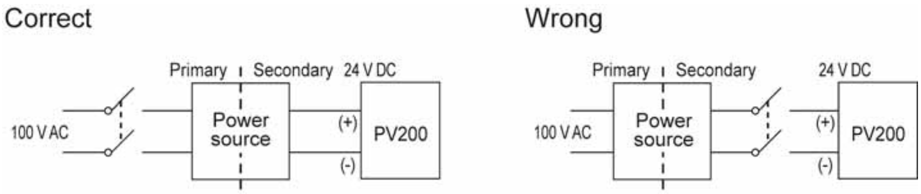
Wiring Power

1. **Prepare a power supply unit which fulfills the following conditions and connect to the POWER(+/-) on the input terminal block.**

Conditions for power supply
- Power voltage: 24 V DC +/- 10 %
- Current capacity: 3.0A or more
- Insulated power supply with a built-in protection circuit

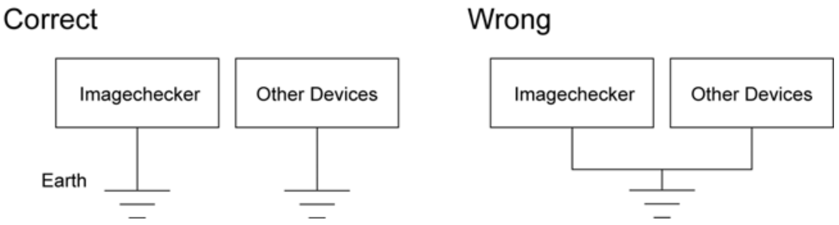
▶ Note

- Ensure to use the separate power supply for the PV200 from the power supply for power devices.
- Turn ON/OFF the power supply at the primary side. If you turn ON/OFF it at the secondary side, the fuses of PV200 may melt down.

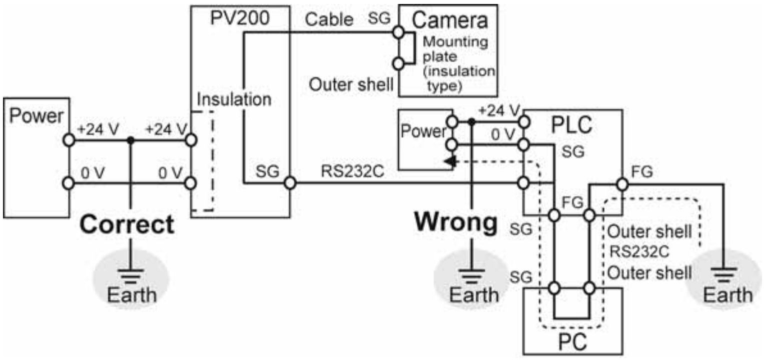


2. **Connect an earthing conductor.**

- Do not share the grounding system with other devices.
- Install the PV200 as close to the ground point as possible and keep the ground wire short.



- The power circuit of PV200 is insulated and you can ground the positive (+) terminal of 24V DC power supply without fault.
- When connecting PV200 with the other devices such as PLC, do not ground the positive terminal of the power supply of the device. If the power supply circuit of the device is not insulated, the connection between the outer shell of the PC and the 0V-power supply may cause a short-circuit condition and burnout.



3. **Connect the input terminal of PV200.**

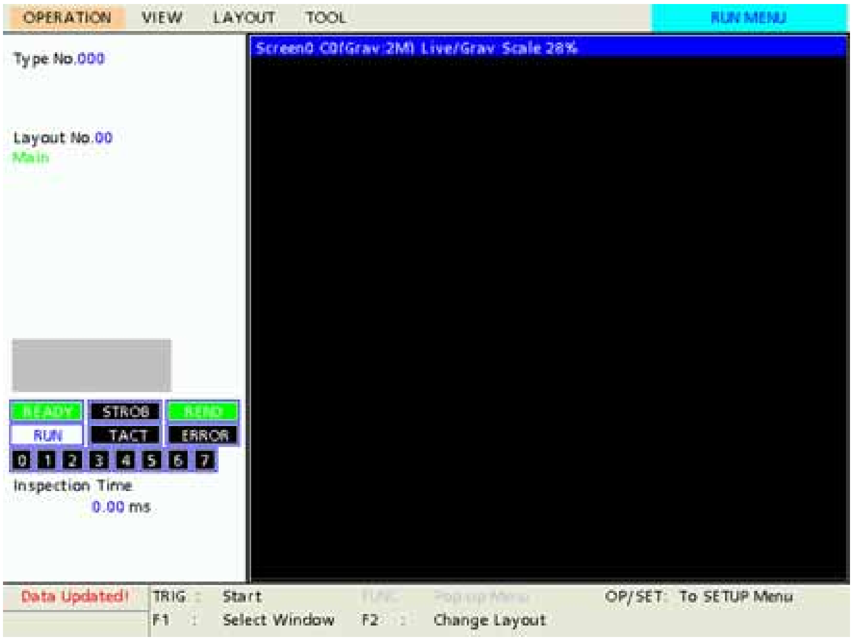
- Connect other input terminals if necessary before connecting the terminal block.

2.6 Supplying Power

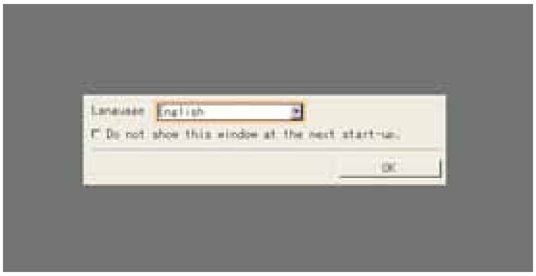
Confirming Start

1. **Supply the power after confirming that the all connections are correct.**

   The splash screen appears and then the default screen of RUN menu is displayed.



When you start the very first time after delivery, the dialog to select interface language appears. Refer to the next chapter for more details.



▶ Note

If the monitor screen displays nothing, confirm the following statuses.

- Is power supplied to PV200 correctly?
- Is the power switch of the monitor ON?
- Does the monitor cable connect correctly?

▼Refer to▼

You can change splash screen. Refer to page 358 for details.

Chapter 3

Basic Operation

3.1 About Windows

3.1.1 Language Selecting Window

When you start the very first time after delivery, the English dialog to select interface language appears. You can display multiple languages with PV200. Select an appropriate language in this dialog.

Since the language can be changed in SETUP menu later as well, select your most accessible language for now.

▼Refer to▼

Switching Language: see page 348.

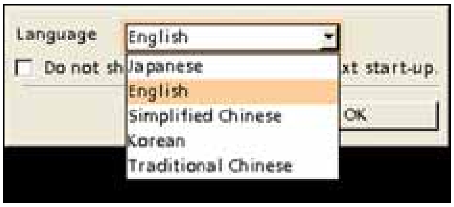
1. **Turn on the power.**

After the splash screen appears, the English dialog to select language is displayed.

2. **Press the Enter key.**

Settable languages are displayed.

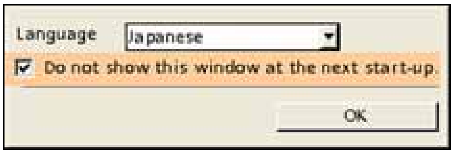
Japanese
English
Simplified Chinese
Korean
Traditional Chinese



3. **Tilt the ENTER key up/down to move the cursor onto the language you want to use and press the ENTER key.**

4. **Tilt the ENTER key up/down to move the cursor onto the lower message and press the ENTER key.**

The message says "Do not show this window at the next start-up."
Pressing the ENTER key checks the check box and the window does not appear from the next startup.


Language: Japanese

☑ Do not show this window at the next start-up.

The English dialog is shown also at the next startup if you do not check it.

5. **Tilt the ENTER key up/down to select “OK” and then press the ENTER key.**

RUN menu is displayed on the screen.

▶ Note

If you make an operation not to display the language selecting window such as selecting "Do not show this window at the next start-up.", you cannot display it again. In this case, make setting from “TOOL” > "General" > "Language" in SETUP menu to switch language.

3.1.2 SETUP Menu and RUN Menu

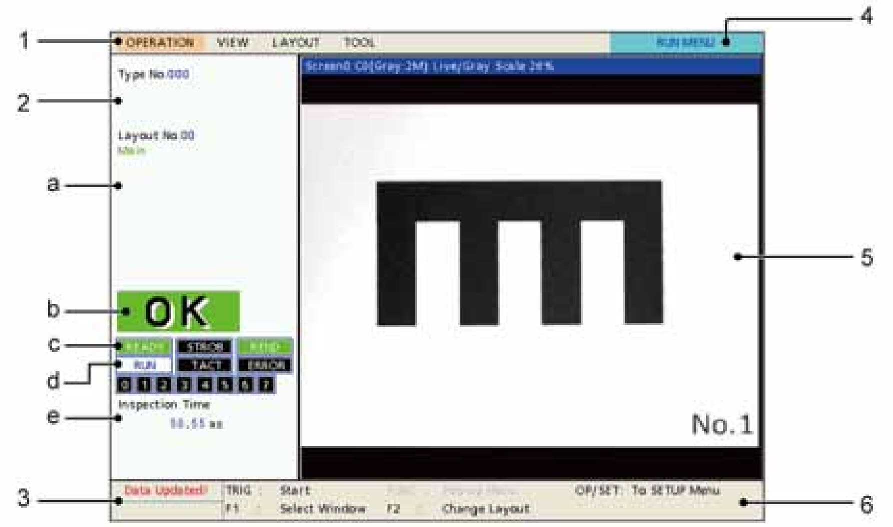
About windows

PV200 has two windows; RUN menu for performing inspections and SETUP menu for making settings such as inspection conditions.

When power is turned on, RUN menu is displayed. To make a configuration, switch to SETUP menu with Ope/Set Switch of the keypad. Switching to SETUP menu stops operation.

RUN menu

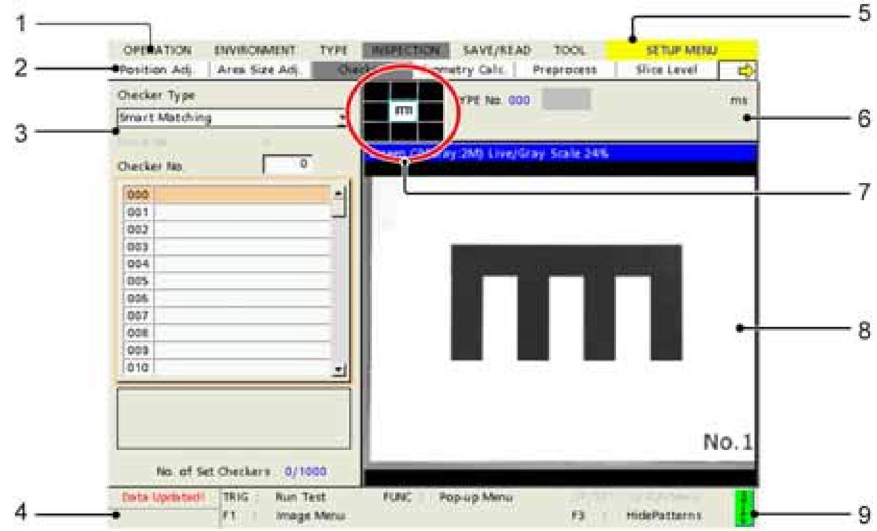
In RUN menu, you can change its layout (type, size and position of displayed windows).



1	**Menu bar**			Displays the menu to set in RUN menu.
2	**Information display area**			
		a	Information	Displays the current type, display pattern and the status of the PV200.
		b	Total judgement result	Displays the result of judgement formula registered as Total Judgement.
		c	Output terminal status	Displays the status of output terminals. ON: Green, OFF: Black
		d	Operation Status	Displays the status operating (RUN) or pausing (STOP).
		e	Time	Displays inspection time and cycle in ms unit. (For details of each time, see page 317.)
3	**Message area**			Displays the message to inform. Example) • The setting was updated. • The voltage of the attached battery became lower.
4	**Display type**			Displays "RUN MENU". (Indicates the current window is RUN menu.)
5	**Screen window**			This is a window to display an image. In addition, a data R/W window which shows data can be displayed in the area.
6	**Key guide**			Displays the operations of each key on the keypad.

SETUP menu

In SETUP menu, the display changes depending on operation.

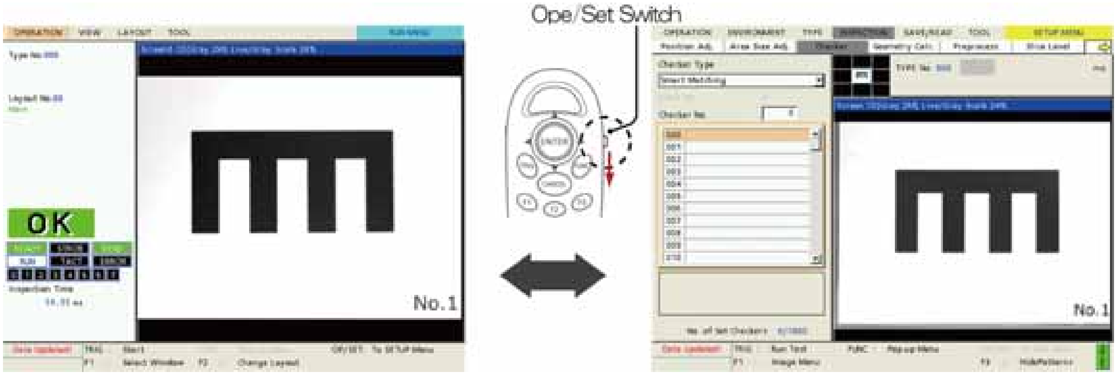


Data Updated!

1	**Main menu**	Displays the menu to set in SETUP menu.
2	**Sub menu**	Displays a submenu of the menu selected in the main menu.
3	**Setting windows**	Setting windows displayed in the upper left of the screen. The above image is an example of screen displaying the checker setting window
4	**Message display area**	Displays the message to inform. Example) The setting was updated. The voltage of the attached battery became lower.
5	**Display type**	Displays "SETUP MENU". (Indicates the current window is SETUP menu".)
6	**Information display area**	• Type number • Inspection time (unit: ms)
7	**Screen window navigator**	Displays the thumbnails of captured images and displays the area currently shown on the screen window in light blue frame.
8	**Screen window**	Displays a camera image.
9	**Key guide**	Guide for the keypad.

Switch between RUN Menu and SETUP Menu (OPE/SET Switch)

To switch the window from RUN menu (default window) to SETUP menu, operate the OPE/SET switch on the keypad. Operate in the same way to return to RUN menu.



RUN Menu (default)

SETUP Menu

Entering a Password

When you switch the window from RUN menu to SETUP menu, a password may be requested to enter.

This is the function that prevents undesired setting changes by mistake. A password can be set from ENVIRONMENT menu in SETUP menu.

▼Refer to▼

For the information of setting a password to switch to SETUP menu, refer to page 343.

1. **Snap the OPE/SET switch in RUN menu.**

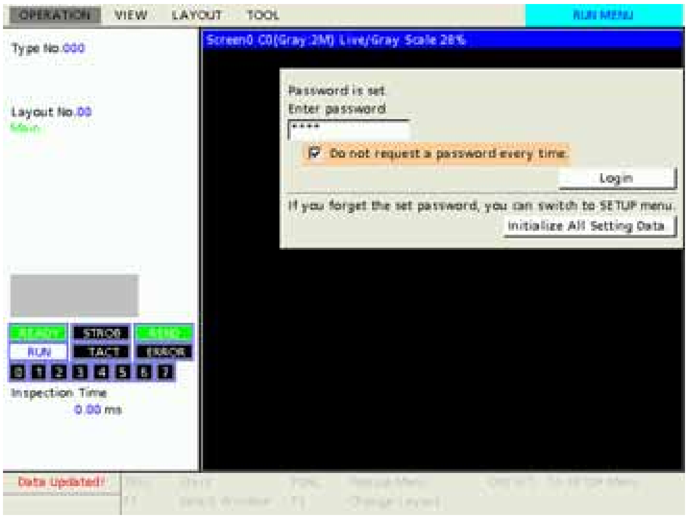
   Password window is displayed.

2. **Enter a password.**

   Use the software keyboard.

3. **Select "Login".**

   Entering the correct password will switch the window to SETUP menu.



Password is set.
Enter password
****
☑ Do not request a password every time.
Login
If you forget the set password, you can switch to SETUP menu.
Initialize All Setting Data

▶ Note

"Do not request a password every time."
Check this item to switch to SETUP menu without entering a password.
Set the switch in "LOCK" side to change to request a password after that. (As the keys on the keypad are disabled when the switch is set to "Lock" side, set it back.)
Also, after you reboot PV200, it requests a password again.

4. **If you forget the password, select "Initialize All Setting Data" to switch to SETUP menu.**

   Note that all the setting data will be initialized when selecting this menu.

3.2 Basic Key Operation

3.2.1 Selecting Items and Inputting Values or Characters

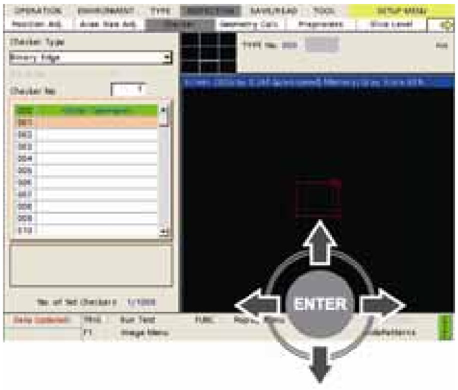
Selecting an Item

To select a menu or a value of an item, follow the instructions below. This manual describes this operation as “select xx”.

1. **Move the cursor to the menu or value you want to set by tilting the ENTER key on the keypad upward/downward/left/right.**

2. **Press the ENTER key.**

   The highlighted menu or value at the step 1 is selected.



Inputting Values

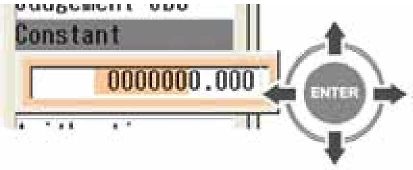
1. **Select a box to Input value.**

2. **Tilt the ENTER key on the keypad upward/downward to change and specify the value.**

   By tilting the ENTER key left/right, you can change the digit position of the inputting value.

3. **Press the ENTER key.**

   The value that you specified at the step 2 is fixed.



Inputting Characters

Input characters in a title or comment of items such as Type, Checker, Layout, Numerical Calculation, or Judgement and a text of items such as Data R/W using the software keyboard.

▶ Note

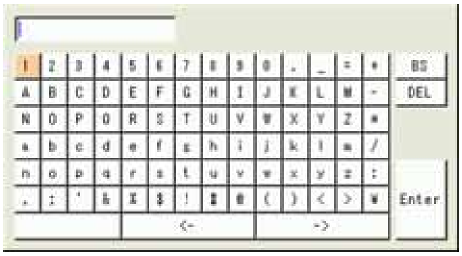
With the setting simulation software “PVWIN200”, you can input the characters that are not on the software keyboard.

1. **Select a box to Input characters.**

   A software keyboard is displayed.

   ▶ Note

   In some cases such as entering a title, you need to press the FUNC key to show pop-up menu and select the item to input them.


1 2 3 4 5 6 7 8 9 0 . _ = + BS
A B C D E F G H I J K L M - DEL
N O P Q R S T U V W X Y Z *
a b c d e f g h i j k l m /
n o p q r s t u v w x y z : Enter
, ; ' & % $! # @ ( ) < > ¥
<-
->

2. **Input character one by one.**

To select characters, move the cursor onto the character to input and press the ENTER key.

To input a space, select a blank key at the lower left.

To collect (delete) characters, select the right/left arrows and move the cursor onto the character to correct (delete).
Selecting “DEL” deletes the character.
Selecting “BS” deletes the previous character.

3. **After inputting is completed, press the ENTER key.**

The specified characters are determined.

3.2.2 Selecting a Display Image (Image Menu)

An image captured with the connecting camera is displayed on the Screen window. You can choose a camera image and an image type to display. Select them from Image Menu.

▶ Note

The information including camera number or type of the image displayed on the screen windows are displayed in the screen window bar. As you change the camera number or image type, the display of the bar is updated.

Displaying Image Menu

In SETUP Menu

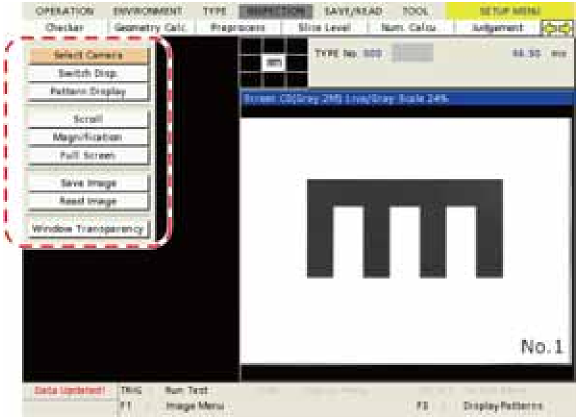
1. **Press the F1 key of the keypad.**

In SETUP menu, Image menu is displayed.

Whenever “F1: Image Menu” is shown in the key guide, Image Menu can be activated.
But, some items of Image Menu may be grayed out to limit changing the settings depending on windows.

▼Refer to▼

The transparency of the background of setting dialog window can be changed.
Refer to page 342 for details.



In RUN Menu

1. **Press the F1 key of the keypad.**

The screen number list is displayed to select window.

2. **Select a screen number to set.**

Image menu is displayed.

Selecting a Camera Image

1. **Select “Select Camera” from Image menu.**

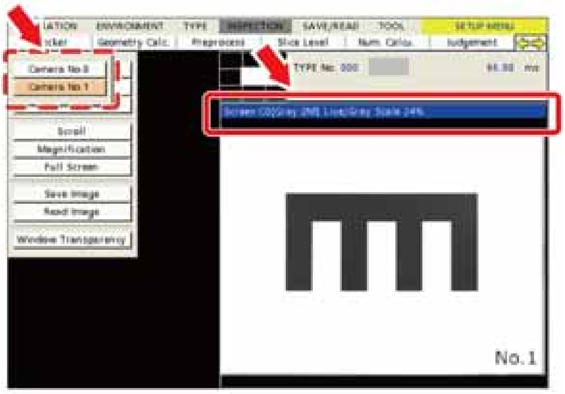
Settable camera No.s are displayed.

2. **Select the camera No. to display.**

The image on the screen window is replaced.

▶ Note

In the screen window bar, the information of the displayed image is updated.



Selecting an Image Type

Select how display the image captured by a camera on the screen window.

Connecting a gray camera (ANPVC1040, ANPVC1210, ANPVC1470)

SETUP Menu

- **Camera No.**
  - **Memory**
    - **Grayscale Preprocess: No** — ————
      - **Slice Level: No**
      - **Slice Level: A-P**
    - **Grayscale Preprocess: (A-P)** — **Step: 1st - 10th**
      - **Slice Level: No**
      - **Slice Level: A-P**
  - **Live** — **Same as “Memory”**

RUN Menu

- **Camera No.**
  - **Memory**
    - **Grayscale Preprocess: No** — ————
      - **Slice Level: No**
      - **Slice Level: A-P**
    - **Grayscale Preprocess: (A-P)** — ————
      - **Slice Level: No**
      - **Slice Level: A-P**
  - **Live** — **Same as “Memory”**
  - **NG Image** — **Latest / Previous** — **Same as “Memory”**

Connecting a color camera (ANPVC2040, ANPVC2260)

SETUP Menu

```
Camera ┬ Memory ┬ Grayscale / Color: No (Color image)
No.    │        │
       │        ├ Converted┬ Grayscale          ──────     ┬ Slice Level: No
       │        │ Gray Img.│ Preprocess: No                │
       │        │          │                               └ Slice Level: A-P
       │        │          │
       │        │          └ Grayscale          ─Step: 1st -┬ Slice Level: No
       │        │            Preprocess:          10th      │
       │        │            (A-P)                          └ Slice Level: A-P
       │        │
       │        └ Extracted ─ Extracted      ┬ White      ┬ Grayscale           ┐
       │          Color Img.  Color (Bulk /  │ (Black BG) │ Preprocess: No      │
       │                      Individual)    │            │ ┌───────────────────┘
       │                                     │            │ └─────     ┬ Slice Level: No
       │                                     │            │            │
       │                                     │            │            └ Slice Level: A-P
       │                                     │            └ Grayscale           ┐
       │                                     │              Preprocess: (A-P)   │
       │                                     │            ┌─────────────────────┘
       │                                     │            └ Step: 1st - ┬ Slice Level: No
       │                                     │              10th        │
       │                                     │                          └ Slice Level: A-P
       │                                     ├ Extracted Color(Gray BG)
       │                                     └ Single Color (Color BG)
       └ Live   ─ Same as “Memory”
```

RUN Menu

```
Camera ┬ Memory ┬ Grayscale / Color: No (Color image)
No.    │        │
       │        ├ Converted┬ Grayscale          ──────     ┬ Slice Level: No
       │        │ Gray Img.│ Preprocess: No                │
       │        │          │                               └ Slice Level: A-P
       │        │          │
       │        │          └ Grayscale          ──────     ┬ Slice Level: No
       │        │            Preprocess:                   │
       │        │            (A-P)                         └ Slice Level: A-P
       │        │
       │        └ Extracted ─ Extracted      ┬ White      ┬ Grayscale           ┐
       │          Color Img.  Color (Bulk /  │ (Black BG) │ Preprocess: No      │
       │                      Individual)    │            │ ┌───────────────────┘
       │                                     │            │ └─────     ┬ Slice Level: No
       │                                     │            │            │
       │                                     │            │            └ Slice Level: A-P
       │                                     │            └ Grayscale           ┐
       │                                     │              Preprocess: (A-P)   │
       │                                     │              ┌───────────────────┘
       │                                     │              └──────    ┬ Slice Level: No
       │                                     │                         │
       │                                     │                         └ Slice Level: A-P
       │                                     ├ Extracted Color(Gray BG)
       │                                     └ Single Color (Color BG)
       ├ Live     ─ Same as “Memory”
       └ NG Image ─ Latest / Previous  ─ Same as “Memory”
```

Options

Memory/Live

- Memory: An image stored in a memory for inspection. The image does not change even if you cover the lens or uncover it.
  If you want to run a test using the image memory of PV200 or images in a SD card in SETUP menu, switch to Memory.
- Live: An image changes in real-time. When you cover the lens with your hand, a captured image will be darker, while it will be lighter when you uncover it.

Binary

You can select this item for an image which contains no color elements and contains grayscale information. You may not be able to select this when connecting a color camera.

- No: When connecting a gray camera, displays an image in 256 gray levels captured by the camera.
  When connecting a color camera, displays a grayscale image converted from a color image or a color extracted image that grayscale preprocess has done.
- Slice Level: A binarized image in black and white based on a gray scale image displayed when selecting "No".
  ▼Refer to▼
  For details, refer to Chapter 4.6.2 “Binarizing an Image (Slice Level)”, page 80.

Grayscale / Color

You can select this item when connecting a color camera.

- No: Displays a color image captured by a color camera.
- Converted Gray Img.: Converts a color image to a gray scale image in a range of 0 to 255 using RGB values for each pixel. Changing RGB coefficients enables to convert a color image to various gray scale images.
- Extracted Color Img.: Converts RGB values of each pixel to HSV (hue, saturation and value) that is better fitted to human sense and extracts colors in a specified area. The image will be a gray scale image with the extracted colors converted to 255 and the other colors converted to 0.

Extracted Color

You can select this item when selecting "Extracted Color Img." with a color camera.

- Bulk: Displays an image extracted by a specified extraction number of eight or sixteen consecutive colors. The number of consecutive colors varies depending on the number of connected color cameras.
- Individual: Displays an image extracted by a single extraction number.

▶ Note

Although a maximum of eight desired extraction numbers can be specified in Checker, the image that is inspected in Checker may not be displayed by selection of Bulk or Individual. However, the image that is actually inspected can be displayed in each checker setting window.

Extraction Display Mode

You can select this item when selecting "Extracted Color Img." with a color camera.

- White (Black BG): An image will be a gray scale image with the extracted colors converted to 255 and the other colors converted to 0. Gray Preprocess can be selected when selecting this mode.
- Extracted Color(Gray BG): Displays extracted colors as a color image on the gray scale image converted from a color image (standard).
- Single Color (Color BG): Displays extracted colors on a color image in "Color for Single Color". The default color is pink.
  ▼Refer to▼ For details, refer to Chapter 4.3.6 "Selecting Color Extraction Mode ”, page 70

NG Image (only for RUN Menu)

Displays a memory image when the result of a judgement formula registered as Total Judgement is "NG". Select from "Latest", "Previous", and "Before the Previous".

- Latest: Displays an image of the latest NG total judgement.
- Previous: Displays an image of the previous NG total judgement.

Grayscale Preprocess A preprocessed image can be displayed when using the function. When using a color camera, it may not be selected depending on the combination of the displays.

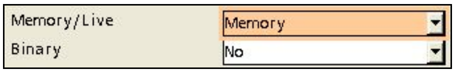
No:	Displays an image before preprocess.
A to P:	To select a Preprocess Group.
Step: 1st to 10th (only for SETUP Menu)	Displays an image preprocessed by the set step of the selected preprocess group. Example) When 10 steps are set in preprocess group A Selecting "3rd" for preprocess step displays the image preprocessed by the 3rd step, and inspects on the image preprocessed by the 10th step.

Selecting Image to Display on Screen Window in SETUP Menu (For Gray Camera)

1. **Select “Memory / Live” from Image menu.**

   The selection screen is displayed.

2. **Select Memory or Live in “Memory / Live”.**



Memory/Live: Memory

Binary: No

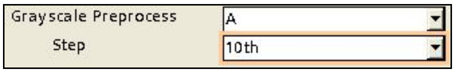
3. **Select "No" or "Slice Level" in “Binary".**

4. **Select "Preprocess".**

   The preprocess selecting screen is displayed.

5. **Select a Preprocess group in “Preprocess”.**

   Set "Step" under the item when you selected A to P for "Preprocess".



Grayscale Preprocess: A

Step: 10th

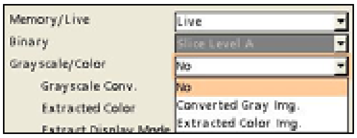
6. **Press the CANCEL key.**

Now you completed selecting a type of image to display in SETUP menu.

Selecting Image to Display on Screen Window in SETUP Menu (For Color Camera)

1. Select “Memory / Live” from Image menu.

The selection screen is displayed.



Memory/Live	Live
Binary	Slice Level A
Grayscale/Color	No
Grayscale Conv.	No Converted Gray Img. Extracted Color Img.
Extracted Color	
Extract Display Mode	

2. Select Memory or Live in “Memory / Live”.

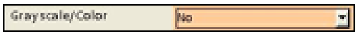
3. Select "No", "Converted Gray Img." or "Extracted Color Img." in "Grayscale/Color".

The display changes according to the selection in Step 3.

No

4. Press the CANCEL key.

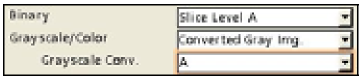
Now you completed selecting a type of image to display in SETUP menu.



Grayscale/Color: No

Converted Gray Img.

4. Select one of the groups A to P in "Grayscale Conv.".



Binary	Slice Level A
Grayscale/Color	Converted Gray Img.
Grayscale Conv.	A

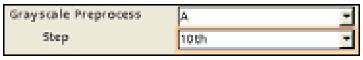
5. Select "No" or "Slice Level" in “Binary".

6. Select "Preprocess".

The preprocess selecting screen is displayed.

7. Select a Preprocess group in “Preprocess”.

Set "Step" under the item when you selected A to P for "Preprocess".



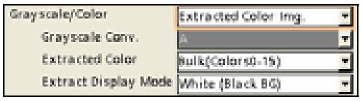
Grayscale Preprocess	A
Step	10th

8. Press the CANCEL key.

Now you completed selecting a type of image to display in SETUP menu.

Extracted Color Img.

4. Select "Bulk" or "Individual" in "Extracted Color".



Grayscale/Color	Extracted Color Img.
Grayscale Conv.	A
Extracted Color	Bulk(Colors0-15)
Extract Display Mode	White (Black BG)

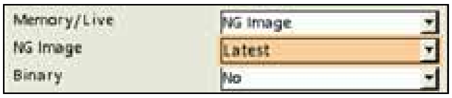
5. Select "White (Black BG)", "Extracted Color (Gray BG)" or "Single Color (Color BG)" in "Extract Display Mode".

**6. When selecting "White (Black BG)" in "Extract Display Mode", a preprocess group and a step can be set.
A slice level can be also selected.**

7. Press the CANCEL key.

Now you completed selecting a type of image to display in SETUP menu.

Selecting Image to Display on Screen Window in RUN Menu (For Gray Camera)



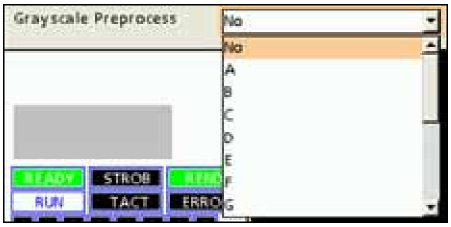
Memory/Live: NG Image
NG Image: Latest
Binary: No

1. **Select “Memory / Live” from Image menu.**

The selection screen is displayed.

2. **Select Memory, Live, or NG Image in “Memory / Live”.**

When you selected "NG Image", then select when the NG of the image occurred from "Latest", "Previous", and "Before the Previous".



Grayscale Preprocess: No

3. **Select "No" or "Slice Level" in “Binary".**

4. **Select "Preprocess" to set a preprocess group.**

5. **Press the CANCEL key.**

Now you completed selecting a type of image to display in RUN menu.

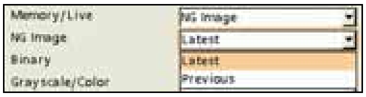
Selecting Image to Display on Screen Window in RUN Menu (For Color Camera)

1. **Select “Memory / Live” from Image menu.**

The selection screen is displayed.

2. **Select Memory, Live, or NG Image in “Memory / Live”.**

When you selected “NG Image”, then select when the NG of the image occurred from “Latest “and “Previous”.



Memory/Live	NG Image
NG Image	Latest
Binary	Latest Previous
Grayscale/Color	

3. **Select "No", "Converted Gray Img." or "Extracted Color Img." in "Grayscale/Color".**

The display changes according to the selection in Step 3.

No

4. **Press the CANCEL key.**

Now you completed selecting a type of image to display in RUN menu.

Converted Gray Img.

4. **Select one of the groups A to P in "Grayscale Conv.".**

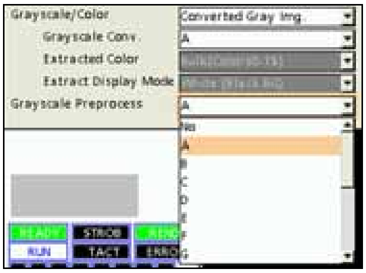
5. **Select "No" or "Slice Level" in “Binary".**

6. **Select a Preprocess group in “Preprocess”.**

The preprocess selecting screen is displayed.

7. **Press the CANCEL key.**

Now you completed selecting a type of image to display in RUN menu.



Grayscale/Color	Converted Gray Img.
Grayscale Conv.	A
Extracted Color	
Extract Display Mode	
Grayscale Preprocess	A

Extracted Color Img.

4. **Select "Bulk" or "Individual" in "Extracted Color".**

5. **Select "White (Black BG)", "Extracted Color (Gray BG)" or "Single Color (Color BG)" in "Extract Display Mode".**

6. **When selecting "White (Black BG)" in "Extract Display Mode", a preprocess group can be set.**
A slice level can be also set.

7. **Press the CANCEL key.**

Now you completed selecting a type of image to display in RUN menu.

3.2.3 Zooming In/out Image (Image Menu)

Displayed camera image can be zoomed in/out. In RUN menu, you can change the size and position of the screen.

Specifying Magnification (Zoom In/out)

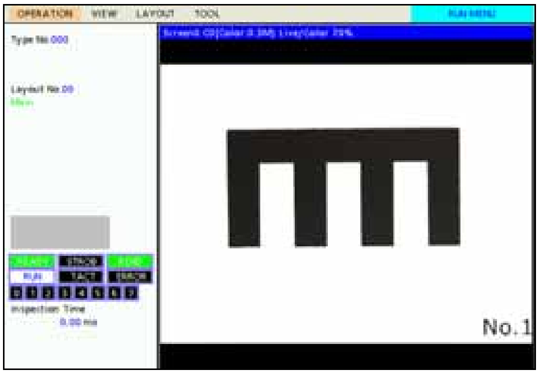
You can change Magnification between 2% and 400% by 1%.

Magnification 100% indicates the status displayed in the following size.

- When using 0.3-Mega Camera: 640 x 480 pixels
  (0.3-Mega Quad-speed Gray Camera / 0.3-Mega Color Camera)
- When using 2-Mega-pixel Camera: 1600 x 1200 pixels
  (2-Mega Gray Camera / 2-Mega Color Camera)
- When using 4-Mega Camera: 2048 x 2048 pixels
  (4-Mega Gray Camera)

1. **Select "Magnification" from Image menu.**

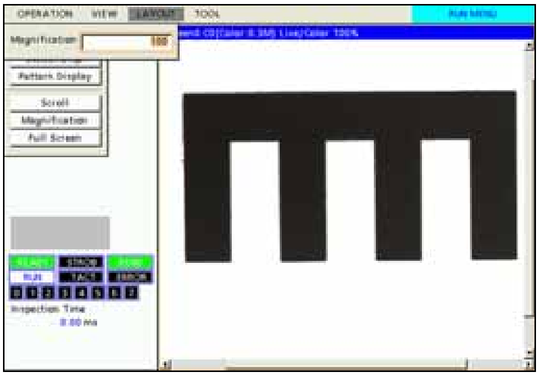
The screen of magnification setting is displayed.



2. **Tilt the ENTER key up/down to change the magnification and then press the ENTER key.**

Pressing the ENTER key displays the image in the specified magnification.
To change the magnification again, press the ENTER key.

3. **After setting is completed, press the CANCEL key.**

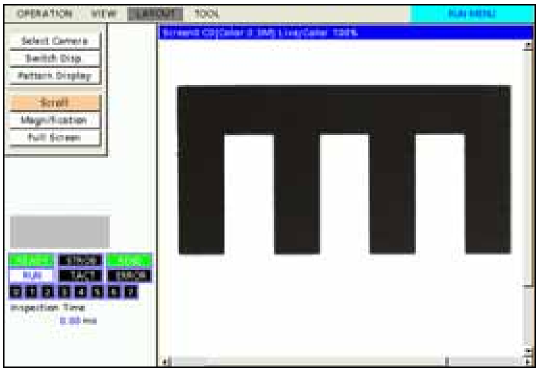


Scrolling

When displaying a zoomed in image, only a part of image can be shown. To show the nondisplayed part, use the scroll function.

1. **Select "Scroll".**

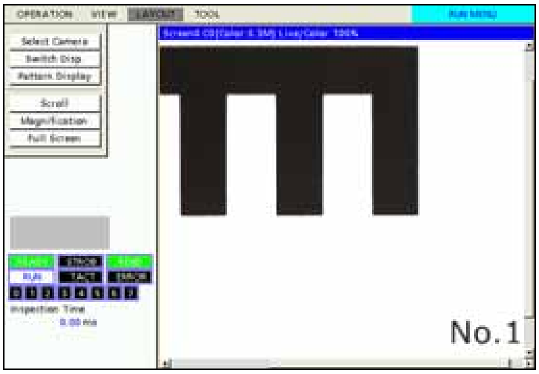
   The SHIFT key is activated.



2. **Tilt the ENTER key to scroll the image.**

   The position of the current image in the whole image is displayed in the upper screen. Use it to make the setting.

   ▶ Note
   Pressing the SHIFT key while you operate makes the scrolling speed faster.



3. **After displaying a desired image, press the ENTER key.**

Displaying Image Full-screen (Full Screen)

This is the setting to display an image full-screen regardless of size of a screen window.

1. **Select "Full Screen".**

   In SETUP menu, the image is displayed in 60% for 0.3-Mega camera, in 24% for 2-Mega camera and in 15% for 4-Mega camera.

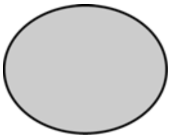
   ▶ Note
   In RUN menu, because the size of screen window varies depending on the layout, the aspect ratio of a window might be different from the ratio of an image. In this case, the image will be displayed adjusting to the smaller side.

3.2.4 Specifying Checker Area

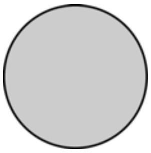
Set an inspection range and a range excluded from inspection with “Area” function. The inspection range is "Inspection area” and the range excluded from inspection is “Mask area”. Area can be set in the following shapes.

Rectangle (Plane scan)

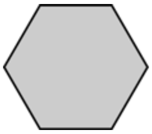
Ellipse



Circle



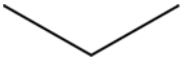
Polygon



(Triangle to 64-gon)

Line (Line Scan)

Broken line



Arc

Depending on checker type, some shapes cannot be set.

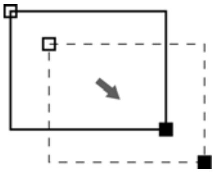
Specifying an Inspection Area

Rectangle (Plane scan)

1. **Select “Rectangle” or “Plane” from “Change Shape” menu.**

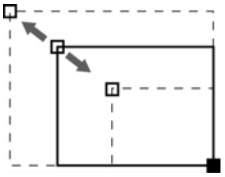
2. **Select "Change".**

Now you can draw an area.



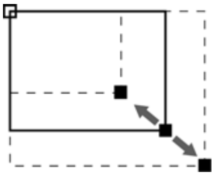
3. **Move the whole rectangle.**

Tilt the ENTER key to move the whole rectangle.
Tilt the ENTER key pressing the SHIFT key to move the area by 10-pixel.
(You can use the SHIFT key also in setting of a start/end point.)
After moving is completed, press the ENTER key.



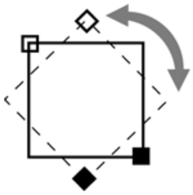
4. **Set the start point (a square mark) of the rectangle.**

Move the start point by tilting the ENTER key and press it to determine the position.



5. **Set the end point (a filled square mark) of the rectangle.**

Move the end point by tilting the ENTER key and press it to determine the position.



6. **Set the angle of the area.**

Set the angle combining the following methods.

- ENTER key: Up/Down = Rotates by 1 degree.
- SHIFT key + ENTER key = Rotates by 0.01 degree.

Press the ENTER key to determine the angle. Now, area setting is completed.

Circle/ Ellipse

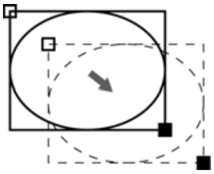
To draw a circle, set a start point and an end point of the circumscribed rectangle of the circle.

1. Select “Circle” or “Ellipse” from “Change Shape” menu.

2. Select "Change".

Now you can draw an area.

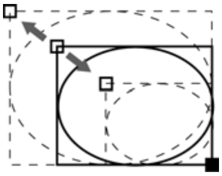
3. Move the area.



Tilt the ENTER key to move the area.
Tilt the ENTER key pressing the SHIFT key to move the area by 10-pixel. (You can use the SHIFT key also in setting of a start/end point.)

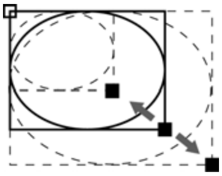
After moving is completed, press the ENTER key.

4. Set the start point (a square mark).



Move the start point by tilting the ENTER key and press it to determine the position.

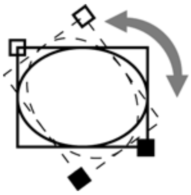
5. Set the end point (a filled square mark).



Move the end point by tilting the ENTER key and press it to determine the position.

Now you completed drawing a circle.

6. Set the angle of the ellipse.



Set the angle combining the following methods.

- ENTER key: Up/Down = Rotates by 1 degree.
- SHIFT key + ENTER key = Rotates by 0.01 degree.

Press the ENTER key to determine the angle. Now, ellipse area setting is completed.

Polygon

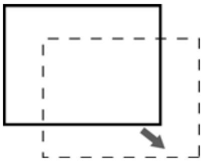
To draw a polygon, add vertices to a rectangle.

1. Select “Polygon” from “Change Shape” menu.

2. Select "Change".

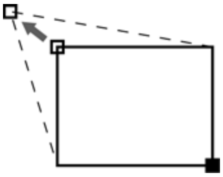
Now you can draw an area. A rectangle is displayed when you set an area for the first time.

3. Move the area.



Tilt the ENTER key to move the area.
Tilt the ENTER key pressing the SHIFT key to move the area by 10-pixel. (You can use the SHIFT key also in vertex setting.)
After moving is completed, press the ENTER key.

4. Set the position of a vertex.



The vertex in a square can be modified. Move the vertex by tilting the ENTER key and press it to determine the position.
The square mark shifts to the next vertex and now you can set the next vertex.
Repeat this operation until the final vertex.

Increasing the Number of Polygon Vertices

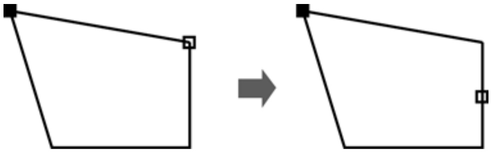
1. **Select "Change".**

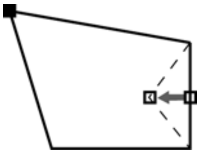
2. **Press the FUNC key at the point where you want to add a vertex.**

The menu adding/deleting vertices is displayed.

3. **Select "Add Vertex".**

A new vertex is added about the middle position between the currently selected vertex and the next vertex.





4. **Adjust the position of the added vertex. After adjusting is completed, press the ENTER key.**

The square mark shifts to the next vertex and now you can set the next vertex. Repeat this operation until the final vertex.

5. **Adjust the position of the added vertex.**

Deleting a Vertex of Polygon

1. **Select "Change".**

2. **Press the ENTER key repeatedly until the vertex you want to delete turns to be modifiable (the square is on the vertex).**

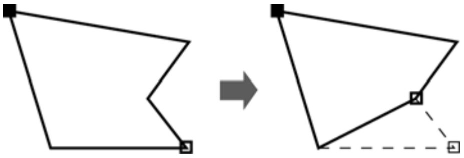
3. **Press the FUNC key.**

The menu adding/deleting vertices is displayed.

4. **Select "Delete Vertex".**

The vertex you selected is deleted.

The square mark shifts to the previous vertex. Press the ENTER key and adjust vertices



Line Scan

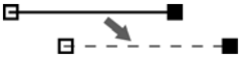
1. **Select “Line” from “Change Shape” menu.**

2. **Select "Change".**

   Now you can draw an area.

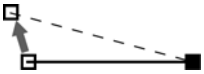
3. **Move the area.**

   Tilt the ENTER key to move the area.
   Tilt the ENTER key pressing the SHIFT key to move the area by 10-pixel.
   (You can use the SHIFT key also in setting of a start/end point.)



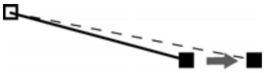
4. **Set the start point (a square mark).**

   Move the start point by tilting the ENTER key and press it to determine the position.



5. **Set the end point (a filled square mark).**

   Move the end point by tilting the ENTER key and press it to determine the position.



Modifying an Inspection Area (when adding a mask area)

When a mask area is set, the inspection area to edit is needed to select.

1. **Select "Change".**

   The inspection area is displayed in orange.
   Tilt the ENTER key upward/downward to display the area you want to edit in orange and press the ENTER key. The area will be modifiable.

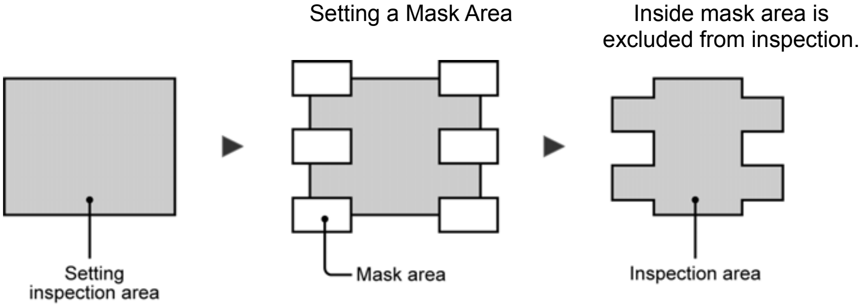
2. **Press the ENTER key to select the inspection area.**

3. **Edit the inspection area.**

4. **After editing is completed, press the CANCEL key.**

Setting a Mask Area

Up to 16 mask areas, where checker does no inspection, can be set in an inspection area. (Some checkers cannot set a mask area. For details, see the descriptions of each checker.)



Adding a Mask Area

1. **Select "Add Mask" in “Area Setting”.**

2. **Select a mask shape to add.**

3. **Select "Change".**

   The inspection area is displayed in orange.

4. **Tilt the ENTER key upward/downward to display the area in orange.**

5. **Draw a Mask Area**

   For details, refer to page 47, “Drawing an Inspection Area”.

6. **After drawing is completed, press the CANCEL key.**

Editing a Mask Area

1. **Select “Change” in “Area Setting” window.**

   The inspection area is displayed in orange.

2. **Tilt the ENTER key upward/downward to display the area in orange and press the ENTER key.**

3. **Edit a Mask Area.**

   For details, refer to page 47 “Drawing an Inspection Area”.

4. **After drawing is completed, press the CANCEL key.**

Deleting a Mask Area

1. **Select "Delete Mask" in “Area Setting”.**

   The mask area is displayed in orange.

2. **Tilt the ENTER key upward/downward to display the area to delete in orange.**

3. **Press the ENTER key.**

   The mask area will be deleted. To delete plural mask areas, repeat this operation.

3.2.5 Copying the Screen Display (Print Screen)

In almost screens, whether RUN menu or SETUP menu, the contents displayed on the entire screen can be copied and output to a SD card. The images are saved as bitmap.

Destination can be changed to Ethernet to save the images directly into a PC.

1. **Display an image to copy.**

2. **Hold down the FUNC key for two seconds or more.**

   In the key guide field, a message of “PRINT SCREEN” appears and the screen is copied.
   When the message disappears, printing the screen is complete.

   ▶ Note
   If the message does not appear, an image cannot be copied in the current screen.

About Image File Name

Example of file name: 071215_150848_0.bmp

Saving image file name consists of date; 6-digit (YYMMDD), time; 6-digit (HHMMSS), and image number; 1-digit (N). Between each of the information, “_” (underscore) is inserted.

- Date and Time:
  Calendar data of PV200
- Image number:
  0 to 9. Numbered consecutively within the same second

About Save Folder of Image Files

For SD card: /Panasonic-EW SUNX Vision/PV200/Screen

For Ethernet: Specify with Image Receiver.

Changing Destination of Image Files

1. **Select “ENVIRONMENT” > “INPUT / OUTPUT” from the menu bar.**

   The screen of communication setting is displayed.

2. **Select "Print Screen".**

3. **Select "Destination".**

   SD card (default): Saves in the SD card inserted in PV200.
   Ethernet: Outputs to Ethernet. Saves in devices such as a PC connected with an Ethernet cable.

Chapter 4

Setting Inspection Conditions

4.1 Procedure for Setting Inspection

Set the inspection conditions in SETUP menu in the following order.

Select a product type No. （Type Switch）	Page 55
Set camera type and capturing conditions *: Adjust White Balance first when using a color camera. (ENVIRONMENT > Camera, TYPE > Type Setting)	page 58
Select Execution Mode condition (TYPE > Type Setting)	page 71
Capture an image	page 78
Preprocess the image to be appropriate for inspection Slice Level, Grayscale Preprocess, Color Preprocess	page 79
Set an inspection Checker, Position Adjustment, Area Size Adjustment	page 95
Calculate the measured data - Geometry Calculation - Numerical Calculation	page 218 page 230
Total Judgement Judgement	page 246
Display detection results with figures or characters on the screen window Character/Figure Drawing	page 256
Output Settings Output judgements, calculated data, and images	page 273
Save settings (Save, Read) Save in the save memory of PV or a SD memory card	page 290

Set as necessary.

Display inspection results during inspections and change the setting values* (Data R/W) (* The settings of checkers, numerical calculations, and judgements)	page 293
Display a fixed shape on the screen window Marker Display	page 312

4.2 Selecting a Product Type No.

4.2.1 What Is a Product Type?

Product Type is a group of settings which are necessary to execute an inspection such as image capturing setting of camera, and conditions of inspection area and inspection method. Multiple types can be registered. You can continue inspections only by switching to (calling up) the registered type if you need to inspect on the object with different conditions.

Regarding types No.0 - 255 as a set of data, PV200 saves the data in "Storage Space in PV200". The data can be saved also in a SD memory card. Up to 100 sets of data can be saved in a SD memory card.

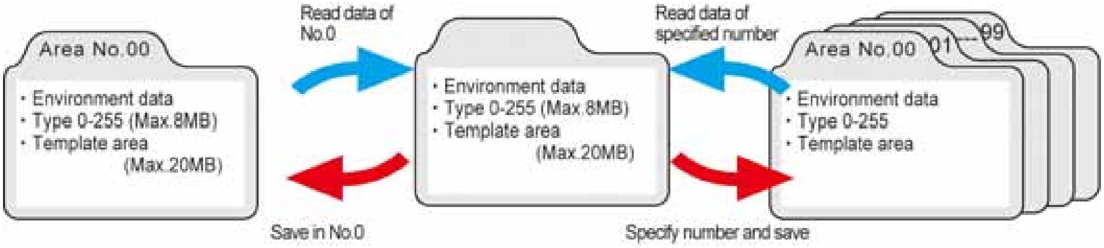
Every time PV200 starts up, it reads saved data from the storage space in PV200 to the execution memory. And, it calls up a product type (*1 from it to set inspection conditions and execute inspections.

Type switching, data calling up to the execution memory, and data saving from the execution memory to the storage space in PV200 or a SD memory card can be executed by inputting I/O signal or sending a command from an external device.

Storage Space in PV200
(Max. 8 MB)

Execution Memory

SD memory card (Max. 32 GB)
/Panasonic-EW SUNX
Vision/PV200/SetData



▼Refer to▼

- *1) About how to specify a type to read at startup, see page 55.
- About how to save/read the setting data, see chapter 4.17 (page 290)

▶ Note

If the data amount of types reaches to the maximum capacity of the setting data area, not all of 256 types may be created. You can confirm the free space of the storage space in PV200 in "Free Space for Setting Data" from "TOOL" > "Information". (page 356).

4.2.2 Selecting a Product Type

Adding/switching a Product Type

1. **Select "TYPE" > “Select Type” from the menu bar.**

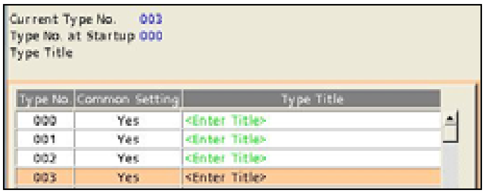
   Type selecting window is displayed.

2. **Select a product type No.**

   The selected type No. is displayed in the “Current Type No.” field.

   ▶ Note

   Selecting a type with blank Type Title field adds a new type. In this case, input a title as the following procedure.



Current Type No. 003
Type No. at Startup 000
Type Title

Type No.	Common Setting	Type Title
000	Yes	<Enter Title>
001	Yes	<Enter Title>
002	Yes	<Enter Title>
003	Yes	<Enter Title>

3. **Press the FUNC key and select “Enter Title” from the displayed menu.**

A software keyboard is displayed.

4. **Enter a title and select “Enter” on the keyboard at the last.**

The entered title will be displayed in “Type Title” field.

Setting a Type to Be Read at Startup

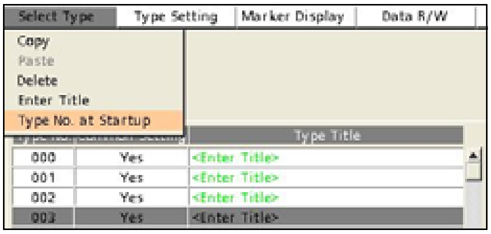
The type to be read at PV200 startup can be specified. This setting can be operated from ENVIRONMENT, and also the type switching window. If you change the setting in the window, the setting of ENVIRONMENT is also updated.

1. **Press the FUNC key in the Type selecting window.**

The pop-up menu appears.

2. **Select “Type No. at Startup”.**

The last Type No. (default):
Reads again the type selected right before turning off the power. The setting is done if you select this.
Selected Type No.:
Reads the type No. specified after.



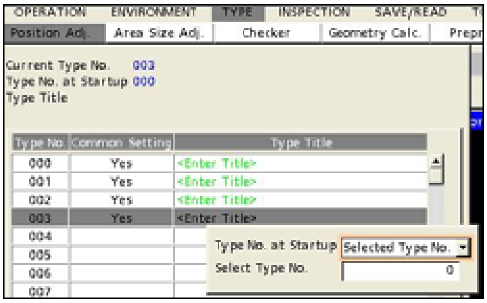
		Type Title
000	Yes	<Enter Title>
001	Yes	<Enter Title>
002	Yes	<Enter Title>
003	Yes	<Enter Title>

3. **Specify “Selected Type No.”.**

4. **After setting is completed, press the CANCEL key.**

5. **Save the data.**

About how to save it, see page 290.



Current Type No. 003
Type No. at Startup 000
Type Title

Type No.	Common Setting	Type Title
000	Yes	<Enter Title>
001	Yes	<Enter Title>
002	Yes	<Enter Title>
003	Yes	<Enter Title>
004		
005		
006		
007		

Type No. at Startup Selected Type No.
Select Type No. 0

Copying Product Type

1. **In type selecting window, move the cursor onto the product type which you want to copy.**

2. **Press the FUNC key and select “Copy” from the displayed menu.**

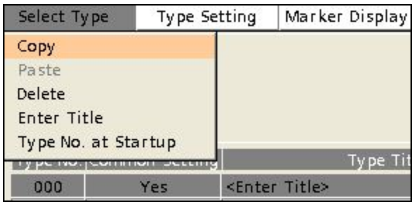
3. **Move the cursor onto the destination product type.**

4. **Press the FUNC key and select “Paste" from the displayed menu.**

The copied type is pasted.

Note

If the type already exists in the destination, the message of overwrite confirmation appears.



		Type Tit
000	Yes	<Enter Title>

Deleting a Product Type

1. In type selecting window, move the cursor onto the product type which you want to delete.

2. Press the FUNC key and select “Delete” from the displayed menu.

3. Select “Yes” following the displayed message.

The type is deleted. If you select “No”, deleting is not executed.

Deleting All Product Types

All crated product types can be deleted at a time. When “Template Registration” is set to “Common”, you can select execute or not separately for initializing all types and clearing all common templates.

▶ Note Note that once you initialize all types, you can never restore them.

1. Select "TYPE" > “Initialize” from the menu bar.

The message confirming initialization appears.
If you select “No”, initialization is not executed.

2. Select “Yes”.

After all types are initialized, “Type No.000” is newly created.

When “Template Registration” is set to “Common”

1. Select "TYPE" > “Initialize” from the menu bar.

The window to choose whether to initialize all types or not is displayed.

2. To initialize all types, select “Yes”. Not to initialize them, select “No”.

Selecting “Yes” initializes all types at the time.
The window to choose whether to clear all common templates or not is displayed.

3. To delete all common templates, select “Yes”. Not to delete them, select “No”.

The table below shows the data that are initialized (or deleted) by selecting the option of the windows.

Initializing all types		Deleting all common template	Data initialized or deleted
No	&	No	None
No	&	Yes	Common templates
Yes	&	No	All types
Yes	&	Yes	Common templates and all types

4.3 Setting Capturing Conditions of Camera

Set conditions of capturing an image of an object.

Camera Type:

Two cameras of five types can be connected. Set a type of camera for each connecting camera ports.

Camera Trigger:

PV200 captures images simultaneously by all cameras. You can select Common Trigger or Detect Trigger. Selecting Common Trigger starts an inspection at the time all cameras finished capturing. Selecting Detect Trigger starts an inspection after PV200 detected that an object is in the inspection area.

Capturing Condition for Each Camera

- Shutter speed: page 62.
- Camera gain: page 62.
- Capture delay: page 64.
- FLASH delay, FLASH span: page 65.
- Partial imaging: page 65.
- Calibration: page 66.
- White Balance: page 63.

Error if Checker Area outside Image:

This function cancels the checker when its area is outside a captured image.

▶ Note

On camera trigger, capturing condition of camera, and the error if checker area is outside the image, you can set individually for each type other than using common setting.

4.3.1 Selecting a Camera Type (ENVIRONMENT)

PV200 provides for five types of cameras and can connect two cameras. Set a type of camera connecting to each camera port. (Note that some cameras cannot be used in combination as shown in the table below.)

▶ Note

When you use just one camera, be sure to connect it to "CAMERA 0".

			CAMERA 1				
			Gray			**Color**	
			0.3M	**2M**	**4M**	**0.3M**	**2M**
CAMERA 0	**Gray**	**0.3M**	OK	OK	**NG**	OK	OK
		2M	OK	OK	**NG**	OK	OK
		4M	**NG**	**NG**	OK	**NG**	**NG**
	Color	**0.3M**	OK	OK	**NG**	OK	OK*
		2M	OK	OK	**NG**	OK*	OK*

* Connectable (Ver.1.10 or later) Image transfer time varies. (Refer to page 12 for details.)

▶ Note

Adjust White Balance first (refer to page 63) when using a color camera. When using two color cameras, adjust the white balance for each camera. Readjust the white balance when you replaced the color camera or changed the camera port to connect.

Selecting a Camera Type

1. **Select “ENVIRONMENT” > “Camera” from the menu bar.**

2. **Select "Camera".**

   Camera setting window is displayed.
   PV200 recognizes the connecting cameras at startup and displays their types in “Connected Camera” field.

3. **Confirm that the types for “Connected Camera” and “Camera Type” are the same.**
   If they are different, select a correct camera type in “Camera Type”.

   The confirmation message appears. Selecting “Yes” changes the camera type.

   ▶ Note

   - If the types for “Connected Camera” and “Camera Type” are different, an image cannot be captured correctly.
   - Changing camera type initializes capturing conditions of cameras. It is advisable to set the correct camera types before setting capturing conditions.

Setting Polarity of FLASH Signal

PV200 sends a FLASH signal which notices the timing of light emission to a strobe lighting. Two terminals (FLASH 0-1) are provided for two cameras. The polarity of the FLASH signals can be selected for each camera.

1. **Select “FLASH Polarity”.**

2. **Select polarity of FLASH Signal.**

   “ON at Low” (default): Turns on FLASH signal along with the timing of image capturing.
   “ON at High”: Turns off FLASH signal along with the timing of image capturing. (In other cases, the signal is ON.)

▼Refer to▼

The span of Flash signal ON and the delay time to ON can be set for each Type and Camera.
Refer to Chapter 4.3.4 for how to set them.

4.3.2 Setting Individual Capturing Condition by Type

Follow the procedure described below to set an Individual capturing condition for the type which is currently being set.

1. **Select "TYPE" > “Type Setting” from the menu bar.**

2. **Select "Camera".**

3. **Select "No (Individual)" for “Common Setting”.**

   Now, the setting you are going to set applies only to the currently setting type.

To return to Common Setting

1. **Select “Type Setting” > "Camera".**

2. **Select "Yes (Common)" for “Common Setting”.**

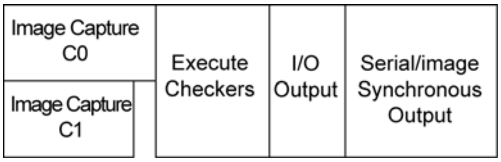
   If the type set to use common setting already exists, the setting condition of the type will be copied to or overwritten the current type.

4.3.3 Selecting Capture Timing (Camera Trigger)

"Common Trigger" is the trigger starting image capturing with two cameras simultaneously.

PV200 cannot give the instruction to capture an image to each camera respectively, however, setting "Capture Delay" enables to vary the timing of image capturing for the two cameras.

Processing image of “Common Trigger”
(when Capture Delay is not set)



Inputting START signal starts capturing an image.

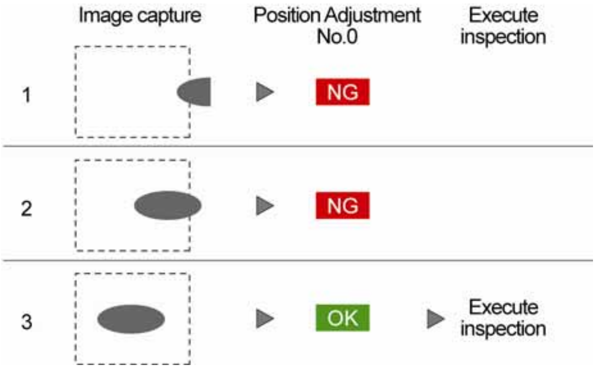
Although image capturing times are different when connecting different types of cameras, checkers and result output are executed after all cameras have completed image capturing.

1. **Set “Camera Trigger” in “Camera” window.**

[Common] (default):	All cameras capture images at the same timing.
[Detect Trigger (common)]:	All cameras capture images at the same timing. If Position Adjustment No.0 is OK, other checkers are executed and results are output. Until Position Adjustment No.0 becomes OK, image capturing and Position Adjustment No.0 will be executed repeatedly.

About Detect Trigger (common)

This function detects an inspect target inside the inspection area with Position Adjustment No.0. It repeats image capturing and execution of Position Adjustment No.0 until the Position Adjustment detects the target (Judgement = OK), and then other checkers are executed and results are output. (“Execute inspection” in the figure on the right.)

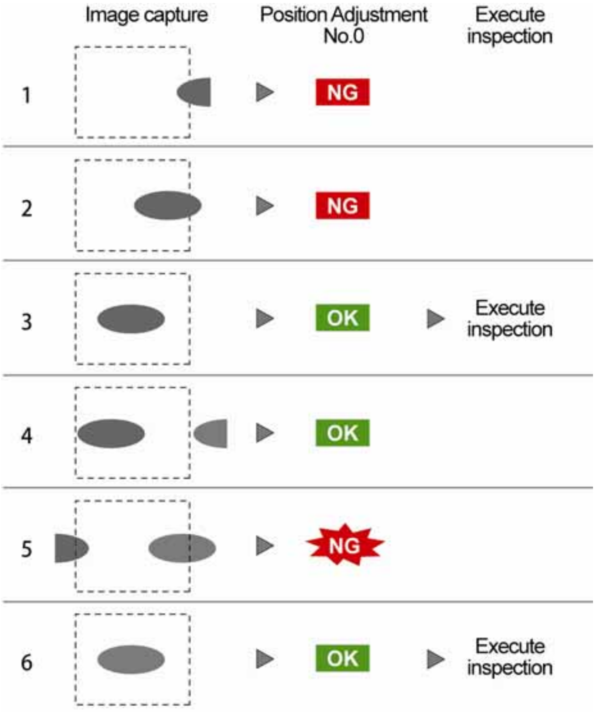


In Continuous Inspection

After an inspection is complete, the device executes image capture and Position Adjustment No.0 again.

The next inspection is not executed if the following judgement of Position Adjustment No.0 is "OK" (No.4 in the right figure).

After "NG" judgement of Position Adjustment No.0 is returned by reasons such as the firstly inspected object moving out of the area (No.5 in the right figure), "OK" judgement of the checker executes the next inspection in the same way as the first inspection.



▼Refer to▼

How to set Continuous Inspection: See page 336.

▶ Note

- When execution mode is “User Defined”, the Position Adjustment of the smallest number in the execution block is executed repeatedly.
  For example, Position Adjustment No.200 for block No.2 and Position Adjustment No.900 for block No.9.
- When Inspection Process mode is “Parallel”, Detect Trigger cannot be used.

4.3.4 Setting Capturing Condition for Each Camera

Selecting Camera to Set

1. **Select "TYPE" > “Type Setting” from the menu bar.**

2. **Select "Camera".**

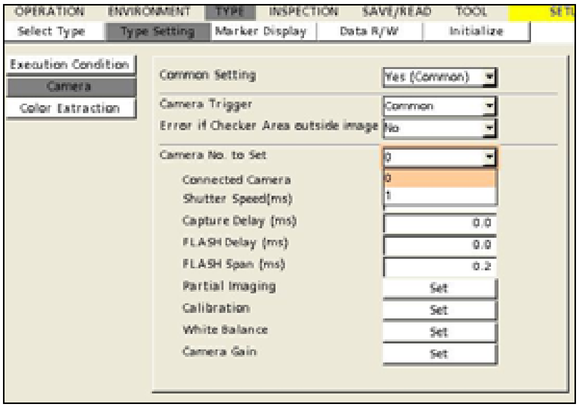
Camera setting window is displayed.

3. **Select "Camera No. to Set".**

Camera No. which can be used is displayed.

4. **Select the camera No. to set the capturing condition.**

The camera type set to the selected camera No. is displayed in “Connected Camera”.



Common Setting: Yes (Common)

Camera Trigger: Common

Error if Checker Area outside image: No

Camera No. to Set: 0

Connected Camera: 0

Shutter Speed(ms): 1

Capture Delay (ms): 0.0

FLASH Delay (ms): 0.0

FLASH Span (ms): 0.2

Partial Imaging: Set

Calibration: Set

White Balance: Set

Camera Gain: Set

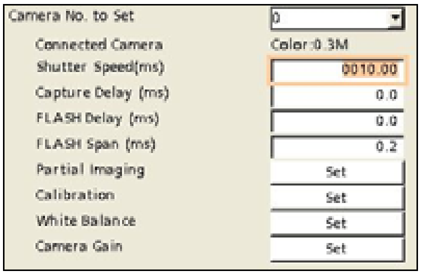
Setting Shutter Speed

Specify shutter speed to suit for moving speed of the inspection object or lighting conditions. The shorter shutter speed (the smaller value), the darker captured image. Adjust lighting illuminance or lens aperture as necessary. To set the shutter speed observing the image, set the display image to "Live".

1. **Select the camera No. to set in “Camera” window.**

2. **Select "Shutter Speed".**

   Now you can specify a value of shutter speed.
   Range of shutter speed:
   0.03 - 1000.00 ms (default: 10.00)
   Setting unit: 0.01 ms



Camera No. to Set: 0
Connected Camera: Color:0.3M
Shutter Speed(ms): 0010.00
Capture Delay (ms): 0.0
FLASH Delay (ms): 0.0
FLASH Span (ms): 0.2

3. **Select desired shutter speed.**

   To observe the image easily, set “Window Transparency (SETUP menu)” to a larger value.

Adjusting Camera Gain

Camera gain is sensitivity of camera. Adjust camera gain when you cannot obtain a desired image even though you have adjusted lens aperture and lighting illuminance (for example, when shutter speed is fast and the image is dark even though with high illuminance).

▶ Note

As increasing the sensitivity or the gain value, an image turns to be lighter and also rougher due to increased noises.

1. **Select the camera No. to set in “Camera” window.**

2. **Select "Gain".**

   Gain value is displayed.
   - Gain Range: 1.00 to 5.00 (Initial Value: 1.00)
   - Setting unit: 0.01

3. **Set gain value.**

   Setting the display image to “Live” updates it to the image captured with the specified gain value. To observe the image easily, set “Window Transparency (SETUP menu)” to a larger value.

4. **Select "Corr. Setting". (Available only for Color Camera.)**

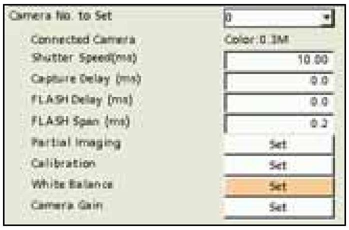
   Adjust the color information of the image captured by the camera and inspect the image.

5. **Adjust R, G, B of the image converted by the correction setting in "Select RGB".**

Adjusting White Balance of Color Camera

Even a white object may be recognized as a color tinged with orange or red depending on irradiated lighting. Adjusting the white balance corrects the variation in colors due to the lighting used, and makes a white object be viewed as white. However, when using a light such as red, blue or green, for example, it cannot correct a white paper that appears tinged with red due to a red LED light to white. It is necessary to make the setting for using a color camera.

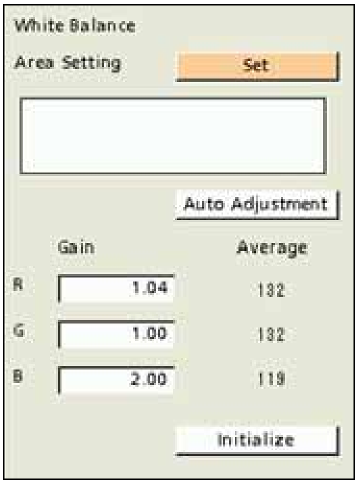
1. **Select the camera No. to set in “Camera” window.**



Camera No. to Set: 0
Connected Camera: Color:0.3M
Shutter Speed(ms): 10.00
Capture Delay (ms): 0.0
FLASH Delay (ms): 0.0
FLASH Span (ms): 0.2

2. **Select "White Balance".**

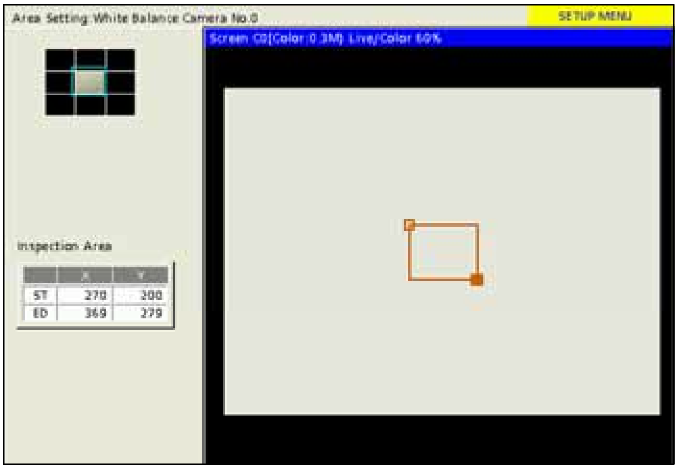
White Balance window is displayed.
Take a white object (such as a white paper) with the camera.



	Gain	Average
R	1.04	132
G	1.00	132
B	2.00	119

3. **Select "Area Setting".**

Set the rectangular area displayed on the screen window in the white area.

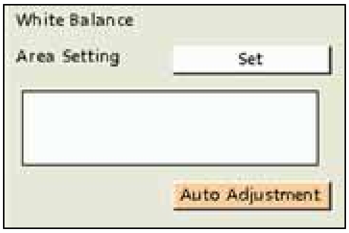


Area Setting White Balance Camera No.0
Screen C0(Color:0.3M) Live/Color 60%

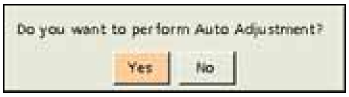
Inspection Area

	X	Y
ST	270	200
ED	369	279

4. **Select "Auto Adjustment".**



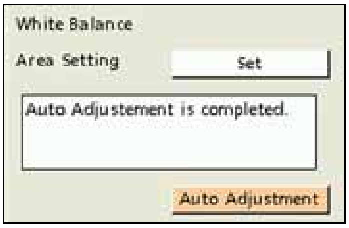
5. **The message as the right figure appears. Select “Yes”.**



Do you want to perform Auto Adjustment?

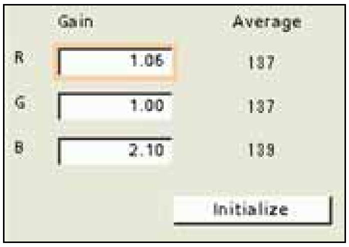
Auto adjustment starts.
When the adjustment is completed successfully, a message "Auto Adjustment is completed." is displayed.
Values are displayed in Gain R, G, and B.
When one of the following messages appears, the adjustment is not completed successfully. Perform Auto Adjustment again.

- Too Bright. Adjust Brightness.
- Too Dark. Adjust Brightness.
- The brightness cannot be adjusted. Move the area to a white space.



Auto Adjustement is completed.

6. **If further adjustment is required after the completion of auto adjustment, directly set the values of gain R, G, and B.**

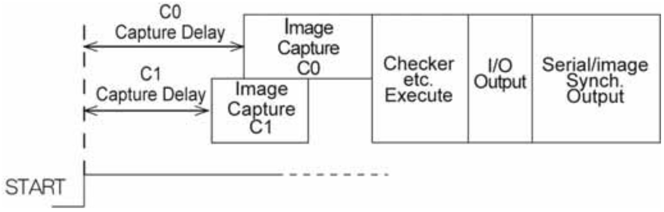


	Gain	Average
R	1.06	137
G	1.00	137
B	2.10	139

Setting Delay Time from START Signal Input to Image Capture

Specify the time after inputting START 0-3 signals before cameras start capturing. Default value is “0”. After signal input, the camera starts image capture without delay. Use it as necessary.

This setting can be set individually for each camera.



(Processing image when 2 cameras are connected.)

1. **Select the camera No. to set in “Camera” window.**

2. **Select "Capture Delay".**

3. **Specify the time from START signal input to capture start.**

   Settable range: 0.0 to 999.9 ms

Setting FLASH Delay and Pulse Output Width

After inputting START signal, light emission timing signal is output from FLASH 0-1 of I/O connector to external strobe flash in pulse. Specify output delay of FLASH signal and outputting pulse width.

1. **Select the camera No. to set in “Camera” window.**

2. **Select “FLASH Delay” and specify delay time.**

Settable range: 0.0 to 999.9 ms

3. **Select “FLASH Span” and specify pulse width of FLASH signal.**

Settable range: 0.2 to 999.9 ms

▶ Note

The lighting is needed to be lit while the camera is capturing an image. Set them correctly along with Capture delay of the camera and Shutter speed.

▼Refer to▼

FLASH signal timing chart: Page 380.

Capturing a Part of Image (Partial Imaging)

This is setting to take a part of image captured by camera in PV200. (The size of image is 640 x 480 pixels for ANPVC1040 and ANPVC2040, 1600 x 1200 pixels for ANPVC1210 and ANPVC2260, and 2048 x 2048 pixels for ANPVC1470.) Decreasing area to be taken shortens capturing time.

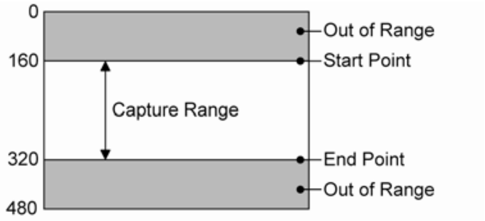
Set the area to be taken by specifying lines with a start point and an end point.

Partial Imaging is the setting by a camera and one area can be set per camera.

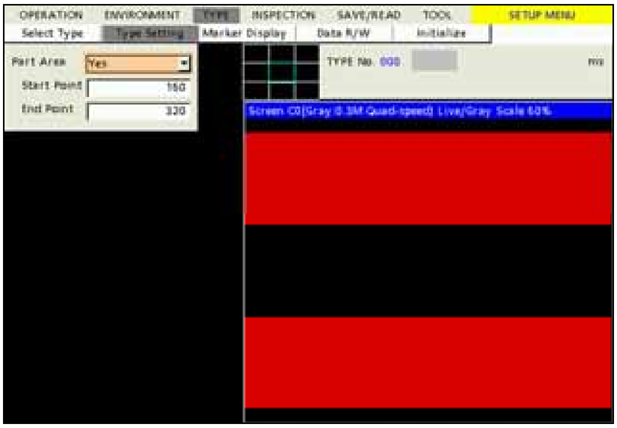
▶ Note

- The gray value of the area other than imaging target will be zero.
- When "Error if Checker Area outside image" has been set to "Yes", a checker the area of which is outside the capturing range is not executed and the result is NG.

In the case of setting
Start point=160 and End point =320



1. **Select the camera No. to set in “Camera” window.**



Part Area: Yes
Start Point: 160
End Point: 320

Screen C0(Gray 0.3M Quad-speed) Live/Gray Scale 60%

2. **Select "Partial Imaging".**

"Partial Imaging" window is displayed.

3. **Set "Part Area" to "Yes".**

Now you can set the start/end point.

4. **Select "Start Point" and specify the starting line of the capturing area.**

While you are specifying a range, the area where no inspection will be done is displayed in red in the image on the screen. Use it to make the setting.

5. **Select "End Point" and specify the ending line of the capturing area.**

▶ Note

Minimum value of settable capturing area

- 0.3-Mega Quad-speed Gray Camera (ANPVC1040): 1 line
- 0.3-Mega Quad-speed Color Camera (ANPVC2040): 2 lines
- 2-Mega Gray Camera (ANPVC1210): 100 lines
- 2-Mega Color Camera (ANPVC2260): 100 lines
- 4-Mega Gray Camera (ANPVC1470): 1 line

6. **After setting is completed, press the CANCEL key.**

Changing the Coordinate Origin and Unit (Calibration)

Calibration is the function that changes detected data of checkers from pixel unit into actual measure and moves coordinate origin to a desired position. Calibration can be set by a camera.

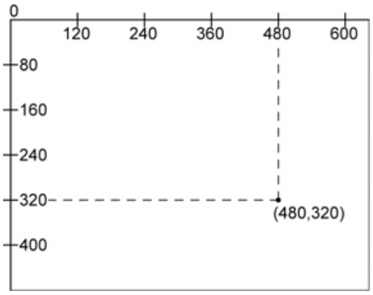
▶ Note

After calibration is set, the data detected by checkers is output in calibrated value. Enter the tolerance in calibrated value in the checkers which detect position (coordinate) or measurement.

Setting example)

The coordinate origin is set at upper left position of the image as the default.

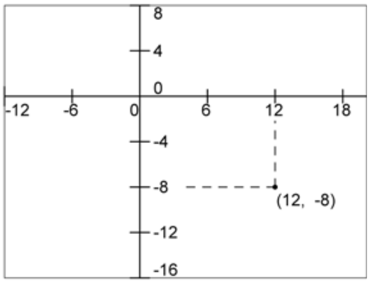
Initial Condition



▶

Setting example)
Coordinate Axis: Rightward and upward
Origin: (240, 160)
Calibration:
10mm=200 pixels
(coefficient: 0.05)

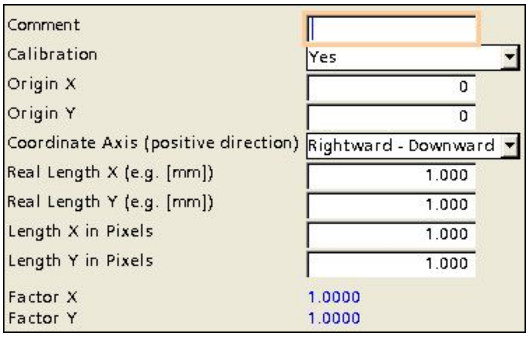
After Calibration



If the detected coordinate in initial condition is (480, 320), the value turns to be (12, -8) after calibration.

Setting Calibration

Before setting calibration, capture an object or a scale with assured measurement to measure actual size in pixel unit.



Comment	
Calibration	Yes
Origin X	0
Origin Y	0
Coordinate Axis (positive direction)	Rightward - Downward
Real Length X (e.g. [mm])	1.000
Real Length Y (e.g. [mm])	1.000
Length X in Pixels	1.000
Length Y in Pixels	1.000
Factor X	1.0000
Factor Y	1.0000

1. **Select the camera No. to set in “Camera” window.**

2. **Select "Calibration".**

“Calibration” window is displayed.

3. **Set “Calibration” to “Yes”.**

Now you can set all items.

4. **Input the setting values for "Real Length X" and "Real Length Y".**

If standard object is 10-mm square, enter “10” either for Real Length X and Real Length Y. Enter Real Length in your desired unit. The unit does not have to be "mm".

5. **Input the setting values for "Length X in Pixels" and "Length Y in Pixels".**

If X and Y are 200 pixels as the result of measuring the standard object, enter “200” either for X and Y. The coefficient converting unit is displayed.

▶ Note

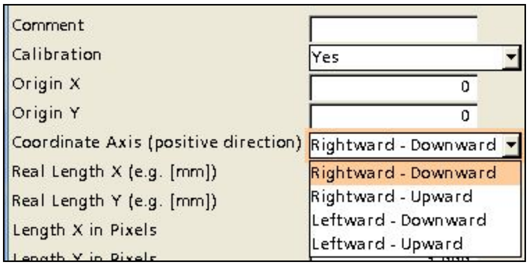
Input range

- Real Length: 1.000 to 10000.000 (settable by 0.001.)
- Length in Pixels: 1.000 to 10000.000 (settable by 0.001.)
- Factor: 0.0001 to 10000.0000

6. **After setting is completed, press the CANCEL key.**

Changing Coordinate Origin

The coordinate origin is set at upper left position of the image as the default. You can change this position.



Comment
Calibration: Yes
Origin X: 0
Origin Y: 0
Coordinate Axis (positive direction): Rightward - Downward
Real Length X (e.g. [mm])
Real Length Y (e.g. [mm])
Length X in Pixels
Length Y in Pixels

1. **Select the camera No. to set in “Camera” window.**

2. **Select "Calibration".**

“Calibration” window is displayed.

3. **Set “Calibration” to “Yes”.**

Now you can set all items.

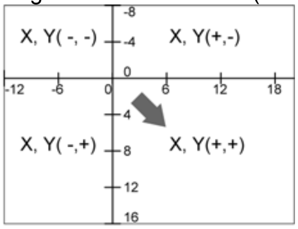
4. **Enter value for “Origin X” and “Origin Y”.**

For example, if you want the position of coordinate (100, 100) to be the origin, enter “100” for them.

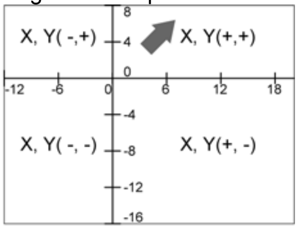
5. **Select "Coordinate Axis".**

Select from the following four types.
Decide which direction from the origin you make it positive side, right or left, up or down.

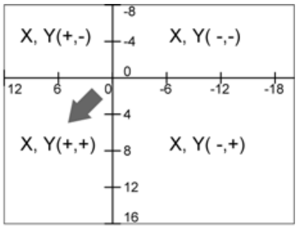
“Rightward - Downward” (default)



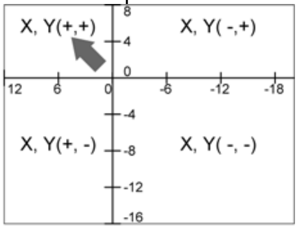
“Rightward - Upward”



“Leftward - Downward”



Leftward - Upward”



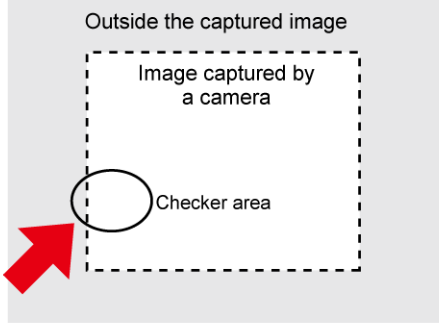
6. **After setting is completed, press the CANCEL key.**

4.3.5 Error if Checker Area Outside Image

This function cancels the checker when its area is outside an image captured by a camera after Position Adjustment or Area Size Adjustment adjusted the area as the figure on the right. In this case, the checker returns "Error".

▶ Note

- When "Part Area" is set to "Yes", an actually captured image is the capturing range.
- When "Rotate" is used in the grayscale preprocess of the checker even though "Part Area" is set, the capturing range is the size of the image that partial imaging has not been executed.



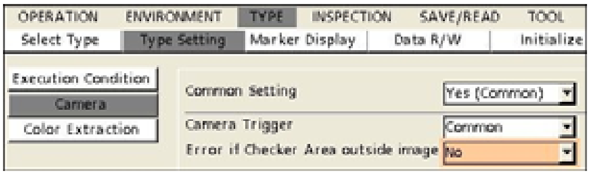
1. **Select "TYPE" > “Type Setting” from the menu bar.**

2. **Select "Camera".**

Camera setting window is displayed.

3. **Select “Yes” or “No” in "Error if Checker Area outside Image".**

No (Default):
Executes a checker even if the checker area is beyond the camera image.



Common Setting: Yes (Common)
Camera Trigger: Common
Error if Checker Area outside image: No

Yes:
Cancels checker if the checker area is beyond the camera image and outputs NG as a result. (The list of checkers and Checker List show the checker is ERROR.)

RUN MENU	No ERROR output and no ERR display.
SETUP MENU	The list of checkers and Checker List show the checker is ERROR.

▶ Note

Note that a checker is canceled if only a small part of the area is beyond the camera image regardless of a checker adjusted by Position Adjustment and Area Size Adjustment because you can create a checker area also outside camera capturing range.

4.3.6 Selecting Color Extraction Mod

1. **Select "TYPE" > "Type Setting" > "Color Extraction" from the menu bar.**

2. **Select "Color Extraction Mode".**

   The setting window of Color Extraction is displayed.
   When connecting two cameras, the registerable number of color extractions for one camera is 8 colors in Fast mode and 64 colors in Extend mode.

Connected camera port	Camera type	Color Extracton Mode	
		Fast (Usable 16 colors)	**Extend (Usable 128 colors)**
CAMERA 0 : CAMERA 1 :	Color Unconnected	16 colors -	128 colors -
CAMERA 0 : CAMERA 1 :	Color Gray	8 colors -	64 colors -
CAMERA 0 : CAMERA 1 :	Gray Color	- 8 colors	- 64 colors
CAMERA 0 : CAMERA 1 :	Color Color	8 colors 8 colors	64 colors 64 colors

3. **Select "Color for Single Color".**

   When specifying "Single Color (Color BG)" for the color of RUN menu or SETUP menu, select the color used to fill in the extracted area. The default color is pink.

4.4 Inspecting Divided Type (Execution Mode)

In PV200, checkers can be divided into ten by checker number to execute just one checker, multiple checkers or all checkers. Divided part is “Block” and the mode to decide how to execute is “Execution mode”.

Block (Up to 10)	Checker (Up to 1000)
No.0	No.0 - 99
No.1	No.100 - 199
:	
No.9	No.900 - 999

Checkers are divided in 100-block-unit from checker No.0. The maximum block number is 10.

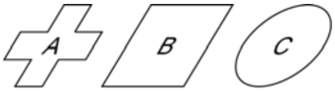
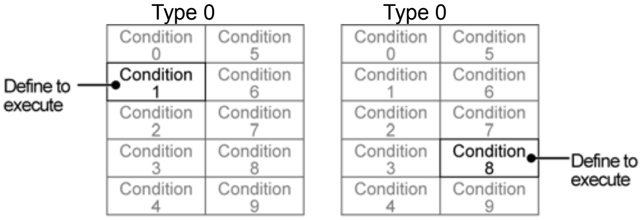
If you set the number of blocks to “2”, for example, checker No.0 to 99 are sorted in block No.0, checker No.100 to 199 are in block No.1 respectively. In this case, numbers larger than 199 cannot be set.

▶ Note

Although checkers No.0 to 999 can be selected if you set the number of blocks to “10”, not all checkers can be always created because the memory capacity of PV200 is constant regardless of the number of blocks.

4.4.1 Selecting an Execution Mode

Select an execution mode according to the inspection to perform. Specify an execution mode from “TYPE” > “Type Setting”.

Usage		Execution Mode
- To execute inspection using only one product type. - To use many product types when there is enough time to switch the product types. - To execute inspections of many parts in a captured image at a time. - To use many checkers, numerical calculations and judgement expressions to perform complicated calculations in an inspection.	▶	**“Execute All”** Executes all Checkers, Numeric Calculations and Judgements in a product type.
To execute different inspection items, checkers or conditions, depending on the type and status of target. Example 1: To determine if the object is reversed or not and inspect with the proper Example 2: To identify the type at an assembly line where multiple types of objects are running down at a time and inspect with the proper condition for each type. 	▶	**“Automatic Switch”** Executes multiple inspections effectively.
To execute various types of simple inspections Example: Only a few checkers are used for each product type, but more than 256 product types exist. **To save time to switch product types** Example: To execute inspections speedily, switching multiple types (up to 10) of conditions.  Type 0 Condition 0 Condition 1 Condition 2 Condition 3 Condition 4 Condition 5 Condition 6 Condition 7 Condition 8 Condition 9 Define to execute Type 0 Condition 0 Condition 1 Condition 2 Condition 3 Condition 4 Condition 5 Condition 6 Condition 7 Condition 8 Condition 9 Define to execute	▶	**“User Defined”** Executes some of the inspections in a product type. (Specify before executing inspection.)

Referring the results of other blocks

In Execute All mode, all the set checkers are executed, however, some blocks are not executed in Automatic Switch mode or User Defined mode. The checker of the unexecuted block retains the previous result when the block was executed.

When a block is executed with a start signal, the result retained by a checker of a block which was not executed with the same start signal can be referred for such block.

Utilizing this function enables to change the capturing condition of Position Adjustment and inspection. Or it is also helpful for measuring the difference between the first captured position and the current position easily.

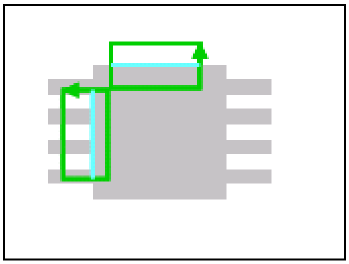
Example 1

(Multiple lighting conditions are needed)

Execute block 0 in which Position Adjustment No.000 is set with back lighting.

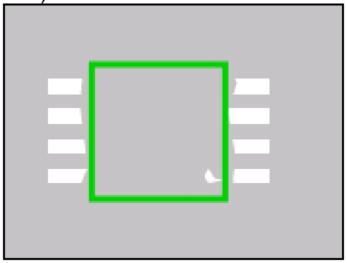
Change the lighting conditions and execute block 1 to inspect the same object again. Although the image suitable for the inspection can be captured with this capturing condition, the adjustment amount of Position Adjustment No.000 executed previously is referred to execute the inspection as there is no base position under this capturing condition.

Block 0
Position Adjustment No.000



With back lighting

Block 1
Binary Window No.100
(Specified Position Adjustment 000)



With reflection (low angle) lighting

Example 2.

(Simple alignment)
Block 0
Smart Matching No.000
Character/Figure Drawing No.000
0: Cross (SMC000)

Block 1
Smart Matching No.100
C100=SMC100_X.000-SMC000_X.000
C101=SMC100_Y.000-SMC000_Y.000
Character/Figure Drawing No.100
0: Cross (SMC000)
1: Circle (SMC000)
2: Circle (SMC000)
Character/Figure Drawing No.101
0 - 2: Character (CAC100)
Character/Figure Drawing No.102
0 - 2: Character (CAC101)

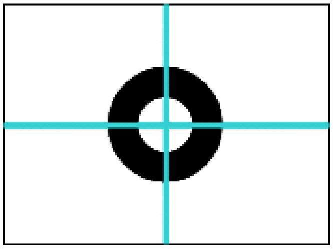
Overview of operation

Capture the first object under block 0.
Detect the object with Smart Matching checker No.000 and draw a cross at the detected position with Character/Figure Drawing No.000.

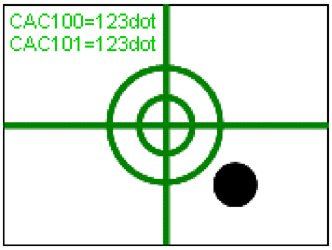
Change the object and capture the second object under block 1. Detect the object with Smart Matching checker No.100 and calculate the shift amount between the two objects with Numerical Calculation.
At this time, the detected position of Smart Matching checker No.000 executed with block 0 is drawn with Character/Figure Drawing No.100.
The shift amount data of the two objects is drawn with Character/Figure Drawing No.101 to 102.
Executing block 1 several times updates the value of SMC100 on each execution and enables to calculate the shift amount. The value of SMC000 is not updated unless block 0 is executed again.

The overview of operation is as above. However, the operation differs in "RUN menu" and "SETUP menu". For details, refer to the next page.

Block 0 = Registration of base position



Block 1 = Calculation of shift amount



Operation in RUN menu

- Execute block 0.

1. **Smart Matching checker No.000 is executed.**
2. **Character/Figure Drawing No.000 is executed and a cross is drawn on the screen window.**

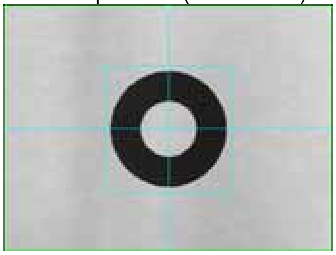
- Execute block 1.

1. **The pattern drawn in the above steps 1 and 2 for block 0 is deleted.**
2. **Smart Matching checker No.100 is executed.**
3. **Numerical Calculation CAC100 to 101 is executed.**
4. **Character/Figure Drawing No.100 to 101 is executed and a cross, circles and numerical calculation result are drawn on the screen window.**
5. **Execute block 1 to repeat the operations 2 through 4.**

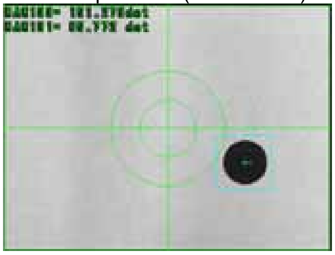
- Execute block 0.

1. **The pattern drawn for block 1 is deleted.**
2. **Smart Matching checker No.000 is executed.**
3. **Character/Figure Drawing No.000 is executed and a cross is drawn on the screen window.**

Block 0 operation (RUN menu)



Block 1 operation (RUN menu)



Operation in SETUP menu

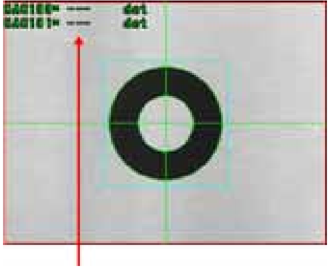
- Execute block 0.

1. **Smart Matching checker No.000 is executed.**
2. **The contents of Character/Figure Drawing set in block 0 and block 1 are displayed.**

- Execute block 1.

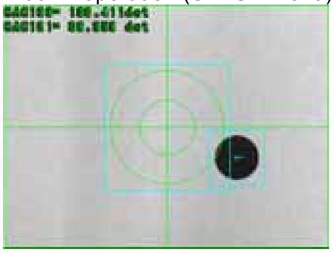
1. **Smart Matching checker No.100 is executed.**
2. **Numerical Calculation CAC100 to 101 is executed.**
3. **The contents of Character/Figure Drawing set in block 0 and block 1 are displayed.**

Block 0 operation (SETUP menu)



As block 1 is unexecuted, no numerical calculation result is displayed.

Block 1 operation (SETUP menu)

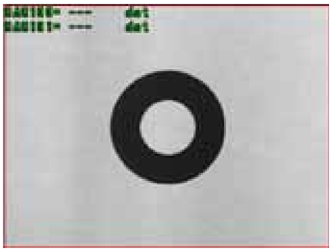


▶ Note

In SETUP menu, all types of drawings are performed regardless of block. When there is no result data necessary for drawing patterns such as cross or circle, no drawing is displayed on the screen window.

Note when turning on the power

When tuning on the power, the settings of all types of Character/Figure Drawing are displayed regardless of block. However, no drawing is displayed right after the power-on because no result data exists that is necessary for drawing a cross or circle.

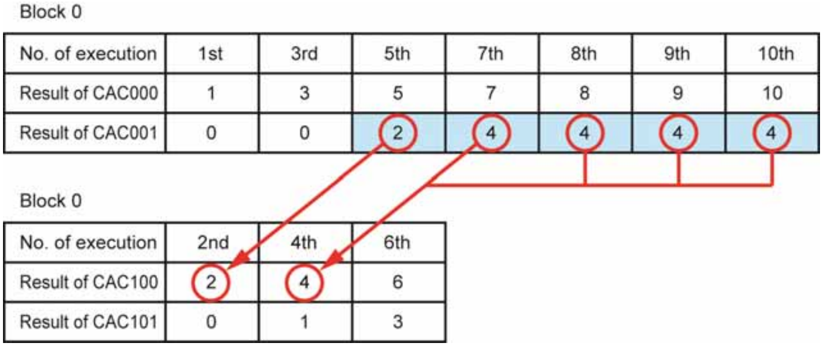


▶ Note

- You can refer to all types of Position Adjustment or Area Size Adjustment in each checker regardless of block.
- Even in Automatic Switch mode and User Defined mode, the results of other blocks can be referred. However, when referring a checker of the block that has never been executed after power-on or type switch, the result is 0.
- In Numerical Calculation, the previous values of other blocks can be also referred. Note that the value before the previous execution of the target block is referred as the previous value, as shown in the example below.

Block 0
CAC000=SYS_COUNT (Scan Count)
CAC001=OCA100_VALUE

Block 1
CAC100=SYS_COUNT (Scan Count)
CAC101=OCA000_VALUE



Block 0

No. of execution	1st	3rd	5th	7th	8th	9th	10th
Result of CAC000	1	3	5	7	8	9	10
Result of CAC001	0	0	2	4	4	4	4

Block 0

No. of execution	2nd	4th	6th
Result of CAC100	2	4	6
Result of CAC101	0	1	3

4.4.2 Inspecting in “Execute All” Mode

The “Execute All” is a factory default execution mode.
This mode executes all set checkers. You do not have to be concerned about “Block” in this mode.

Specifying Execution Mode and Number of Blocks

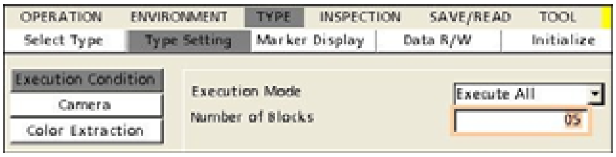
1. **Select "TYPE" > “Type Setting” from the menu bar.**

   “Type Setting” window is displayed.

2. **Select "Execution Condition".**

3. **Select “Execute All” for “Execution Mode”.**

4. **Enter the number of blocks 1 to 10 for “Number of Blocks”.**



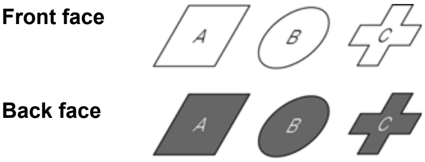
Execution Mode: Execute All
Number of Blocks: 05

4.4.3 Inspecting in “Automatic Switch” Mode

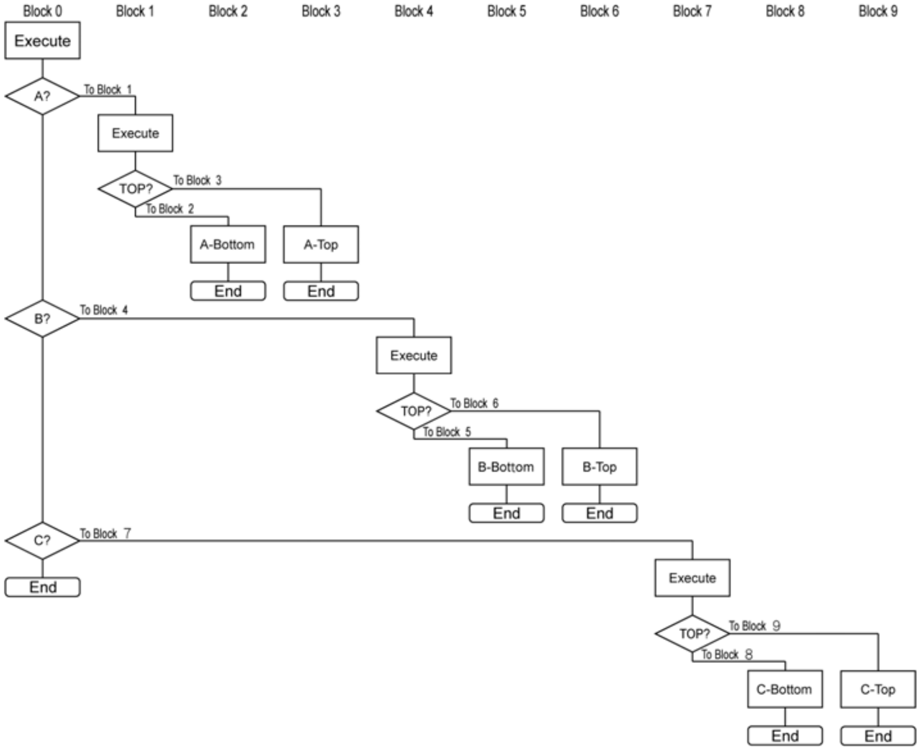
Automatic Switch mode inspects multiple blocks orderly. Firstly block No.0 is executed. The result decides the next operation; proceed another block, execute the next block, or terminate the inspection. These conditions can be set in Judgement setting window.

Example)

When inspecting the front and back face of three types of objects shown on the right, they are identified their type (A/B/C) and top or bottom, and then inspected as needed.



Flow concept



▶ Note The number of the executed block is displayed in the information area.

Specifying Execution Mode and Number of Blocks

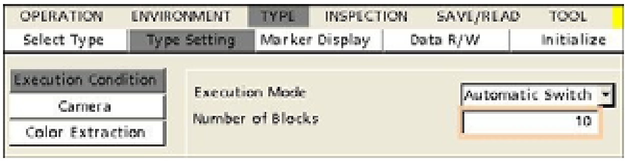
1. **Select "TYPE" > “Type Setting” from the menu bar.**

“Type Setting” window is displayed.

2. **Select "Execution Condition".**

3. **Select “Automatic Switch” for “Execution Mode”.**

4. **Enter the number of blocks 2 to 10 for “Number of Blocks”.**



Execution Mode: Automatic Switch
Number of Blocks: 10

Setting a Branch Condition

1. **Select "INSPECTION” > “Judgement” from the menu bar.**

The screen of Judgement setting is displayed.

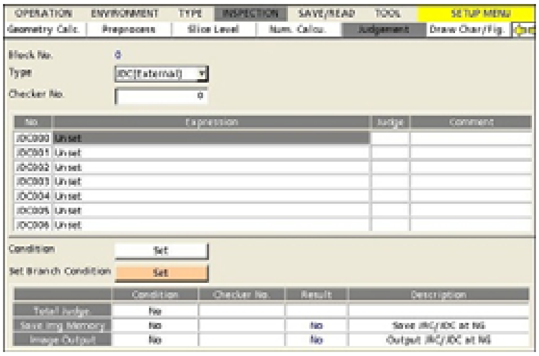
2. **Select "Set Branch Condition".**

The branch condition setting screen is displayed.

3. **Select "Block No.0".**

Branch 0-8 are displayed.
(When the number of blocks is 10.)
Branch condition is the result of the external output register (JDC) or the internal register (JRC) of the judgement of the specified block. Conditions are applied from the top. When the result meets the set condition, the right end block will be executed. When it does not meet, the next branch will be executed.

In the example shown on the right, the setting of the Branch 0 indicates that if judgement No.50 is OK, Block 1 will be executed, if it is NG, proceeds to Branch 1.

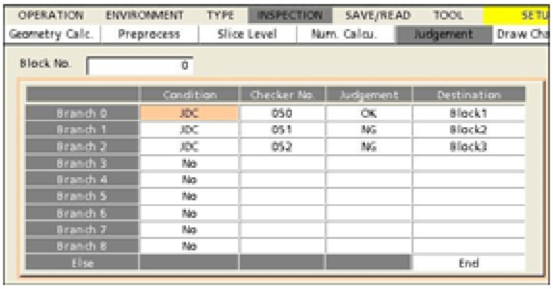


Block No. 0
Type JDC(External)
Checker No. 0

No	Expression	Judge	Comment
JDC000	Unset		
JDC001	Unset		
JDC002	Unset		
JDC003	Unset		
JDC004	Unset		
JDC005	Unset		
JDC006	Unset		

Condition
Set Branch Condition

	Condition	Checker No.	Result	Description
Total Judge	No			
Save Img Memory	No		No	Save JRC/JDC at NG
Image Output	No		No	Output JRC/JDC at NG



Block No. 0

	Condition	Checker No.	Judgement	Destination
Branch 0	JDC	050	OK	Block1
Branch 1	JDC	051	NG	Block2
Branch 2	JDC	052	NG	Block3
Branch 3	No			
Branch 4	No			
Branch 5	No			
Branch 6	No			
Branch 7	No			
Branch 8	No			
Else				End

4. **Set branch conditions.**

- Condition and Checker No.:
  Specify Judgement type and number to set as a branch condition.
- Judgement:
  Specify a condition to meet. When specifying "OK", the branch condition is satisfied if the result of the set Judgement expression is OK.

▶ Note

As "Destination", you can set the block number that is larger than the currently setting block or "End".
For instance, Block 0 cannot be set as a branch destination for Block No.1.
"End" indicates to end the inspection.
To set the behavior when no branch conditions are fulfilled, select "Destination" field in "False" line.

Set branch conditions as necessary.

5. **Set branch condition of the destination block if needed.**

6. **After setting is completed, press the CANCEL key.**

4.4.4 Inspecting in “User Defined” Mode

In this mode, inspections are executed by each block. Specify a block No.0 to 9 when inputting start signal from the external devices. (I/O input, serial command communication or Ethernet command communication.) The checkers, the numerical calculations, and the judgements belong to specified block are executed and output. The number of the executed block is displayed in the information area.

Specifying Execution Mode and Number of Blocks

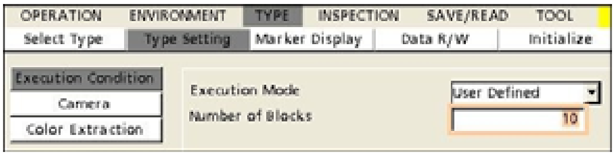
1. Select "TYPE" > “Type Setting” from the menu bar.

“Type Setting” window is displayed.

2. Select "Execution Condition".

3. Select “User Defined” for “Execution Mode”.

4. Enter the number of blocks 2 to 10 for “Number of Blocks”.



Execution Mode: User Defined

Number of Blocks: 10

How to Set a Block

Specify a block to input a signal and send a command to execute an inspection.

When inputting a start signal through I/O, specify the block number with IN 0-3.

When sending a serial command, send a designated command to specify the block No.

Block	I/O (STRT)				Serial command*
	IN3	IN2	IN1	IN0	
No.0	off	off	off	off	%S0
No.1	off	off	off	**ON**	%S1
No.2	off	off	**ON**	off	%S2
No.3	off	off	**ON**	**ON**	%S3
No.4	off	**ON**	off	off	%S4
No.5	off	**ON**	off	**ON**	%S5
No.6	off	**ON**	**ON**	off	%S6
No.7	off	**ON**	**ON**	**ON**	%S7
No.8	**ON**	off	off	off	%S8
No.9	**ON**	off	off	**ON**	%S9

Starting an Inspection by Keypad

For the type set as “User Defined”, you can specify a block when starting an inspection with the keypad.

1. Press the TRIG key (Start) in RUN menu.

A window to select a block No. to execute is displayed.

2. Select the block No. to execute.

The specified block is executed.

4.5 Capturing an Image

This function can save an image processing of inspection object in the memory.

Specify the inspection area and conditions based on the image. The image is for setting criteria of an inspection. Capture a base object maintaining the lighting condition to take an image.

1. **Press the F1 key and select “Delete” from the displayed menu.**

2. **Select “Live” for "Memory/Live".**

3. **Place an object beneath the camera.**

4. **Press the TRIG key.**

   A test run is executed and an image is captured.

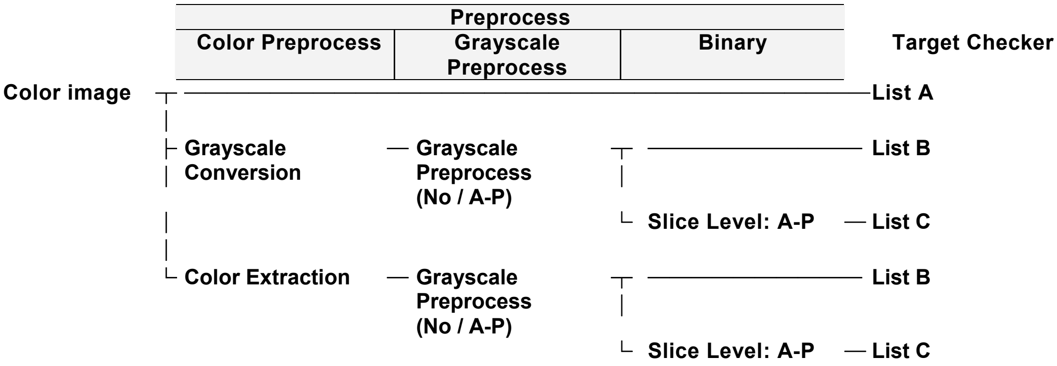
▶ Note

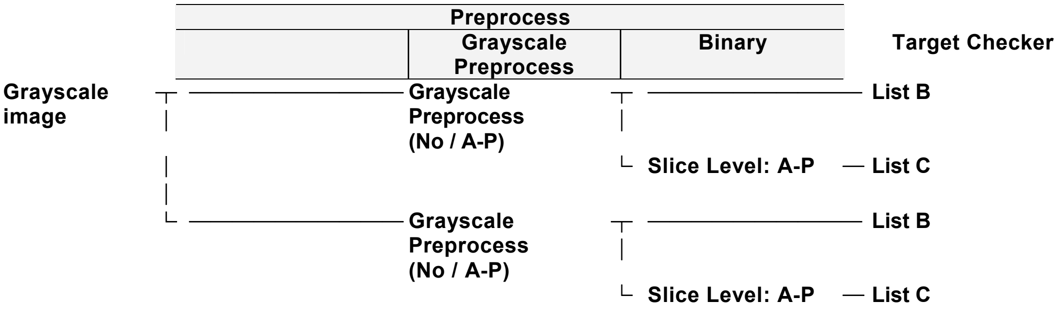
You can call up the images saved in PV200 or a SD memory card to set checkers and execute a test. To use the saved images, select "Memory".

About how to save and read images, refer to pages 289, 288, 289).

4.6 Image Preprocessing (Binary / Preprocess)

PV200 inspects gray scale images and color images. Gray scale images are signals taken from a camera as images with 256 intensities (0 to 255). Color images are colored images. Connecting a color camera enables to inspect colored images. The function that applies filtering process on an image captured by a camera in order to execute desired inspections based on the gray image is “Preprocess”.



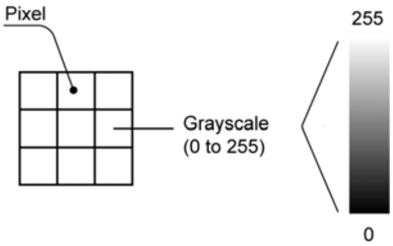


Target Checker List	**List A**	**Color Window**
	List B	**Gray Window / Gray Edge / Smart Matching / Flaw Detection / Connector (Gray Window) / Connector (Gray Edge) / Smart Edge (Circle) / Smart Edge (Line)**
	List C	**Line / Binary Window / Binary Edge / Feature Extraction / Connector (Binary Window)**

▶ Note

- The target checker also includes the same functions of Position Adjustment and Area Size Adjustment.
- Even when the same grayscale preprocess group is used in the grayscale preprocess for a color image, the target image varies depending on the setting of Grayscale Conversion/Color Extraction. It is recommended to separate grayscale conversion groups for each grayscale conversion group and color extraction used in each checker.
- Both for color and grayscale images, the target image varies depending on the setting of Grayscale Conversion/Color Extraction/Grayscale preprocess even when the same slice level group is used in binary operation. It is recommended to separate slice level groups according to the combination of the grayscale conversion group, color extraction and grayscale preprocess group used in each checker.

4.6.1 Preprocessing on Gray Image (Slice Level / Grayscale Preprocess)

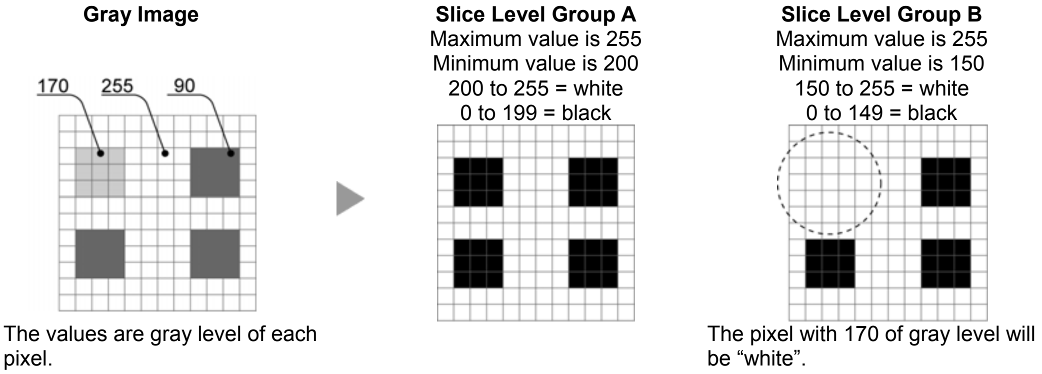


When using a gray camera, PV200 takes in signals from the camera as an image with 256 intensities (0 to 255). The image is “gray image” and the 256 intensities are "gray value“. The higher gray value indicates the brighter pixel, and the lower gray value the darker pixel. When using a color camera, performing the color preprocess enables to display the image as a gray image.

Among the preprocess on a gray image, the process that makes a gray image into a monochrome image is binarization and a binarized image is a binary image. Some of inspection functions scan with this binary image.

4.6.2 Binarizing an Image (Slice Level)

In PV200, up to 16 sets of slice level (A to P) can be registered per type and camera for the inspection with gray values, which is called slice level group. Which slice level group is used to inspect an image is set in the window for setting the inspection conditions when creating a checker.



The values are gray level of each pixel.

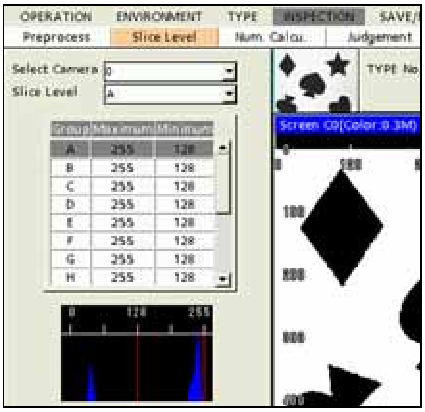
The pixel with 170 of gray level will be “white”.

▶ Note

Changing the setting values of a slice level group also changes the setting values for the checkers which specify the same slice level group. You can adjust quickly. On the other hand, even if you intend to change the slice level of a certain checker, it may affect the settings of other checkers. In this case, change the slice level group to another group that is not used by other checkers.

Especially, when the color or gray preprocess is used in each checker, the target gray images vary. For adjusting the values of a slice level, check if the change is appropriate for all the checkers that the slice level group is used.

Setting a Slice Level



Select Camera: 0
Slice Level: A

Group	Maximum	Minimum
A	255	128
B	255	128
C	255	128
D	255	128
E	255	128
F	255	128
G	255	128
H	255	128

1. **Select "INSPECTION” > “Slice Level” from the menu bar.**

“Slice Level” setting window is displayed.

▶ Note

Slice level can be modified also in setting window of a checker which scans with a binary image.

2. **Select a group to set from the table.**

“Slice Level” setting sub-window is displayed.

3. **Select "Auto Adjustment".**

If the image turned to be a desired binary image, setting is completed.

4. **Select “Minimum” to specify the minimum value.**

Specify the maximum value as necessary.
Changing values updates the displayed image.

▶ Note

Beneath the table, a histogram is displayed. The two red lines indicate the minimum value and the maximum value. Refer to the histogram as necessary.

5. **After setting is completed, press the CANCEL key.**

4.6.3 Setting Grayscale Conversion

Using this function converts a color image to a gray scale image in a range of 0 to 255 using RGB values for each pixel. Changing RGB coefficients enables to convert a color image to various gray scale images.

Up to 16 sets of grayscale conversion (A to P) can be registered per type and color camera. These sets are called grayscale conversion groups. When creating each checker, select "Converted Gray Img." in "Select Color Image", and select "Set" to specify a grayscale conversion group the image of which is used for the inspection.

"Grayscale Conversion" can be modified also in setting window of each checker.

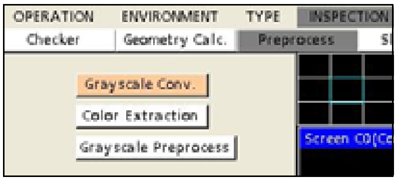
▶ Note

If the setting values of a grayscale conversion group are changed, these changes are also reflected in multiple checkers that the same grayscale conversion group is specified. So you can adjust quickly. On the other hand, even if you intend to change the grayscale conversion of a certain checker, it may affect the settings of other checkers. In this case, change the grayscale conversion group to another group that is not used by other checkers.

Setting a Grayscale Conversion Level

1. **Select "Inspection" > "Preprocess" from the main menu.**

The window to select a preprocess type appears.

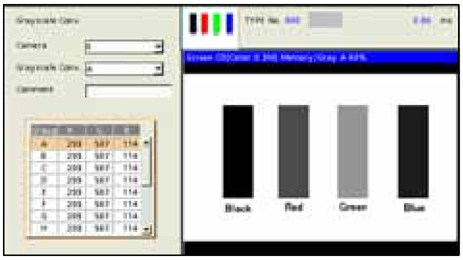


2. **Select "Grayscale Conv.".**

The window for selecting a grayscale conversion group appears, and the screen window shows converted grayscale images.

3. **Select a camera image to set Grayscale Conversion from "Camera".**

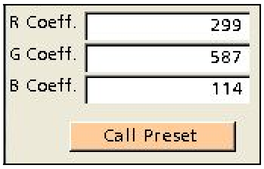
The camera image selected in "Camera" is displayed.



4. **Select a group to set from the table.**

The grayscale conversion setting window appears.

5. **Set R coeff., G coeff. and B coeff.**



R Coeff. 299

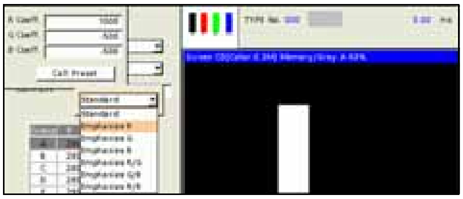
G Coeff. 587

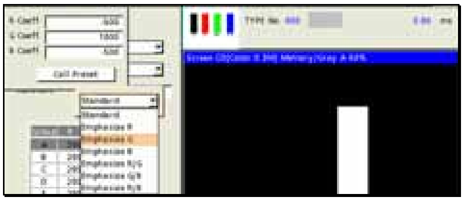
B Coeff. 114

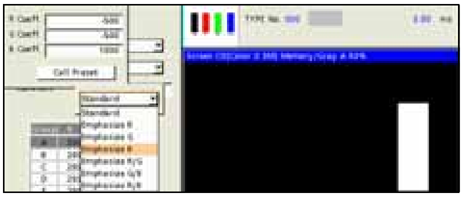
The images displayed on the screen window vary when changing the coefficients.
The input range of each coefficient is -1000 to 1000.

▶ Note

You can call the preset RGB coefficients and finely adjust them as necessary.
The preset values are as below.







	R Coeff.	G Coeff.	B Coeff.
Standard	299	587	114
Emphasize R	1000	-500	-500
Emphasize G	-500	1000	-500
Emphasize B	-500	-500	1000
Emphasize R/G	500	500	-1000
Emphasize G/B	-1000	500	500
Emphasize R/B	500	-1000	500

▼Refer to▼

For further information, refer to the User's Manual Color Operation Guide.

6. **After setting is completed, press the CANCEL key.**

4.6.4 Setting Color Extraction

Color Extraction is a function that extracts specific colors by registering the colors based on a color image. It converts RGB values of each pixel to HSV (hue, saturation and value) that is better fitted to human sense and extracts colors in a specified area. An image will be a gray scale image with the extracted colors converted to 255 and the other colors converted to 0.

Extracted colors can be registered for each camera. The number of registrable colors varies depending on the color extraction mode used and the number of cameras connected. (For details of the number of registrable colors, see page 70.)

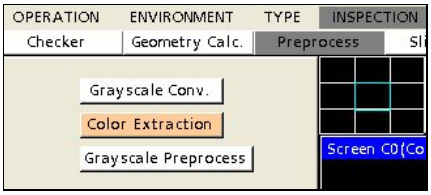
Select "Set" to specify a color extraction No. after selecting "Select Color Image" > "Extracted Color Img." when creating a checker.
Up to eight color extraction numbers can be specified for one checker.

Color Extraction can be modified also in the setting window of each checker.

▶ Note

If the setting values of a color extraction group are changed, these changes are also reflected in multiple checkers that the same color extraction group is specified. So you can adjust quickly. On the other hand, even if you intend to change the color extraction of a certain checker, it may affect the settings of other checkers. In this case, change the color extraction group to another group that is not used by other checkers.

Setting Color Extraction Conditions

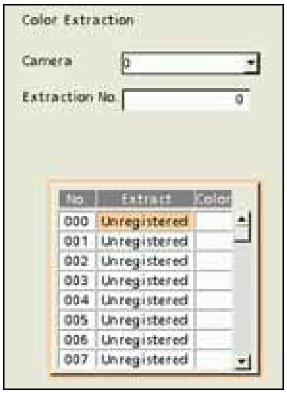


1. Select "Inspection” > “Preprocess” from the main menu.

The window to select a preprocess type appears.

2. Select "Color Extraction".

The window for selecting a color extraction group appears, and the screen window is switched to display color images.



Camera: 0

Extraction No.: 0

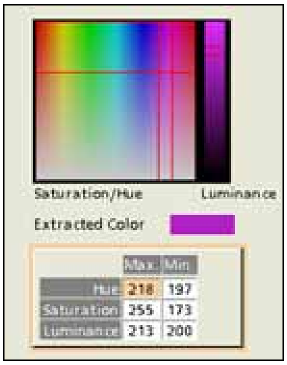
No	Extract	Color
000	Unregistered	
001	Unregistered	
002	Unregistered	
003	Unregistered	
004	Unregistered	
005	Unregistered	
006	Unregistered	
007	Unregistered	

3. Select a camera image to set color extraction from “Camera”.

The camera image selected in “Camera” is displayed.

4. Select a group to set from the table.

The color extraction setting window appears. The extraction display mode for the screen window is changed to "Single Color (Color BG)".
The extracted color of the highlighted extraction No. is displayed on the color image in "Color for Single Color".



	Max	Min
Hue	218	197
Saturation	255	173
Luminance	213	200

5. Set the maximum and minimum values of hue, saturation and value.

Changing the values changes the extracted parts.
The maximum and minimum values are indicated by red lines in the color field. The input range of each setting is 0 to 255. Only for hue, the maximum value can be set to a smaller value than the minimum value.
In this case, the part of hue that is not included in the range of the maximum and minimum values is extracted. When the maximum and minimum values are reversed, those values of hue are indicated by blue lines.
In the color field, they are indicated by the blue lines. In addition, the columns of the values are highlighted in blue.

▼Refer to▼
For further information, refer to the User's Manual Color Operation Guide.

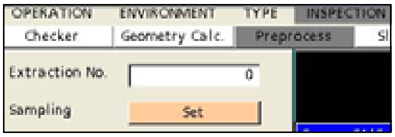
6. **After setting is completed, press the CANCEL key.**

▶ Note

The color represented by the median between maximum and minimum values of hue, saturation and value is displayed as an extracted color. Note that the actual extracted color may be different from the assumed color if the range of the maximum and minimum values is wide.

Setting Color Extraction Conditions by Sampling

In "Sampling", a sampling area can be specified with a rectangle window. The maximum and minimum values of hue, saturation and value are automatically set to extract all the colors in the sampling area. If colors you want to extract are not extracted outside the sampling area, reexecute "Sampling" or finely adjust the maximum and minimum values determined by sampling.



Extraction No. 0

Sampling

1. **Select "Sampling".**

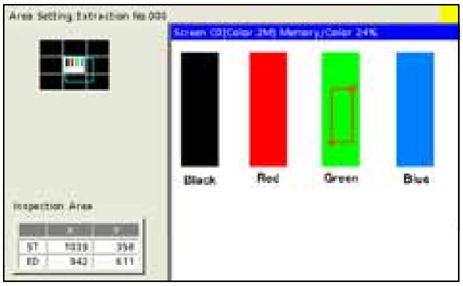
Now you can draw an area.

▶ Note

- The default size of the area is as below.
  - 0.3-Mega Color Camera: 24 x 24 pixels
  - 2-Mega Color Camera: 36 x 36 pixels
- If the size and the position of the area is changed, the changes are memorized until you exit from the setting window of color extraction.

2. **Move the whole rectangle and change the size.**

The procedures for moving the rectangle and changing the size are the same as the one for setting an inspection area. Specifying the end point determines the position and size of the area and extracts all the colors in the area.


Area Setting Extraction No.000
Screen 00(Color 2M) Memory/Color 24%
Black
Red
Green
Blue
Inspection Area

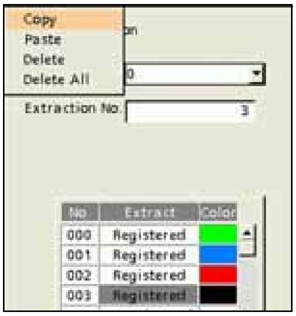
	X	Y
ST	1039	358
ED	942	611

Copying Color Extraction

1. **Highlight the color extraction number you want to copy and press the FUNC key.**

The pop-up menu appears.

2. **Select "Copy".**



Extraction No. 3

No.	Extract	Color
000	Registered	🟩
001	Registered	🟦
002	Registered	🟥
003	Registered	⬛

3. **Move the cursor onto the destination color extraction number and press the FUNC key.**

The pop-up menu appears.

▶ Note

It cannot be copied to the number indicated in gray.

4. **Select "Paste".**

The color extraction is copied.

▶ Note

If a color extraction has been already set in the destination, the message of overwrite confirmation appears.

Deleting Color Extraction Conditions

1. **Highlight the color extraction number you want to delete and press the FUNC key.**

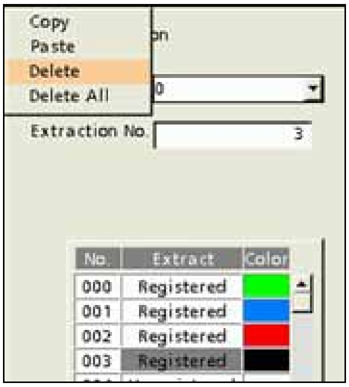
   The pop-up menu appears.

2. **To delete only the selected color extraction number, select “Delete”, and to delete all color extraction conditions, select “Delete All”.**

   The confirmation screen is displayed.

3. **Select “Yes”.**

   The selected color extraction number or all color extraction conditions are deleted. Select "No" to cancel.



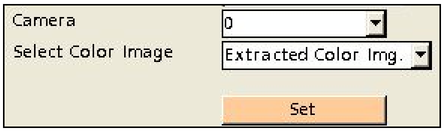
Extraction No. 3

No.	Extract	Color
000	Registered	🟩
001	Registered	🟦
002	Registered	🟥
003	Registered	⬛

Setting Extracted Colors Used in Checker

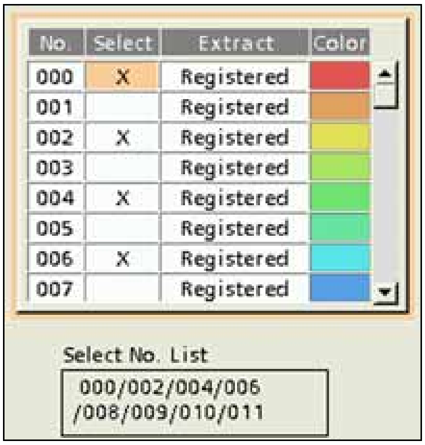
1. **Select "Area Setting" > "Select Color Image" > "Set" from the setting menu of each checker.**

   The selection window appears. The table shows "Registered" in the number that the color extraction condition has been already set.
   The screen window is changed to "Single Color (Color BG)".


Camera 0
Select Color Image Extracted Color Img.

2. **Select the color extraction number to use.**

   Select necessary color extraction numbers using the "colors" displayed in the window as a reference. The color extraction numbers that cannot be used due to the selected color extraction mode or the number of connected cameras are displayed in gray. Up to eight color extraction numbers can be selected for one checker. The "X" mark is displayed in the "Select" column of the selected color extraction number, and the number appears in Select No. List.



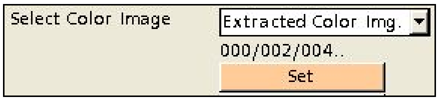
No.	Select	Extract	Color
000	X	Registered	🟥
001		Registered	🟧
002	X	Registered	🟨
003		Registered	🟩
004	X	Registered	🟩
005		Registered	🟩
006	X	Registered	🟦
007		Registered	🟦

Select No. List
000/002/004/006
/008/009/010/011

▶ Note

The color represented by the median between maximum and minimum values of hue, saturation and value is displayed as an extracted color. The actual extracted color may be different from the assumed color if the range of the maximum and minimum values is wide.

Move the cursor onto "Extract" and press the ENTER key to set the conditions of "Color Extraction".


Select Color Image Extracted Color Img.
000/002/004..

3. **After setting is completed, press the CANCEL key.**

   Up to three color extraction numbers can be confirmed in "Area Setting " menu.

4.6.5 Setting Grayscale Preprocess

In PV200, up to 16 sets of preprocess (A to P) can be registered per type and camera for grayscale images. The sets of preprocess A-P are preprocess groups. Up to 10 steps of filters can be set for a preprocess group. PV200 also has a function to temporarily disable a part of the specified 10 steps.

Which preprocess group (A to P) is applied is set in the checker setting window. Preprocess can be modified also in setting window of a checker.

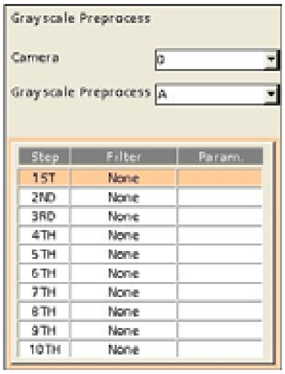
▶ Note

Changing the setting values of a grayscale preprocess group also changes the setting values for the checkers which specify the same grayscale preprocess group. You can adjust quickly. On the other hand, even if you intend to change the grayscale preprocess of a certain checker, it may affect the settings of other checkers. In this case, change the grayscale preprocess group to another group that is not used by other checkers.

Especially, note that the target grayscale images vary depending on the color preprocess when using a color camera. For adjusting the values of a grayscale preprocess, check if the change is appropriate for all the checkers that the grayscale preprocess group is used.

1. **Select "INSPECTION" > "Preprocess" from the menu bar.**

   The screen to select a preprocess type appears.



Grayscale Preprocess

Camera: 0

Grayscale Preprocess: A

Step	Filter	Param.
1ST	None	
2ND	None	
3RD	None	
4TH	None	
5TH	None	
6TH	None	
7TH	None	
8TH	None	
9TH	None	
10TH	None	

2. **Select "Grayscale Preprocess".**

   The screen to select a preprocess group is displayed.

3. **Select a camera image to set preprocess from "Camera".**

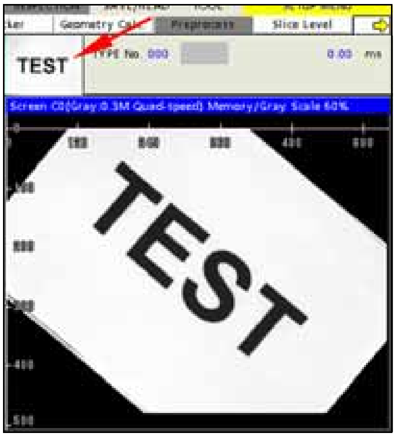
   The camera image selected in "Camera" is displayed.

4. **Select a preprocess group to set from "Preprocess".**

   The current setting of the preprocess group is displayed.

5. **Select "1ST".**

   The screen of preprocess setting is displayed.



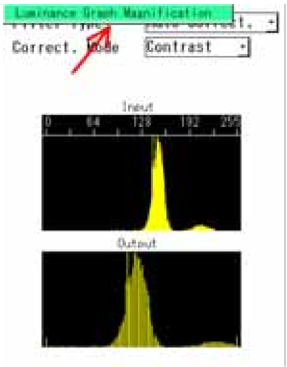
6. **Select "Filter Type" and specify the desired filter from 21 types grouped into 6 categories.**

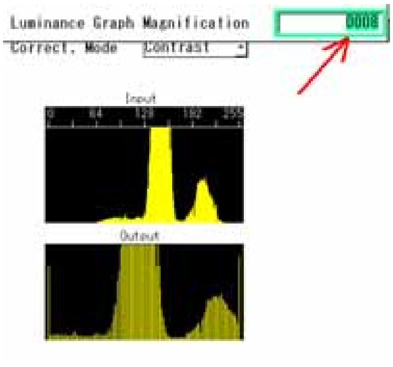
   The image is updated to be an image applied the specified filter.
   The image before applying preprocess can be confirmed in the window navigator area (pointed by the arrow in the right figure).

   Two luminance graphs showing the gray level distribution are displayed in the lower part of the Preprocess setting window. "Input" shows the gray level distribution before applying Preprocess, and "Output" shows the one after applying Preprocess.

▶ Note

The magnification of the vertical axis of graphs can be changed.
Increasing magnification displays gray levels that are difficult to see at 1-fold magnification, and enables them to be checked.
Press the FUNC key and select "Luminance Graph Magnification" from the pop-up menu to specify magnification. It can be specify in a range of 1 to 1024.





7. **Set the parameter for the selected filter.**

Set details (Direction, Filter Size, Maximum, and Minimum, etc) as necessary.

▶ Note

Direction is to apply the selected preprocess and the options are X, Y, and X/Y.

8. **Set 2ND to 10TH process as necessary.**

When multiple steps are set, PV200 processes from 1ST step in numeric order.

9. **After setting is completed, press the CANCEL key.**

▶ Note

As an image displayed in SETUP menu, an image in the mid-course phase of preprocess can be selected. Press the F1 key and select “Grayscale Preprocess” from the displayed Image menu.

Copying Grayscale Preprocess

1. **Highlight the step you want to copy and press the FUNC key.**

The pop-up menu appears.

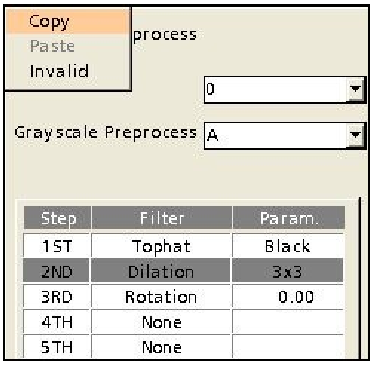
2. **Select "Copy".**

3. **Move the cursor onto the destination step and press the FUNC key.**

The pop-up menu appears.

4. **Select "Paste".**

The preprocess is copied.



0

Grayscale Preprocess A

Step	Filter	Param.
1ST	Tophat	Black
2ND	Dilation	3x3
3RD	Rotation	0.00
4TH	None	
5TH	None	

▶ Note

If a preprocess has been already set in the destination, the message of overwrite confirmation appears. Selecting “Yes” executes copying the checker.

Disabling the Set Preprocess

Using this function disables a specified step and enables to execute an inspection or run a test without deleting the setting.

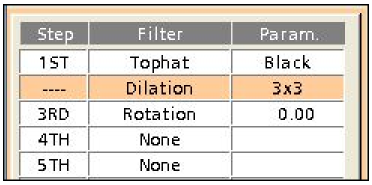
1. **Highlight the step you want to disable and press the FUNC key.**

The pop-up menu appears.

2. **Select "Invalid".**

The display in the column showing [Step] of the selected step changes to "----".
In the example on the right, "2ND" changed to "----" to show the step is invalid. In this case, the image rotation of the third step is executed after the feature extraction of the first step.

Select "Invalid" from the pop-up menu again to enable the preprocess in the invalid step.



Step	Filter	Param.
1ST	Tophat	Black
----	Dilation	3x3
3RD	Rotation	0.00
4TH	None	
5TH	None	

▶ Note

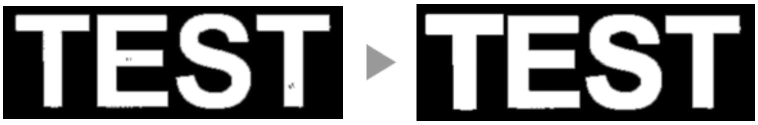
The invalid/valid setting is saved as type data.

Grayscale Preprocess Filter List

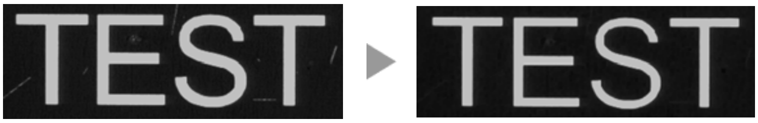
Index 1

- Main application: Denoising
- Common parameter: Size: 3x3, 5x5, 7x7, 9x9
  Direction: X/Y, X(only), Y(only)

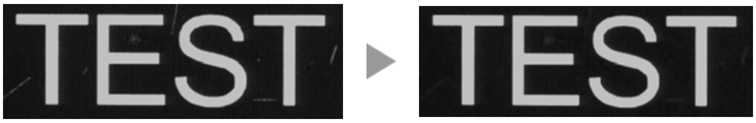
Dilation
Dark (or black) noises are removed. Black areas in the image of the object contract. White areas in the image of the object expand.



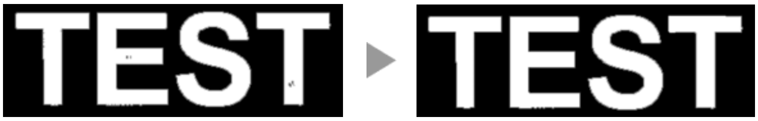
Erosion
Light (or white) noises are removed. White areas in the image of the object contract. Black areas in the image of the object expand.



Erosion -> Dilation
After removing light (or White) noises, return the contracted area to its original size.



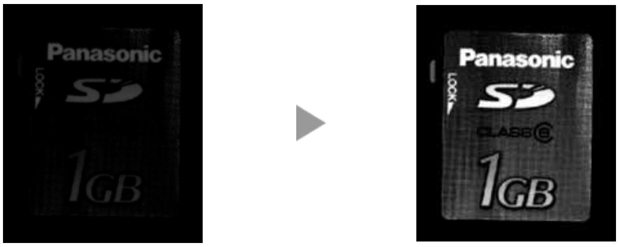
Dilation -> Erosion
After removing dark (or black) noises, return the expanded area to its original size.



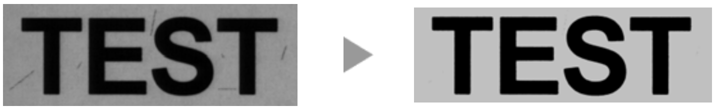
Index 2

Main application: Change in gray level

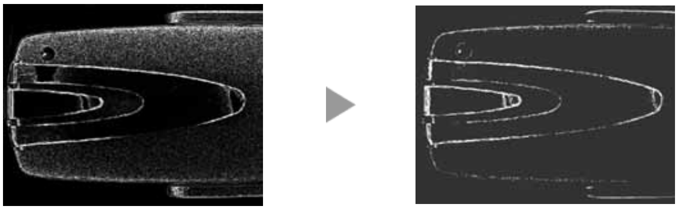
Auto Correction
Automatically corrects the brightness or contrast according to the luminance graph for the whole image.



Gray Cut
Reorganizes the specified grayscale range into the one between 0 and 255. This function is effective if there are any light or dark noises in the background, or if the contrast of the image of the object is low.

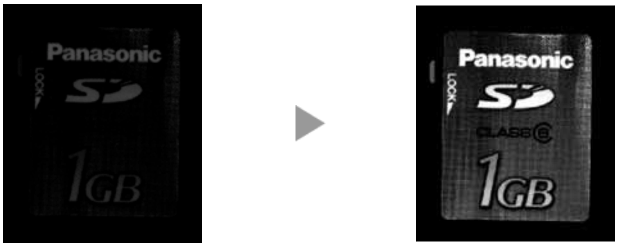


Area Averaging
Averages the brightness in the specified area.



▼Refer to▼ Page 90

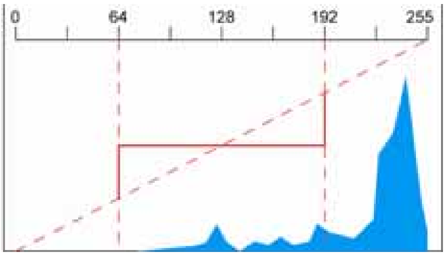
Correction Setting
Divides 256 gray levels into 8 groups. Nine-point gray levels are specified. SMPerformance



Area Averaging

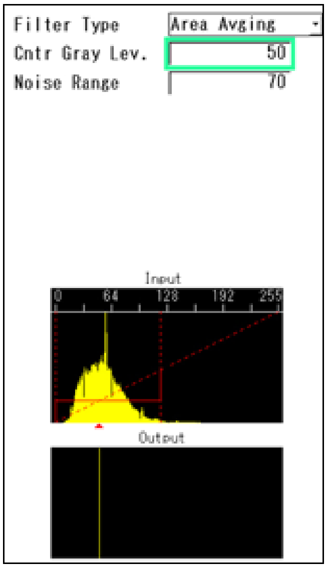
In Area Averaging, the pixel with the gray level of "Center Gray Level" +/- "Noise Range" is converted to "Center Gray Level".

When "Center Gray Level" is 128 and "Noise Range" is 64, the gray level of the pixel the gray level of which is 64 to 192 is "128".



When "Center Gray Level" is 50 and "Noise Range" is 70, the gray level for the pixel the gray level of which is 0 to 120 is converted to 50.

In the case of the above setting, the gray level to be converted is -20 to 120. However, as the gray level is only available in the range of 0 to 255, it is processed as above.


Filter Type Area Avging
Cntr Gray Lev. 50
Noise Range 70

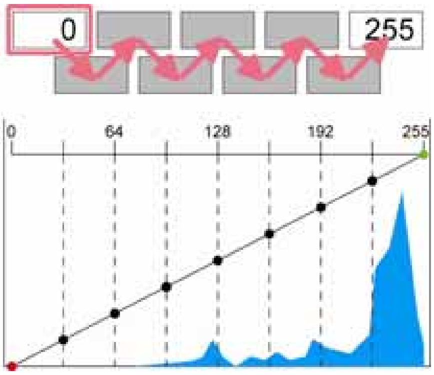
Correction Setting

Gray levels in a range of 0 to 255 are divided into 8 blocks, and the gray levels can be changed at 9 points.

1. **Select "LUT Setting".**

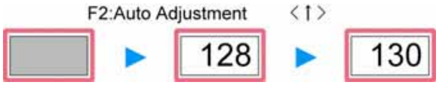
   The values are displayed only for the two points (i.e. 0 and 255) among nine points. Tilting the ENTER key up/down increases or decreases the values at the points where the values are displayed.
   The luminance graph indicates the point that the value has been input in green and the point that is being changed in red.

Tilting the ENTER key left/right/up/down moves the cursor.



2. **Move the cursor onto the point you want to change the value and press the F2 "Auto Adjustment".**

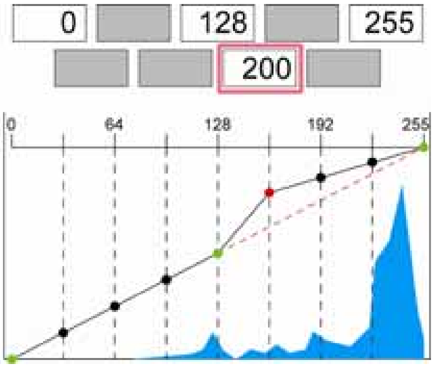
   The value for the selected gray level (at the point marked with a black circle on the graph) is displayed.



3. **Tilt the ENTER key up/down to specify the value.**

   Changing the value moves the point on the luminance graph up/down. The other points are automatically adjusted along with the point moved up/down.
   At this time, the point that the value has been already input is not automatically adjusted as the value is fixed.

   In the right example, as the point with the gray level of 128 is determined, the point on the luminance graph does not change even if the next gray level has been changed from 160 to 200.

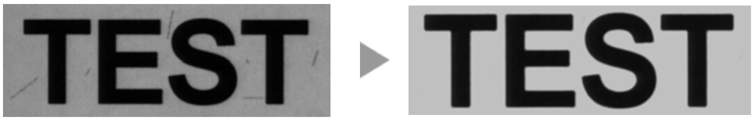


4. **After setting the necessary points, press the ENTER key or "CANCEL" key to fix the setting.**

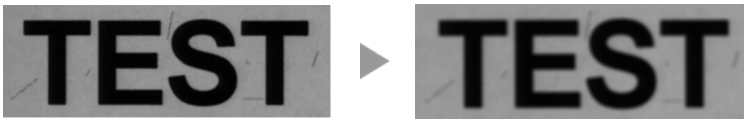
Index 3

Main application: Defocusing

Median
Removes light or fine noises.



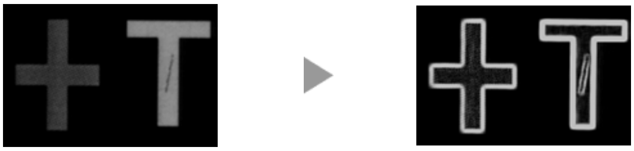
Smoothing
Decreases noises by blurring an image to help measuring the position of the object.



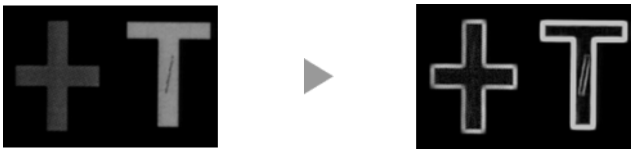
Index 4

- Main application: Contour enhancement
- Common parameter: Size: 3x3, 5x5, 7x7, 9x9

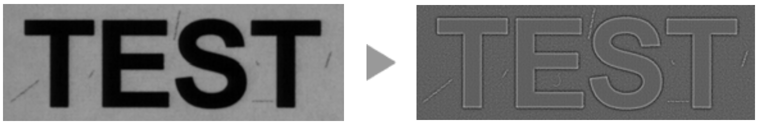
Sobel
Same as “Prewitt”. More easily extracts the area of lower contrast.



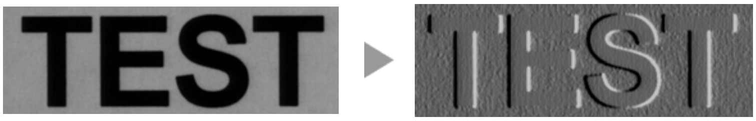
Prewitt
Extracts the area of which grayscale value changes. The image becomes an image with extracted outlines and edges of the object.



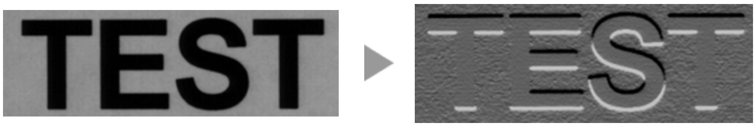
Laplacian
Extracts the area of which grayscale value changes.



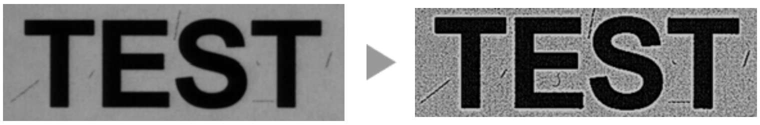
Edge Extract X
In the X direction, extracts the area of which grayscale value changes.



Edge Extract Y
In the Y direction, extracts the area of which grayscale value has been changed.



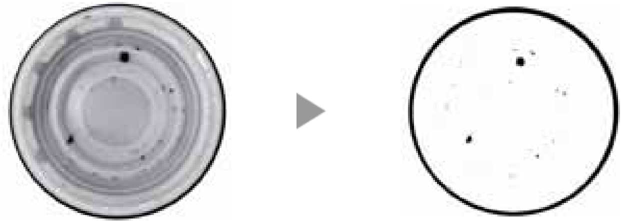
Sharpen
Enhances the area of which grayscale value changes. The image becomes sharp. The noises may also be enhanced.



Index 5

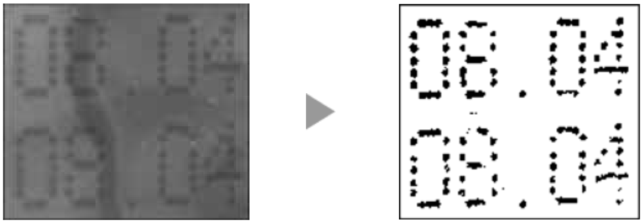
Main application: Flaw detection

Tophat
This is a filter to extract a point with a small area or a thin line.



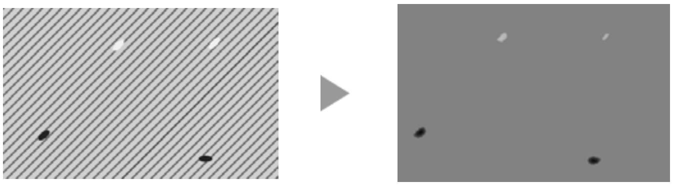
Dynamic
Divides the image into specified areas, and performs Binary process by comparing the brightness in the area. It is helpful to binarize the image the brightness of which is uneven.

▼Refer to▼ Page 92



Frequency Extraction
It can be executed with the combination of the process for smoothing the fine change in shading and the process for equalizing the moderate unevenness of brightness.

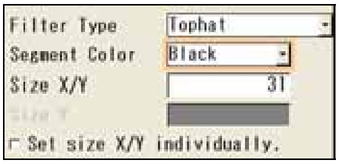
▼Refer to▼ Page 92



Setting Tophat

1. **Select the color of foreign objects you want to extract in "Segment Color".**

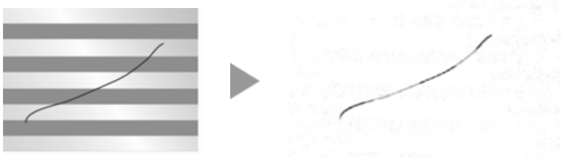
   Black: Extracts the foreign objects darker than the background.
   White: Extracts the foreign objects lighter than the background.



Filter Type: Tophat
Segment Color: Black
Size X/Y: 31
Size Y
☐ Set size X/Y individually.

2. **Specify the size (thickness) of the foreign objects you want to extract in "Size X/Y".**

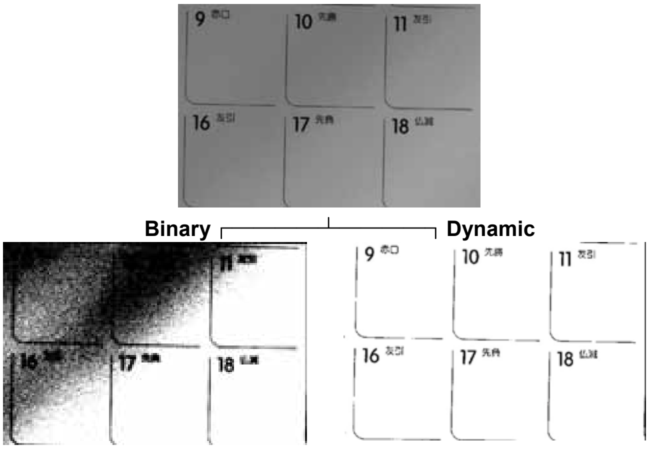
   The background information larger than the size specified here (such as patterns. The black horizontal lines in the example on the right) is removed.
   Select (check) "Set size X/Y individually." to set X and Y directions to different sizes. Now you can set Size Y.



Setting Dynamic thresholding

Binarizes pixels using the threshold that is calculated by adding the offset value to the gray average of the specified size. The pixels with the gray level over the threshold change to white, and the pixels with the gray level below the threshold change to black.

It is helpful to binarize the image the brightness of which is uneven or the image the brightness of which varies.

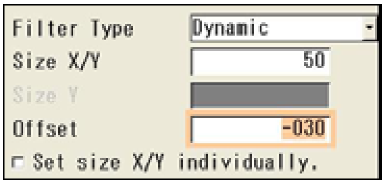


1. **Set "Size X/Y".**

   Set a range to calculate the average.
   Select (check) "Set size X/Y individually." to set X and Y directions to different sizes. Now you can set Size Y.

2. **Set "Offset".**

   When the average is 100 and the offset is -30, binarizes the pixels with the gray level over 70 to white and the pixels with the one below 70 to black.



Filter Type: Dynamic
Size X/Y: 50
Size Y
Offset: -030
☐ Set size X/Y individually.

About Frequency Extraction

Two filters are provided, which are Smoothing Filter and Sharpening Filter.

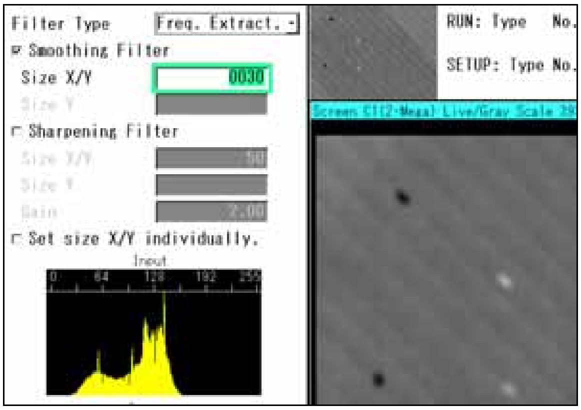
Using "Smoothing Filter" removes fine edges. Defocused image can be obtained in whole. (Removes high frequencies.) Using "Sharpening Filter" removes the part showing the modest variation in brightness. Image with a clear-cut edge can be obtained. (Removes low frequencies.) Using these two filters in combination enables a specific frequency to be obtained.

1. **Select and check "Smoothing Filter".**

2. **Set "Size X/Y".**

   If "Sharpening Filter" is unchecked, only the result of the application of Smoothing Filter can be confirmed.
   Set the appropriate value to remove unnecessary edges by increasing the value checking the image.

   Select (check) "Set size X/Y individually." to set X and Y directions to different sizes. Now you can set Size Y.



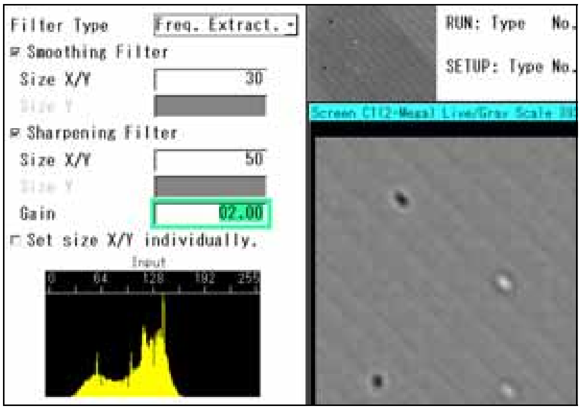
Filter Type: Freq. Extract.
☑ Smoothing Filter
Size X/Y: 0030
Size Y
☐ Sharpening Filter
Size X/Y: 50
Size Y
Gain: 2.00
☐ Set size X/Y individually.

RUN: Type No.
SETUP: Type No.
Screen C1(2-Mega) Live/Gray Scale

3. **Select and check "Sharpening Filter".**

4. **Set "Size X/Y" and "Gain".**

   Set the value to enhance the part you want to extract checking the image.
   Increasing the gain makes the difference in the gray level of the image larger.



Filter Type: Freq. Extract.

☑ Smoothing Filter

Size X/Y: 30

☑ Sharpening Filter

Size X/Y: 50

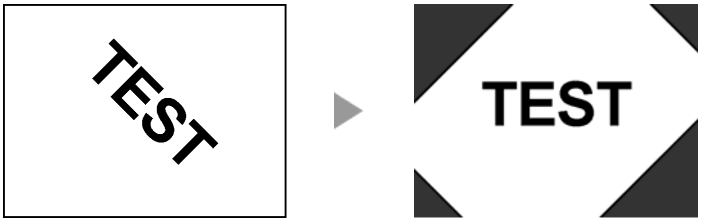
Gain: 02.00

☐ Set size X/Y individually.

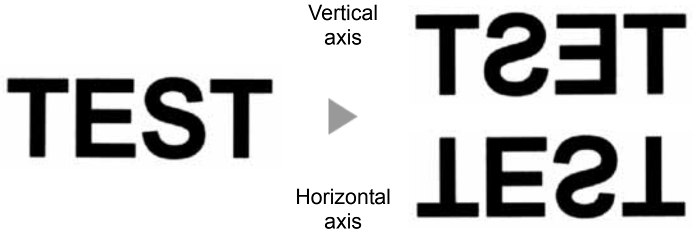
Index 6

Main application: Rotation and Reflection

Rotation
Rotate the whole captured image at a specified angle. The gray level can be specified for the blank spaces of the image created by the rotation (i.e. the gray area in the right figure).
When rotating the image partially captured, the area out of the capturing range is also displayed with the specified background luminance (gray level).
After the image rotation, the blank space created by the rotation (displayed with background luminance) is also preprocessed and inspected as a part of the image.
Also, when "Part Area" is set and the image is rotated, the capturing range is the size of the image that partial imaging has not been executed. Refer to page 69.



Reflect
Reflects an image.
The direction of reflection is selected from either "Vertical axis" or "Horizontal axis". If the preprocess is executed for an image partially captured with setting the direction to "Horizontal axis", the whole captured image is reflected with a horizontal axis as the center of reflection to perform the inspection.



4.7 Setting Inspection Area and Conditions (Checker)

4.7.1 Types and Overview of Checkers

Checker is a general term of the areas and the conditions for inspecting a captured image.

Seventeen types of checkers are available in the PV200. You can set up to 1000 checkers per product type and checker type (when the number of used blocks is 10). However, the maximum number of checkers available for a type is 1000.

▶ Note

- The way of counting differs depending on checkers. One checker is not always counted as one. Before you create a new checker, confirm the number of set checkers displayed on the checker number selecting window.
- The default number of used blocks is one. At this time, checkers can be set to No.000 to 099. If you want to use checkers after No.100, change the number of used blocks. For the information of the number of used blocks, refer to Chapter 4.4, page 71.

Types of Checkers

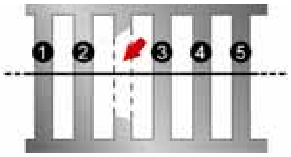
The following checkers are available in the PV200.

Line

Main application: Presence/absence inspection, Counting

Description: Line binarizes an image captured by a camera and measures white or black pixels on a line. Judges as OK or NG on the measured value.

Refer to: 104 p

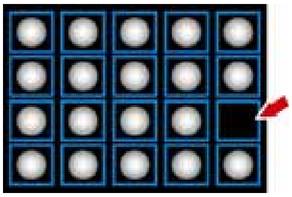


Binary Window

Main application: Measurement of size, Presence/absence inspection

Description: Binary Window binarizes an image captured by a camera and measures an area or the number of white or black pixels. Judges as OK or NG on the measured value.

Refer to: 108 p

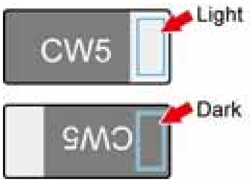


Gray Window

Main application: Measurement of brightness, Orientation recognition

Description: Calculates the gray average values of all pixels in a specified area and judges as OK or NG using the measured number.

Refer to: 111 p

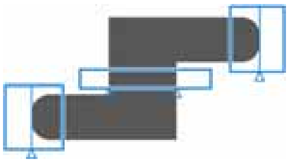


Binary Edge

Main application: Position detection, Measurement of length (at high speed)

Description: Binary Edge binarizes an image captured by a camera and detects an edge between white and black pixels. Judges as OK/NG according to its existence.

Refer to: 113 p

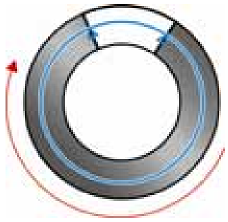


Gray Edge

Main application: Position detection, Measurement of length (at high inspection accuracy)

Description: Gray Edge detects a brightness changing point on a grayscale image and judges as OK or NG in accordance with the number of detected points. This function is effective if the variation in image brightness is small and the contrast of an edge is low.

Refer to: 117 p

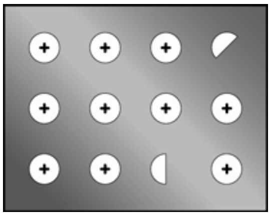


Feature Extraction

Main application: Position detection, Angle detection, Counting

Description: Binarizes an image captured by a camera and detects a specified size of clusters of white or black pixels and judges as OK or NG depending on the measured number. Outputs the feature quantity such as the coordinates of a center of gravity or principal axis angle (+/-90 degrees).

Refer to: 122 p

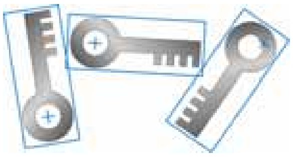


Smart Matching

Main application: Position detection, Angle detection, Type recognition

Description: Smart Matching searches and detects a similar part to the registered image pattern.
Outputs the detected position and angle, and similarity degree or correlation value. Scans with a gray image.

Refer to: 128 p

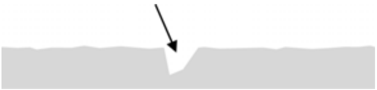


Flaw Detection

Main application: Flaw detection, Detection of a flaw, missing edge, burr on the surface, Detection of a dirt

Description: Calculates gray average value within the segmented area (cell) in a line, arc and circle or rectangular area. If the PV200 detects an area more than a certain level of difference in average gray, the device judges it as a flaw.

Refer to: 143 p

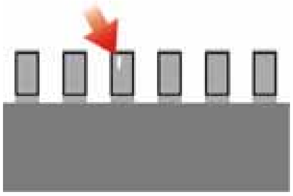


Connector (Binary Window, Gray Window)

Main application: Appearance inspection of lead pins

Description: Inspects appearance of many pins using the method of Binary Window (Gray Window) checker.

Refer to: 153 p

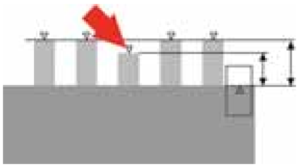


Connector (Gray Edge)

Main application: Measurement of pitch of lead pins, float check, Connector gap, Width measurement

Description: Using the edge detecting principle of Gray Edge, Connector (Gray Edge) measures pitches of many pins, detects floats, and measures gaps of a connector. It has also Detect Mode which inspects width or height of parts, using many edges.

Refer to: 158 p

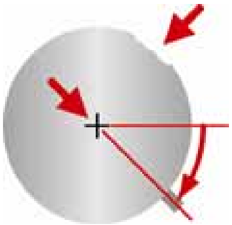


Smart Edge (Circle)

Main application: Detection of the center point of round object, detection of a missing edge, burr on the surface, detection of the position or angle of projection, circularity inspection

Description: Detects the radius or diameter of a round object based on the coordinate value of the edge of the object detected by setting a number of cells.
A ring-shaped object or circular object can be inspected.

Refer to: 169 p

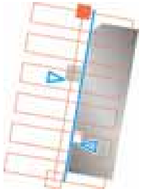


Smart Edge (Line)

Main application: Detection of the position or angle of uneven end face.

Description: Detects the approximate line based on the coordinate value of the edge of the end face detected by setting a number of cells.
Detecting the coordinate value or angle of the approximate line enables the detection of the position or angle of the object by setting only one checker.

Refer to: 188 p



Color Window

Main application:

Description: Calculates the maximum, minimum, average and standard deviation values of each gray value of R, G and B in the inspection area set for a color image.

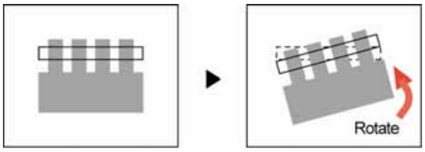
Refer to: 202 p

Position/Rotation Adjustment

Main application: Adjustment of object position and rotation angle

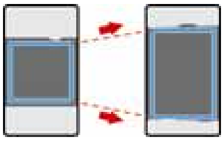
Description: Detects the misalignment and rotation angle of the object from the base position.

Refer to: 205 p



Area Size Adjustment

Main application: Adjustment of area size of checkers



Description: Detects the size of the object.

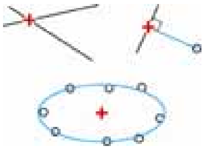
Refer to: 215 p

Geometry Calculation

Main application: Geometry calculation using detected data

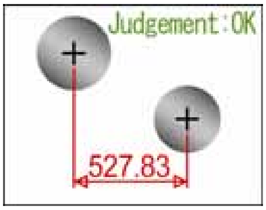
Description: Conduct seven kinds of geometry calculations using the coordinate values and lines detected by each checker.
Items such as the intersection point of two lines or approximate circle can be calculated without setting operation expressions.

Refer to: 218 p



Character/Figure Drawing

Main application:	Display of inspection data or results on the screen window
Description:	Draw six kinds of figures including characters using detected data on the screen window It is possible to change the drawing color or draw figures in the detected area depending on inspection results.
Refer to:	256 p



4.7.2 Creating a Checker

Creating a New Checker

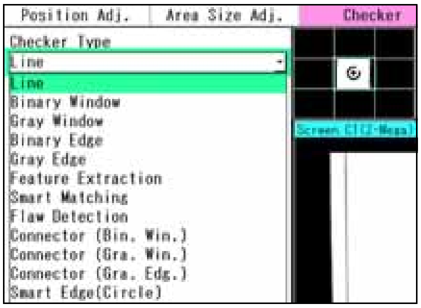
1. **Select “INSPECTION” > "Checker".**
2. **Select a checker type to create in "Checker Type".**
3. **Select the checker No. list and specify a checker number to create.**

   A new checker of the specified type is created and setting window is displayed.

   To select the number not displayed in the list, move the cursor to display the desired number or specify the number in “Checker No.” field above the table.

   ▶ Note

   As the default setting, the number of available checkers is 100 (0-99) for each checker. Increasing the number of blocks enables to create checkers after No.100. To set the number of blocks, select “TYPE” > "Type Setting > "Execution Condition" > "Number of Blocks".



Copying Checker

1. **Move the cursor onto the checker number you want to copy and press the FUNC key.**

   The Pop-up menu appears.

2. **Select "Copy".**
3. **Move the cursor onto the destination checker number and press the FUNC key.**

   The Pop-up menu appears.

4. **Select "Paste".**

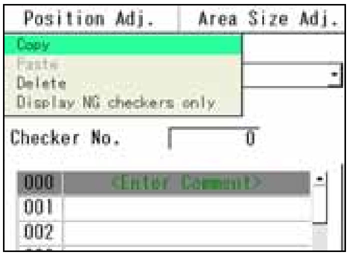
   The checker is copied.

   ▶ Note

   If a checker already exists in the destination, the message of overwrite confirmation appears. Selecting “Yes” executes pasting the checker.

5. **Press the ENTER key to select the pasted checker.**

   The setting window of the pasted checker is displayed.



Deleting a Checker

1. **Move the cursor onto the checker number you want to delete and press the FUNC key.**

The pop-up menu appears.

2. **Select "Delete".**

The confirmation screen is displayed.

3. **Select “Yes”.**

The checker is deleted. Select "No" to cancel.

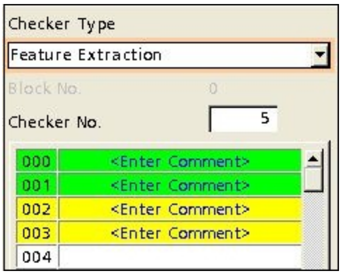
Displaying a checker list

The checker list shows created/uncreated checker, comment, camera number and inspection result.

Checker status, Comment

The column on the right of checker number shows comments. The comments input in the checker setting window are displayed. When you have not set a comment for the checker, the list shows “Enter Comment”.

If any characters are displayed in the comment field, the checker of that number is already created.



Checker Type: Feature Extraction

Block No. 0

Checker No. 5

000 <Enter Comment>
001 <Enter Comment>
002 <Enter Comment>
003 <Enter Comment>
004

Camera No.

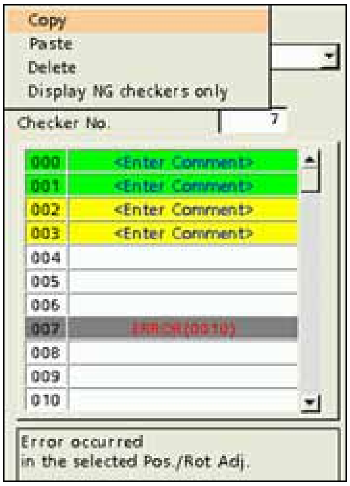
Checker number and comment fields are displayed in different colors for each camera number selected in "Camera" in the checker setting window.

- Camera No.0: Green
- Camera No.1: Yellow

Inspection Result

When the inspection result is abnormal, "ERROR(####)" (#### = Alphanumeric characters) is displayed in the comment field, and the cause of the error is displayed in the field below the list.

Only the checkers judged as NG and the checkers with abnormal inspection results can be displayed in the following method.



Checker No. 7

000 <Enter Comment>
001 <Enter Comment>
002 <Enter Comment>
003 <Enter Comment>
004
005
006
007 ERROR(0010)
008
009
010

Error occurred
in the selected Pos./Rot Adj.

1. **Press the FUNC key.**

The pop-up menu appears.

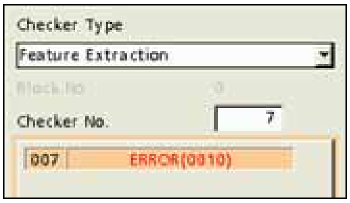
2. **Select "Display NG checkers only".**

Only the checkers that are judged as NG are displayed.

Note

When “None” is displayed, it shows all the checkers of the selected types are judged as OK.

Repeat the above 1 and 2 again. Now, all checker numbers are displayed.



Checker Type: Feature Extraction

Block No. 0

Checker No. 7

007 ERROR(0010)

Selecting Display Pattern on Screen Window

Set the display methods of various patterns to be displayed on the screen window in SETUP Menu.

The display methods are selected for the following patterns.

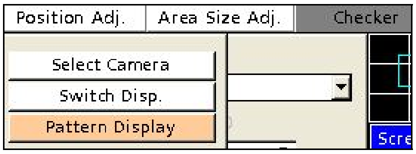
- Arrows indicating the inspection area and scan direction of checkers (including Position Adjustment and Area Size Adjustment)
- Result of Geometry Calculation
- Figures set in Character/Figure Drawing
- Calibration Scale

However, in the window to set the above checkers (e.g. when selecting "INSPECTION" > "Geometry Calculation"), select whether or not to display only the patterns of the selected checker number or checker type instead of selecting "Display/Hide".

1. **Press the F1 key in SETUP Menu.**

Image menu is displayed.

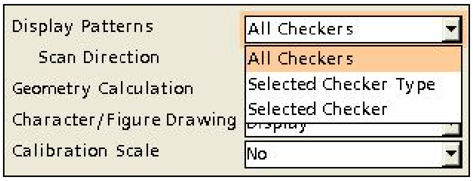
2. **Select "Pattern Display".**



3. **Select “Display” or “Hide” for "Pattern Display".**

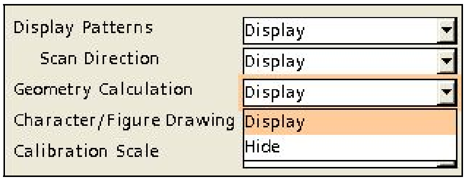
Specify the conditions to display patterns in the checker setting window ("INSPECTION" > "Checker") and the checker list window ("INSPECTION" > "Checker List").

All Checkers (Default):
When selecting this, all the set checker patterns are displayed.

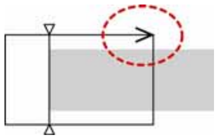

Display Patterns: All Checkers
Scan Direction
Geometry Calculation
Character/Figure Drawing
Calibration Scale: No

Selected Checker Type:
The checker patterns of the checker type selected in "Checker Type" are displayed. If Smart Matching Checker No. 0 is selected, all the checker patterns that have been set for Smart Matching checker are displayed.

Selected Checker:
Only the checker pattern for the checker number currently being selected is displayed.
If Smart Matching Checker No. 0 is selected, only that checker pattern is displayed.


Display Patterns: Display
Scan Direction: Display
Geometry Calculation: Display
Character/Figure Drawing
Calibration Scale

4. **Select whether to display an arrow to indicate the scan directions of checkers or not in "Scan Direction".**



Target Checker
Binary Edge / Gray Edge / Connector (Gray Edge) / Smart Edge (Circle) / Smart Edge (Line)

5. **Select “Display” or “Hide” for "Geometry Calculation" and "Character/Figure Drawing".**

In the window after selecting Geometry Calculation or Character/Figure Drawing, select "All Checkers" or "Selected Checker" for the condition to display patterns.

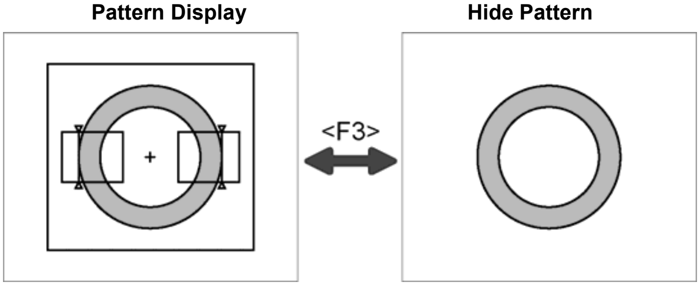
6. **Select “No” or “Yes” for “Calibration Scale”.**

[Yes]: Displays a calibration scale.
[No]: Hides a calibration scale. (Calibration will be executed.)

Hiding Pattern on Screen Window

The checker patterns displayed on the screen window can be hidden in SETUP Menu.

Pressing the F3 key switches between displaying and hiding.



Note

This selection is kept until you cut the power of PV200. Once you reboot PV200, the patterns will be displayed.

Common settings for checkers

The procedures for selecting Camera, setting Preprocess, selecting Slice Level group and selecting Position Adjustment group set for each checker except Color Window are common to all checkers. As for Slice Level group, it is set only for the checkers that scan objects with binary images.

Selecting a Camera

Select which camera image is used for inspections.

1. **Select "Area Setting" > "Camera".**

   Select a camera number to use.

Selecting Usage of Color Image in Inspection

Set this when using a color camera.

1. **Select "Area Setting" > "Select Color Image".**

   Select "Converted Gray Img." or "Extracted Color Img.".
   - Converted Gray Img.: Inspects the grayscale image converted from a color image.
   - Extracted Color Img.: Inspects the image created by extracting specific colors of a color image.

2. **Select "Set".**
   - When selecting "Converted Gray Img." in step 1, select a grayscale conversion group (A to P).
   - When selecting "Extracted Color Img." in step 1, select a color in "Color Extraction No.". (More than one colors can be selected.) Refer to page 85 for details.

3. **After setting is completed, press the CANCEL key.**

   The selected extraction number is displayed above the "Set" button of "Select Color Image".

Selecting Preprocess / Slice Level Group

Select a preprocess and slice level group to apply on an image captured by a camera.

1. **Select “Inspection Condition” > "Preprocess".**

   “Preprocess” window is displayed.

2. **Select a Grayscale preprocess group (A to P) in “Grayscale Preprocess”.**

   Note For details of preprocess, refer to page 86.

3. **After setting is completed, press the CANCEL key.**

   Return to “Inspection Condition” setting window. The selected preprocess group is displayed.

4. **Select “Slice Level".**

   “Slice Level” setting window is displayed.

5. **Select a Slice Level group (A to P).**

   For the details on binarization, refer to page 80.

6. **After setting is completed, press the CANCEL key.**

   Return to “Inspection Condition” setting window. The selected slice level group is displayed.

Selecting Position Adjustment

Position Adjustment is helpful when position or angle of an inspection object is unstable. Select a Position Adjustment checker that has been already set. Refer to page 205 for details of position adjustment.

1. **Select "Position Adj." in Area Setting window.**

   The list of position adjustment is displayed.

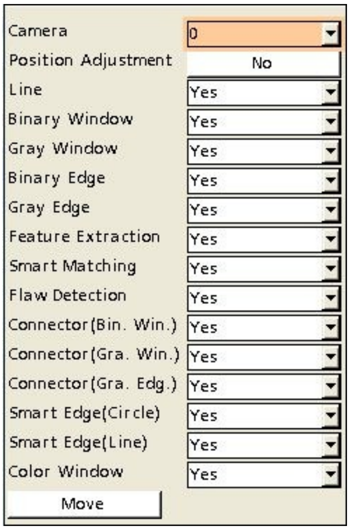
   ▶ Note If a position adjustment checker is not created, “Position Adj.” cannot be selected.

2. **Select a Position Adjustment No. from the list.**

4.7.3 Moving Checkers in Group

When you want to move the checker areas after creating checkers, you can move the areas of checkers set for each camera by checker types or setting value of Position Adjustment.

This function is helpful to move several checkers or to move them keeping the positions between them.



Camera	0
Position Adjustment	No
Line	Yes
Binary Window	Yes
Gray Window	Yes
Binary Edge	Yes
Gray Edge	Yes
Feature Extraction	Yes
Smart Matching	Yes
Flaw Detection	Yes
Connector(Bin. Win.)	Yes
Connector(Gra. Win.)	Yes
Connector(Gra. Edg.)	Yes
Smart Edge(Circle)	Yes
Smart Edge(Line)	Yes
Color Window	Yes

1. **Select “INSPECTION” > "Group Move".**

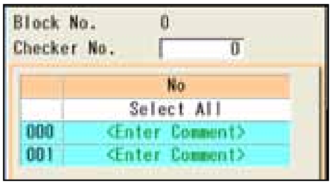
2. **Specify a camera No. used by the checkers you want to move in [Camera].**

3. **Specify conditions of checkers to move in "Position Adjustment".**

No:
To move the checkers that select "No" for Position Adjustment in the checker setting window.

Select All:
To move all checkers regardless of the settings of Position Adjustment in the checker setting window.

Select Position Adjustment No.:
Select a Position Adjustment which is already set.
To move the checkers that select the same Position Adjustment No. in the checker setting window.



Block No. 0
Checker No. 0

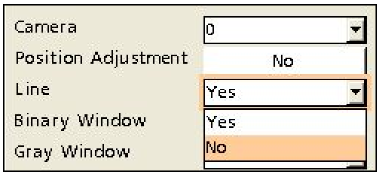
	No
	Select All
000	<Enter Comment>
001	<Enter Comment>

4. **Set the checker to exclude from group move to [No].**

Unset checkers are not needed to be set to [No].

▶ Note

As a result of the above setting, if there is no checker to be moved, the "Move" button is shown in gray and cannot be selected.



Camera	0
Position Adjustment	No
Line	Yes
Binary Window	
Gray Window	

5. **Press [Move] button to move the areas.**

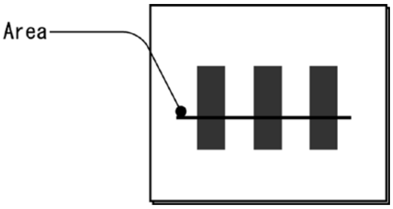
After moving them, press the ENTER key to fix the position.
Pressing the CANCEL key cancels group move.

Now you have completed group move.

4.7.4 Line

What is Line?

Line checker binarizes an image captured by a camera and counts target colored pixels and the number of objects on a line. Judges as OK/NG according to those values.

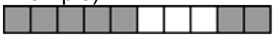


Output Data

No. of Pixels: Outputs in the number of target colored pixels on the line.

No. of Objects: The number of parts of pixel string.

Example)



Target color = black
No. of Pixels = 7, No. of Objects = 2

Pixel Judgement: If detected pixel count is within the allowable range you have set, the object will be judged as "OK", if it exceeds the allowable range, the object is judged as "NG".

Objects Judgement: If detected object count is within the allowable range you have set, the object will be judged as "OK", if it exceeds the allowable range, the object is judged as "NG".

(Total) Judgement: Total judgement result of Pixel Judgement and Objects Judgement.
If two of them are “OK”, the object will be judged as "OK"; otherwise, the object will be judged as "NG".

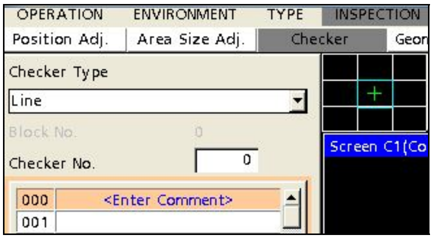
Specifying Checker No.

1. **Select “Line” in "Checker Type".**

2. **Select the checker No. list and specify a checker number to set.**

3. **Press the ENTER key to determine the checker No.**

   “Line” setting window is displayed. The binary image is displayed on the screen window regardless of camera type.



Checker Type
Line

Block No. 0

Checker No. 0

000 <Enter Comment>
001

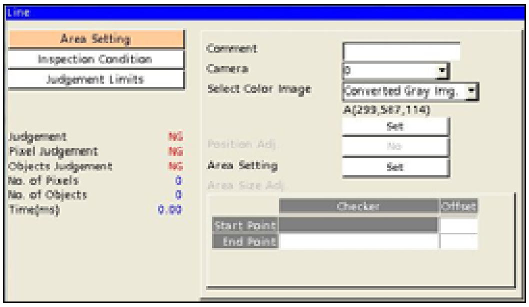
Selecting a Camera

Select a camera image to set “Line” checker.

1. **Select “Area Setting” in “Line” setting window.**

2. **Select a camera No. in “Camera”.**

   The selected camera image is displayed.



Comment
Camera 0
Select Color Image Converted Gray Img.
A(299,587,114)
Position Adj.
Area Setting
Area Size Adj.

Judgement NG
Pixel Judgement NG
Objects Judgement NG
No. of Pixels 0
No. of Objects 0
Time(ms) 0.00

3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

The binary image converted by the selected method is displayed.
Refer to page 101.

Note
Select a displayed image type (Live/Memory and Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Grayscale Preprocess / Slice Level Group/ Position Adjustment

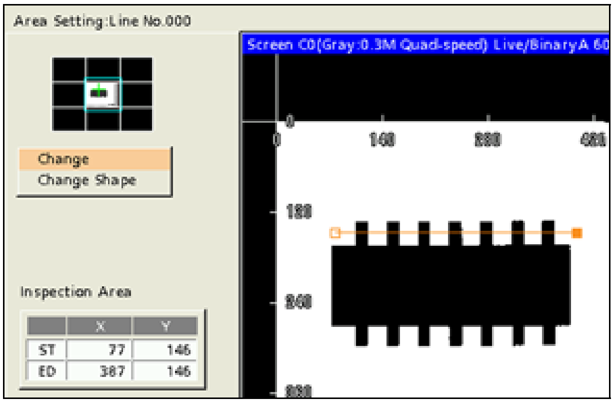
Refer to page 101

Setting an Inspection Area

Set a line which is the inspection span.

Note
You cannot set a Mask Area in Line checker.

1. **Select “Area Setting” in “Line” setting window.**



Inspection Area

	X	Y
ST	77	146
ED	387	146

2. **Select "Area Setting".**

Area setting window is displayed.

3. **Select a shape of inspection area from “Change Shape”.**

Line, Broken line, and Ellipse are available.

4. **Select “Change” and draw an area.**

Refer to the section of Drawing an Inspection Area, page 47.

5. **After drawing is completed, press the CANCEL key.**

Using Area Size Adjustment

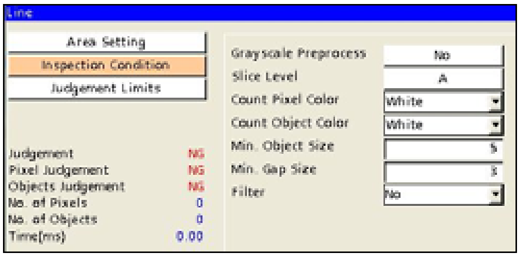
Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker.

Refer to Chapter 4.9, page 215 about Area Size Adjustment and the setting procedure.

Selecting a Target Color

Set to count pixels of either white or black on a binary image. Target color can be selected for each of pixel counting and object counting.

1. **Select “Inspection Condition” > “Count Pixel Color”.**



Grayscale Preprocess: No
Slice Level: A
Count Pixel Color: White
Count Object Color: White
Min. Object Size: 5
Min. Gap Size: 5
Filter: No

Judgement: NG
Pixel Judgement: NG
Objects Judgement: NG
No. of Pixels: 0
No. of Objects: 0
Time(ms): 0.00

2. **Select “White” or “Black” to detect.**

White (default):
Counts the number of white pixels within the area.
Black:
Counts the number of black pixels within the area.

3. **Select “Count Object Color”.**

4. **Select “White” or “Black” to detect.**

White (default): Counts the number of white objects within the area.
Black: Counts the number of black objects within the area.

Dilation and Erosion on Binary Image (Filter)

This is the function that dilates or erodes the pixels of color selected for target color to count. Use this function mainly when you delete a slight noise or enhance a detected area. If applying this function is not necessary, proceed to the next step.

1. **Select “Inspection Condition” > "Filter".**

The list of settable filters is displayed.

2. **Select "Filter" to process the image to be a desired image.**

Changing filters updates the displayed image. Confirm it and set.

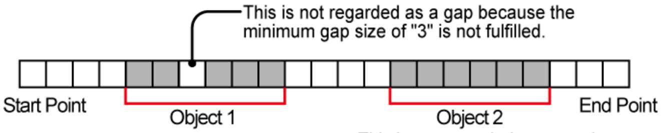
Setting Criteria for Counting Objects

Set object criteria to count. The following two items are the criteria.

- Min. Object Size:
  Decides the number of pixels to regard as an object.
- Min. Gap Size:
  Decides the minimum value of gap which is the number of pixels lying between objects and with different color from target.

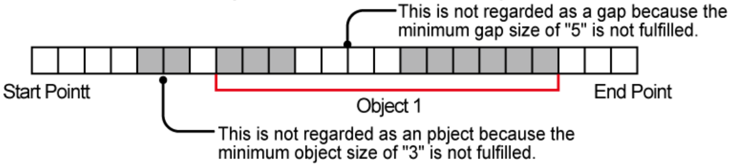
Example 1)

- Min. Object Size = 2
- Min. Gap Size = 3


This is not regarded as a gap because the minimum gap size of "3" is not fulfilled.
Start Point
Object 1
Object 2
End Point

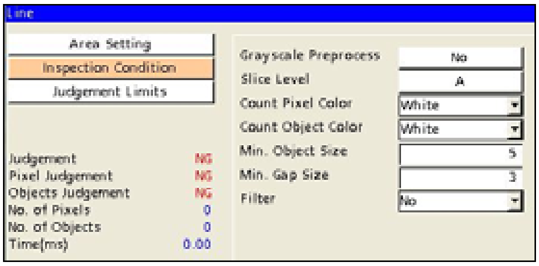
Example 2)

- Min. Object Size = 3
- Min. Gap Size = 5


This is not regarded as a gap because the minimum gap size of "5" is not fulfilled.
Start Pointt
Object 1
End Point
This is not regarded as an pbject because the minimum object size of "3" is not fulfilled.

1. **Select "Inspection Condition".**

2. **Enter “Min. Object Size” and “Min. Gap Size”.**



Grayscale Preprocess	No
Slice Level	A
Count Pixel Color	White
Count Object Color	White
Min. Object Size	5
Min. Gap Size	3
Filter	No

Judgement	NG
Pixel Judgement	NG
Objects Judgement	NG
No. of Pixels	0
No. of Objects	0
Time(ms)	0.00

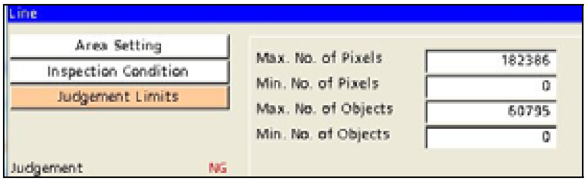
Setting Judgement Limits

Set tolerance (Maximum and Minimum values) of the counted pixels and objects. If the counted pixels and objects are within the tolerance, the object will be judged as "OK", if it is out of it, the object is judged as "NG".

1. **Select "Judgement Limits".**

2. **Enter "Max. No. of Pixels." and "Min. No. of Pixels".**

   Enter the values in pixels.



Max. No. of Pixels 182386
Min. No. of Pixels 0
Max. No. of Objects 60795
Min. No. of Objects 0
Judgement NG

3. **Enter "Max. No. of Objects." and "Min. No. of Objects."**

4. **After inputting is completed, press the CANCEL key.**

Running a Test

Confirm if the current settings perform an inspection properly.

1. **Press the TRIG key.**

   When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

   ▶ Note

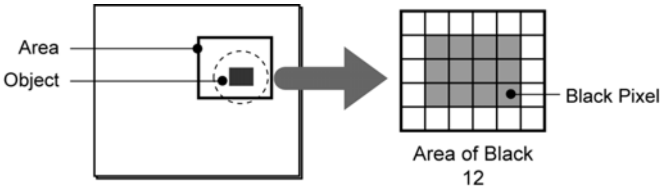
   Position adjustment and area size adjustment are also executed at the same time if they are used.

2. **Confirm the inspection result.**

4.7.5 Binary Window

What Is Binary Window?

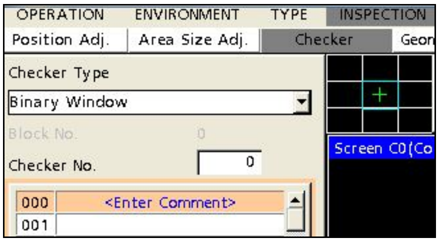
Binary Window binarizes an image captured by a camera and measures an area or the number of white or black pixels. Judges as OK/NG according to the measured area.



Output Data

Area:	Outputs in the number of pixels.
Judgement:	If the number of detected area is within the allowable range you have set, the object will be judged as "OK", if it exceeds the allowable range, the object will be judged as "NG".

Specifying Checker No.



Checker Type: Binary Window
Block No. 0
Checker No. 0
000 <Enter Comment>
001

1. **Select “Binary Window” in "Checker Type".**

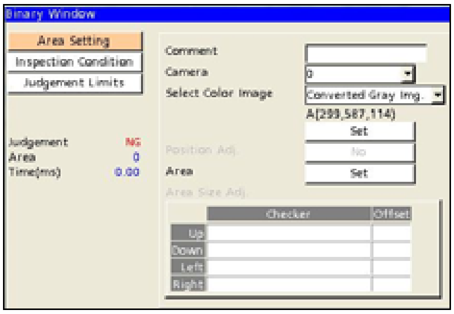
2. **Select the checker No. list and specify a checker number to set.**

3. **Press the ENTER key to determine the checker No.**

“Binary Window” setting window is displayed. The binary image is displayed on the screen window regardless of camera type.

Selecting a Camera

Select a camera image to set Binary Window checker.



Comment:
Camera: 0
Select Color Image: Converted Gray Img.
A(299,587,114)
Set
Position Adj.: No
Area: Set
Judgement NG
Area 0
Time(ms) 0.00

1. **Select “Area Setting” in “Binary Window” setting window.**

2. **Select a camera No. in “Camera”.**

The selected camera image is displayed.

3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

The binary image converted by the selected method is displayed.
▼Refer to▼ page 101.

▶ Note

Select a displayed image type (Live/Memory or Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Grayscale Preprocess / Slice Level Group / Position Adjustment

Refer to page 101

Setting an Inspection Area

Set a range to measure area.

1. **Select “Area Setting” in “Binary Window” setting window.**
2. **Select "Area".**

   “Area Setting” window is displayed.
3. **Select a shape of inspection area from “Change Shape”.**

   Select from Rectangle, Ellipse, Circle and Polygon.
4. **Select “Change” and draw an area.**

   Refer to section of Drawing an Inspection Area (page 47).
5. **After drawing is completed, press the CANCEL key.**

When you want to exclude a part from inspection (Mask area)

Up to 16 mask areas, where checker does no inspection, can be set in an inspection area.

Select "Add Mask" in “Area Setting”, specify a shape and draw an area. Refer to section of Setting a Mask Area (page 51) for details.

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker.

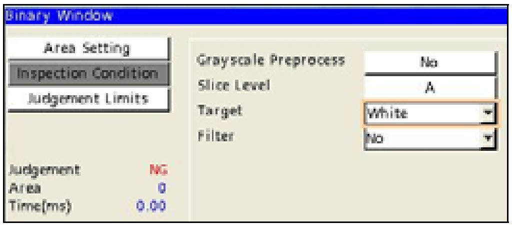
Refer to Chapter 4.9, page 215 about Area Size Adjustment and the setting procedure.

Select a Target Color

Set to detect pixels of either white or black on a binary image.

1. **Select “Inspection Condition” > "Target".**
2. **Select “White” or ”Black” to detect.**

   White (default): Measures the area of the pixels in white.
   Black: Measures the area of the pixels in black.



Grayscale Preprocess: No
Slice Level: A
Target: White
Filter: No

Judgement: NG
Area: 0
Time(ms): 0.00

Dilation and Erosion on Binary Image (Filter)

This is the function that dilates or erodes the pixels of the color selected in “Target”. Use this function mainly when you delete a slight noise or enhance a detected area. If applying this function is not necessary, proceed to the next step.

1. **Select “Inspection Condition” > "Filter".**

   The list of settable filters is displayed.

2. **Select "Filter" to process the image to be a desired image.**

   Changing filters updates the displayed image. Confirm it and set.

Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of the measured area. If the measured area is within the tolerance, the object will be judged as "OK", if it is out of it, the object is judged as "NG".

1. **Select "Judgement Limits".**

2. **Input the setting values for "OK Judge. Max." and "OK Judge. Min".**

   Enter the values in pixels.

3. **After inputting is completed, press the CANCEL key.**

Running a Test

Confirm if the current settings perform an inspection properly.

1. **Press the TRIG key.**

   When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

   ▶ Note

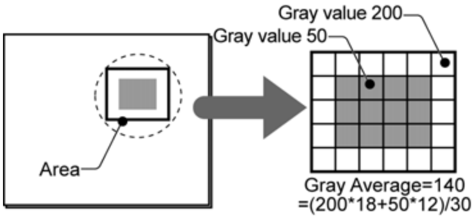
   Position adjustment and area size adjustment are also executed at the same time if they are used.

2. **Confirm the inspection result.**

4.7.6 Gray Window

What Is Gray Window?

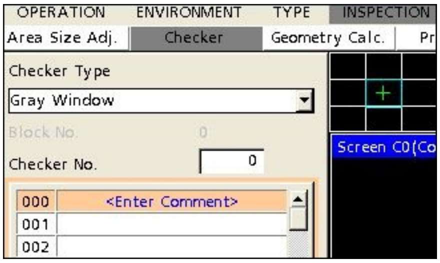
Gray Window calculates the gray average of the inspection area based on the gray values of every pixel on a gray image captured by a camera. And then the checker judges as OK/NG using the value.



Output Data

Gray Average:	Average of gray value within an area.
Judgement:	If the calculated gray average is within the allowable range you have set, the object will be judged as "OK", if it exceeds the allowable range, the object will be judged as "NG".

Specifying Checker No.



Checker Type: Gray Window
Block No. 0
Checker No. 0
000 <Enter Comment>
001
002

1. **Select “Gray Window” in "Checker Type".**
2. **Select the checker No. list and specify a checker number to set.**
3. **Press the ENTER key to determine the checker No.**

   “Gray Window” setting window is displayed. The gray image is displayed on the screen window regardless of camera type.

Selecting a Camera

Select a camera image to set “Gray Window” checker.

1. **Select “Area Setting” in “Gray Window” setting window.**
2. **Select a camera No. in “Camera”.**

   The selected camera image is displayed.
3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

   The gray scale image converted by the selected method is displayed.
   Refer to page 101.

   Note
   Select a displayed image type (Live/Memory or Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Grayscale Preprocess / Position Adjustment

Refer to page 101

Setting an Inspection Area

Set an area to measure gray average.

1. **Select “Area Setting” in “Gray Window” setting window.**

2. **Select "Area".**

   “Area Setting” window is displayed.

3. **Select a shape of inspection area from “Change Shape”.**

   Select from Rectangle, Ellipse, Circle and Polygon.

4. **Select “Change” and draw an area.**

   Refer to section of Drawing an Inspection Area (page 47).

5. **After drawing is completed, press the CANCEL key.**

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker.

Refer to Chapter 4.9, page 215, about Area Size Adjustment and the setting procedure.

When you want to exclude a part from inspection (Mask area)

Up to 16 mask areas, where checker does no inspection, can be set in an inspection area. Select "Add Mask" in “Area Setting”, specify a shape and draw an area.
For details, refer to page 51, “Setting a Mask Area”.

Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of gray average. If the measured gray average is within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG".

1. **Select "Judgement Limits".**

2. **Input the setting values for "OK Judge. Max." and "OK Judge. Min".**

3. **After inputting is completed, press the CANCEL key.**

Running a Test

Confirm if the current settings perform an inspection properly.

1. **Press the TRIG key.**

   When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

   ▶ Note

   Position adjustment and area size adjustment are also executed at the same time if they are used.

2. **Confirm the inspection result.**

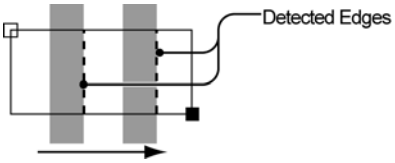
4.7.7 Binary Edge

What Is Binary Edge?

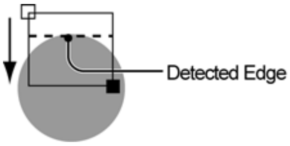
Binary Edge binarizes an image captured by a camera and detects an edge between white and black pixels. The checker judges as OK or NG in accordance with the number of detected points.

Detect Example)

Condition: Scan direction = Horizontal
Edge Condition = Black -> White
Detected Position =All



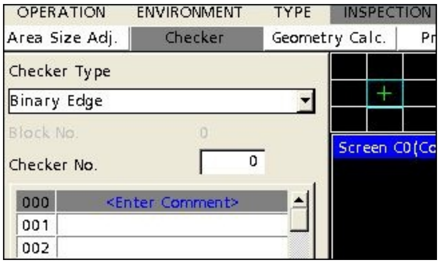
Condition: Scan direction = Vertical
Edge Condition = White -> Black



Output Data

Coordinates X and Y of edges	
Detect color of edges (+ / -):	Type of an edge, which is white -> black (-) or black -> white (+).
No. of Objects:	The number of detected edges. The value is 0 to 256.
Judgement:	If the number of detected objects is within the range you have set, the object will be judged as "OK", if it exceeds the range, the object is judged as "NG".

Specifying Checker No.



Checker Type
Binary Edge
Block No. 0
Checker No. 0
000 <Enter Comment>
001
002
Screen C0(Cc

1. **Select “Binary Edge” in "Checker Type".**
2. **Select the checker No. list and specify a checker number to set.**
3. **Press the ENTER key to determine the checker No.**

   “Binary Edge” setting window is displayed. The binary image is displayed on the screen window regardless of camera type.

Selecting a Camera

Select a camera image to set Binary Edge checker.

1. **Select “Area Setting” in “Binary Edge” setting window.**
2. **Select a camera No. in “Camera”.**

   The selected camera image is displayed.
3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

   The binary image converted by the selected method is displayed.
   ▼Refer to▼ page 101.

   ▶ Note
   Select a displayed image type (Live/Memory or Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Grayscale Preprocess / Slice Level Group / Position Adjustment

▼Refer to▼ page 101

Setting an Inspection Area

Set a range to detect an object.

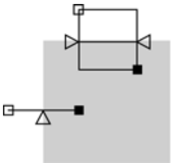
▶ Note

You cannot set a Mask Area in Binary Edge checker.

1. **Select “Area Setting” in “Binary Edge” setting window.**
2. **Select "Area (Set)”.**

   “Area Setting” window is displayed.
3. **Select a shape of inspection area from “Change Shape”.**

   Select from Line and Plane.
   For detecting a flat edge at high speed, Line scan is suitable. And Plane scan suits for detecting a round or pointed edge.



4. **Select “Change” and draw an area.**

   Refer to section of Drawing an Inspection Area (page 47).
5. **After drawing is completed, press the CANCEL key.**

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker. Refer to Chapter 4.9, page 215 about Area Size Adjustment and the setting procedure.

Selecting Detect Condition of Edge

Set detailed conditions such as detecting direction of edge.

1. **Select "Inspection Condition".**

   Set Scan Direction, Edge Condition, Detected Position.
2. **Select "Search Method".**

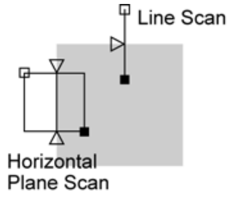
   Set "Filter" and "Width".

About Conditions

Scan direction (Horizontal/Vertical) -- Only Plane scan

Horizontal: Scans horizontally* from the start to the end points.

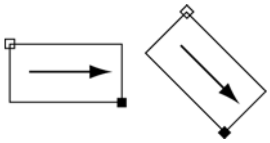
Vertical: Scans vertically* from the start to the end points.



Note

*If you set a rotated area, it scans at the rotated angle.

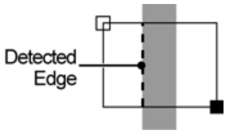
Scan direction = Horizontal



Edge Condition (White -> Black(-) / Black -> White(+) / Both)

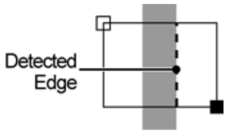
White -> Black(-)

Detects a point changing from white to black as an edge.



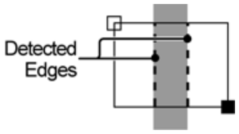
Black -> White(+)

Detects a point changing from black to white as an edge.



Both

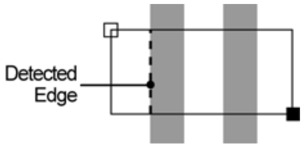
Detects both point from white to black and from black to white.



Detected Position (Front / All)

Front

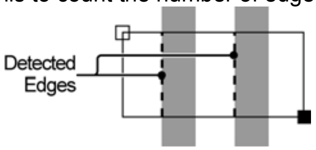
Scans from the start point and detects the first edge.



No. of Objects = 1

All

Detects all edges which meet the condition in the area. Use this to count the number of edges.



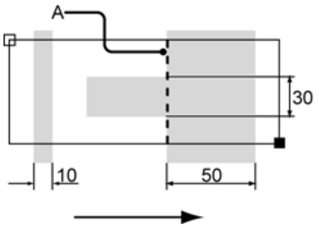
No. **of Objects = 2**

Filter/Width

These are conditions of object size. The function prevent from detecting undesired part such as noise within the area. Adjust them when desired edge cannot be detected after testing.

Filter: Condition of length in scan direction.

Width: Condition of length in the direction at right angle to the scan.



Example:

When you want to detect “A” in the right figure as an edge, set Filter to 20 and Width to 40.

The first object with length in scan direction 10 and the nose with width 30 are not detected. And only “A” meets the condition and is detected.

Dilation and Erosion on Binary Image (Filter)

This is the function that dilates or erodes the pixels of color selected in “Edge Condition”. Use this function mainly when you delete a slight noise or enhance a detected area. If applying this function is not necessary, proceed to the next step.

1. **Select “Inspection Condition” > "Filter".**

   The list of settable filters is displayed.

2. **Select "Filter" to process the image to be a desired image.**

   Changing filters updates the displayed image. Confirm it and set.

Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of the number of detected edges. If the number of detected edges is within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG".

1. **Select "Judgement Limits".**

2. **Input the setting values for "OK Judge. Max." and "OK Judge. Min".**

3. **After inputting is completed, press the CANCEL key.**

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set “Window Transparency (SETUP menu)” to larger value. (See “Changing Window Transparency”, page 342)

1. **Press the TRIG key.**

   When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

   ▶ Note

   Position adjustment and area size adjustment are also executed at the same time if they are used.

2. **Confirm a judgement result and the number of detected objects.**

   ▶ Note

   The list of detected edges is displayed in the lower part of the setting window.
   When selecting this table and highlighting an edge data, the mark on the screen window indicating the detect position turns to pink.

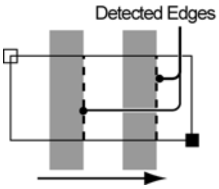
4.7.8 Gray Edge

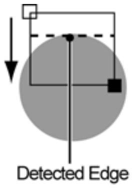
What Is Gray Edge?

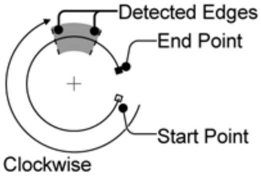
Gray Edge detects a brightness changing point (edge) on a grayscale image and judges as OK or NG in accordance with the number of detected points. This function is effective if the variation in image brightness is small and the contrast of an edge is low.

Detect Example)

Condition:	Scan direction = Horizontal Edge Condition = Dark -> Light Detected Position =All	Scan direction = Vertical Edge Condition = Light -> Dark	Scan direction = Clockwise Edge Condition = Both



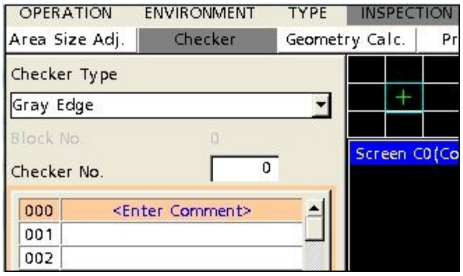




Output Data

Coordinates X and Y of edges	
Edge Differential:	Differential value of detected edge (degree of gray value change)
No. of Objects:	The number of detected edges. The value is 0 to 256.
Judgement:	If the number of detected objects is within the allowable range you have set, the object will be judged as "OK", if it exceeds the allowable range, the object will be judged as "NG"

Specifying Checker No.



Checker Type: Gray Edge

Block No. 0

Checker No. 0

000 <Enter Comment>

001

002

1. **Select “Gray Edge” in "Checker Type".**
2. **Select the checker No. list and specify a checker number to set.**
3. **Press the ENTER key to determine the checker No.**

   “Gray Edge” setting window is displayed. The gray image is displayed on the screen window regardless of camera type.

Selecting a Camera

Select a camera image to set Gray Edge checker.

1. **Select “Area Setting” in “Gray Edge” setting window.**
2. **Select a camera No. in “Camera”.**

   The selected camera image is displayed.
3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

   The gray scale image converted by the selected method is displayed.
   ▼Refer to▼ page 101.

Note

Select a displayed image type (Live/Memory and Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Grayscale Preprocess / Slice Level / Position Adjustment

Refer to page 101

Setting an Inspection Area

Set a range to detect an object.

Note

You cannot set a Mask Area in Gray Edge checker.

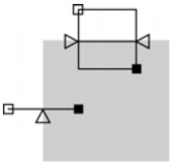
1. **Select “Area Setting” in “Gray Edge” setting window.**

2. **Select "Area (Set)".**

   “Area Setting” window is displayed.

3. **Select a shape of inspection area from “Change Shape”.**

   Select from Line, Plane, and Ellipse.
   For detecting a flat edge at high speed, Line scan is suitable. And Plane scan suits for detecting a round or pointed edge.



4. **Select “Change” and draw an area.**

   See the description in the next section for setting procedure of an arc. For the setting procedure of other shapes, refer to section of “Drawing an Inspection Area” (page 47).

5. **After drawing is completed, press the CANCEL key.**

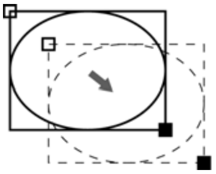
Setting Procedure of Arc

To draw an arc in Gray Edge checker, firstly specify its size and position, select scan direction (clockwise/counterclockwise), and then set an arc start point and an arc end point.

1. **Move the area.**

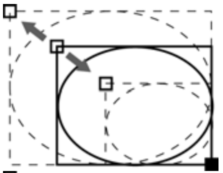
   Tilt the ENTER key to move the area.
   Tilt the ENTER key pressing the SHIFT key to move the area by 10-pixel.
   (You can use the SHIFT key also in setting of a start/end point.)

   After deciding the position, press the Enter key.



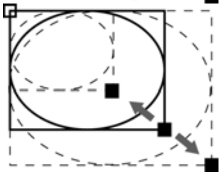
2. **Set the start point (a square mark).**

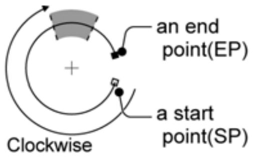
   Move the start point by tilting the ENTER key and press it to determine the position.

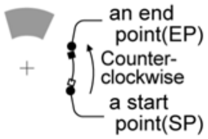


3. **Set the end point (a filled square mark).**

   Move the end point by tilting the ENTER key and press it to determine the position.







4. **Press the FUNC key and select a scan direction "Clockwise" or "Counterclockwise".**

Default is "Clockwise".

5. **Tilt the ENTER key left/right to specify a start point(SP) and an end point(EP).**

Tilting it right moves the start point(SP)/end point(EP) clockwise and tilting left moves counterclockwise.
The coordinates of the start point(SP) and end point(EP) are displayed in the lower left on the screen. Use them to make setting.

6. **After setting the end point(EP), press the CANCEL key.**

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker.

Refer to Chapter 4.9, page 215 about Area Size Adjustment and the setting procedure.

Selecting Detect Condition of Edge

Set detailed conditions such as detecting direction of edge.

1. **Select "Inspection Condition".**

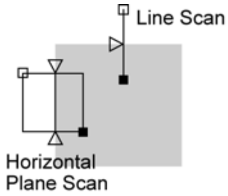
Set Scan Direction, Scan Method, Edge Condition, Edge Threshold and Detected Position.

2. **Select "Search Method".**

Set Scan Pitch, Filter, Width and Average Range.

About Conditions

Scan direction (Horizontal/Vertical) -- Only for Plane scan

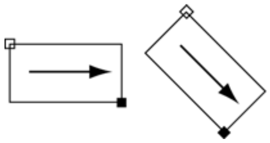


Horizontal: Scans horizontally* from the start to the end points.

Vertical: Scans vertically* from the start to the end points.

▶ Note *If you set a rotated area, it scans at the rotated angle.

Scan direction = Horizontal



Scan Method: Projection / Single

Set this when using projection scan. Projection scan calculates average brightness in the vertical direction against the scan direction per column (or row) and detects the edges based on the composite image.

Original Image

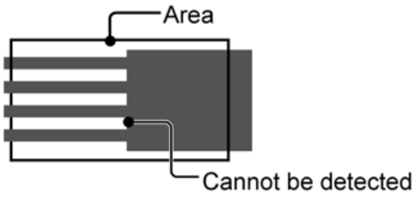
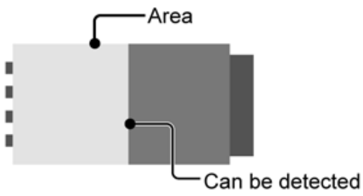
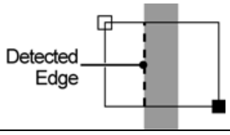
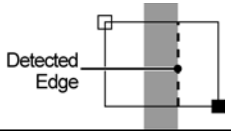
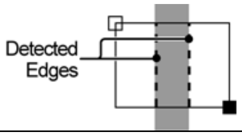


Image after projection scanning
(Scan direction = horizontal)



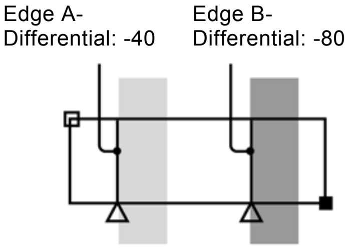
Edge Condition (Light -> Dark/ Dark-> Light/ Both)

Light ->Dark	**Dark-> Light**	**Both (default)**
Detects a pixel that changes from high gray to lower gray (or from light to dark).  	Detects a pixel that changes from low gray to high gray (or from dark to light).  	Detects a pixel that changes both from light to dark and from dark to light. 

Edge Threshold: 1 - 255

This is a condition on contrast or bright differential of an edge to detect. Setting it to larger extracts only edges with high contrast and lower extracts also low contrast edges. Quantified value of the contrast is differential value.

Example)
When edge threshold=30, the edge A and B are extracted.
When edge threshold=50, only the edge B is extracted.

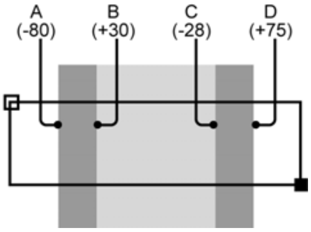


Detected Position (Front / Peak / All / Front/ Rear)

Among the edges meeting the condition, decides which edges to output.

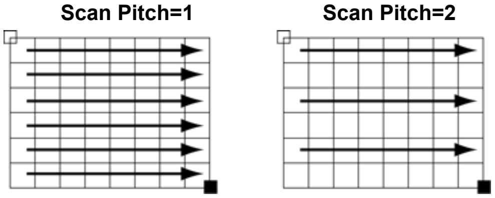
In the example below, "Edge Condition" is set to "Both".

Front	Scans from the (arc) start point and detects the first edge. In the right figure, A is detected.
Peak	Detects the position having the highest absolute differential value as an edge. In the right figure, A is detected.
All	Detects all edges which meet the condition. In the right figure, all edges A, B, C, and D are detected.
Front/ Rear	Detects the two points, the nearest position from the (arc) start point and from the (arc) end point. In the right figure, A and D are detected.



Scan Pitch (only for Plane scan)

With this item, set amount of scan skipping. As you set larger value, the skipping pitch increases. If you have enough inspection time to spend, use default value, 1.



Filter and Width

These functions allow checkers to ignore undesired objects in front (in the start point side) of the area to detect. If the undesired objects are detected by running a test, increase the “Width” value.

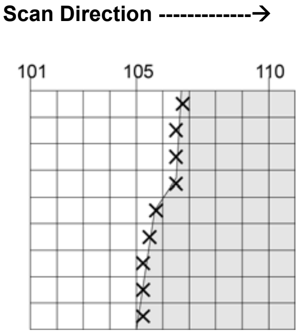
In addition of above, if the detect object is other than a straight line, including round and pointed object, increase both "Width" and "Filter" values.

Average Range

This item decides how many pixels from the detected edge positions are averaged. If the desired position cannot be detected as a result of the test using the default value, change the Average Range value. Increasing the Average Range value detects the position slightly inside the edge of the object. Decreasing the value detects the position on the edges of the object.

To detect a front edge of a circle, pointed or irregular object, set the Average Range value to be low as much as possible.

Average Range = 0	The detection position is the edge position on the tip of the detected part. (In the example on the right, the detection position is located on the bottom line.)
Average Range = 1	The average value of the coordinate values of the edges on the tip of the detected part. (In the example on the right, the tip edge is located on the line 105. Thus, the coordinate values of the edges on the lines from 105.0 to 105.9 are averaged.)
Average Range = 2	The average value of the coordinate values of the edges located between on the tip line and on the next line. (In the example on the right, the tip edge is located on the line 105. Thus, the coordinate values of the edges on the lines from 105.0 to 106.9 are averaged.)



▶ Note

If you set the Average Range value to 1 or more, Y coordinate of the horizontal scan and X coordinate of the vertical scan will be averaged as well.

Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of the number of detected edges. If the number of detected edges is within the tolerance, the object will be judged as "OK", if it is out of it, the object is judged as "NG".

1. **Select "Judgement Limits".**

2. **Input the setting values for "OK Judge. Max." and “OK Judge. Min".**

3. **After inputting is completed, press the CANCEL key.**

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set “Window Transparency (SETUP menu)” to larger value. (“Changing Window Transparency”, page 342)

1. **Press the TRIG key.**

   When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

   ▶ Note

   Position adjustment and area size adjustment are also executed at the same time if they are used.

2. **Confirm a judgement result and the number of detected objects.**

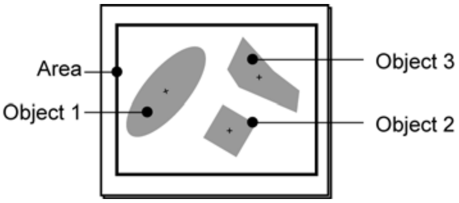
   ▶ Note

   The list of detected edges is displayed in the lower part of the setting window.
   When selecting this table and highlighting an edge data, the mark on the screen window indicating the detect position turns to pink.

4.7.9 Feature Extraction

What Is Feature Extraction?

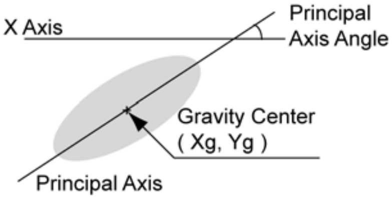
Feature Extraction binarizes an image captured by a camera, detects a specified size of clusters of white or black pixels (hereinafter called “object”), and then judges as OK or NG depending on the measured number. The checker outputs the feature quantity such as the coordinates of a center of gravity or principal axis angle (+/-90 degrees).

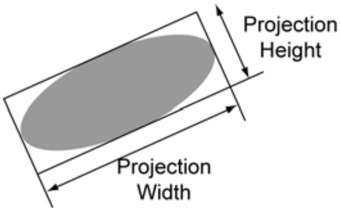


Output Data

Feature quantity of an object

Area:	Area of an object (in pixels)
Gravity X/ Gravity Y:	Gravity center X and Y of a detected object
Perimeter:	Perimeter length of an object
Principal axis angle:	The angle between the principal axis angle and X axis
Projection Width/Height:	The width and height of the rectangle circumscribing around an object





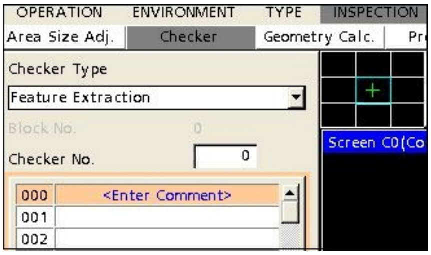
No. of Objects:	The number of detected objects
Judgement Results:	If the number of detected objects is within the allowable range you have set, the object will be judged as "OK", if it exceeds the allowable range, the object will be judged as "NG".

Specifying Checker No.

1. **Select “Feature Extraction” in "Checker Type".**

2. **Select the checker No. list and specify a checker number to set.**

   To select the number not displayed in the list, move the cursor to display the desired number or specify the number in “Checker No.” field above the table.



Checker Type: Feature Extraction

Block No. 0

Checker No. 0

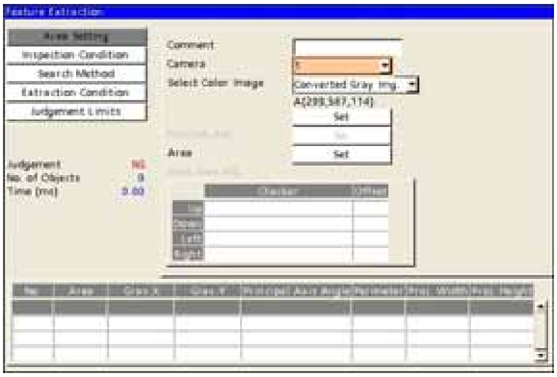
000 <Enter Comment>
001
002

3. **Press the ENTER key to determine the checker No.**

   “Feature Extraction” setting window is displayed. The binary image is displayed on the screen window regardless of camera type.

Selecting a Camera

Select a camera image to set Feature Extraction checker.



Comment
Camera: 1
Select Color Image: Converted Gray Img.
A(299,587,114)
Area
Judgement: NG
No. of Objects: 0
Time [ms]: 0.00

1. **Select “Area Setting” in “Feature Extraction” setting window.**

2. **Select a camera No. in “Camera”.**

   The selected camera image is displayed.

3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

   The binary image converted by the selected method is displayed.
   ▼Refer to▼ page 101.

   ▶ Note
   Select a displayed image type (Live/Memory or Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Grayscale Preprocess / Slice Level Group/ Position Adjustment

▼Refer to▼ page 101

Setting an Inspection Area

Set a range to detect an object.

1. **Select “Area Setting” in “Feature Extraction” setting window.**

2. **Select "Area (Set)".**

   “Area Setting” window is displayed.

3. **Select a shape of inspection area from “Change Shape”.**

   Select from Rectangle, Ellipse, Circle and Polygon.

4. **Select “Change” and draw an area.**

   Refer to section of Drawing an Inspection Area (page 47).

5. **After drawing is completed, press the CANCEL key.**

When you want to exclude an area from inspection (Mask area)

Up to 16 mask areas, where checker does no inspection, can be set in an inspection area.

Select "Add Mask" in “Area Setting”, specify a shape, and draw an area. Refer to section of Setting a Mask Area (page 51) for details.

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker.

Refer to Chapter 4.9, page 215 about Area Size Adjustment and the setting procedure.

Select a Target Color

Set to detect which object of white or black on a binary image.

1. **Select “Inspection Condition” > "Target".**

2. **Select “White” or “Black” to detect.**

White (default): Detects a white object.
Black: Detects a black object.

Dilation and Erosion on Binary Image (Filter)

This is the function that dilates or erodes the pixels of color selected in “Target”. Use this function mainly when you delete a slight noise or enhance a detected area. If applying this function is not necessary, proceed to the next step.

1. **Select “Inspection Condition” > "Filter".**

The list of settable filters is displayed.

2. **Select "Filter" to process the image to be a desired image.**

Changing filters updates the displayed image. Confirm it and set.

Set the Number of Objects to Detect

Set the maximum number of objects to detect. Specifying “10” detects 10 prior objects after sorting or in order of appearance.

1. **Select “Inspection Condition” > "Output: Objects 1 - x".**

2. **Set the number of objects to detect.**

Default: 100
Settable Range: 1 to 10000

Select a condition to number objects (Sorting)

This is a function used to output and calculate feature data. When multiple objects were detected, the function arranges in a certain rule and numbers the first object as No.0 in ascending order.

1. **Select “Sorting” and specify information to use in sorting.**

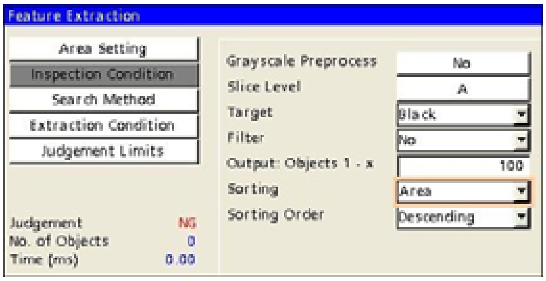
Select from Area, X, and Y.

2. **Select “Sorting Order” and then select either of Ascending or Descending.**

Ascending: Sorts with the object of small value in the top.
Descending: Sorts with the object of large value in the top.

▶ Note

When setting “Area” and “Descending”, it sorts with the object of the largest area in the top in descending order. You can confirm the result in the detected result list.



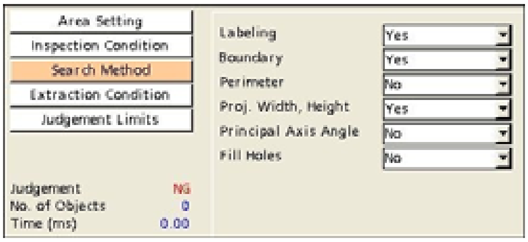
Grayscale Preprocess: No
Slice Level: A
Target: Black
Filter: No
Output: Objects 1 - x: 100
Sorting: Area
Sorting Order: Descending

Judgement: NG
No. of Objects: 0
Time (ms): 0.00

Selecting Feature Data to Measure

Select feature quantity data to measure on a detected object. Setting unnecessary items to “No” decreases the inspection time.

Selectable feature data types are Perimeter, Projection Width/Height and Principal Axis Angle.



Labeling: Yes
Boundary: Yes
Perimeter: No
Proj. Width, Height: Yes
Principal Axis Angle: No
Fill Holes: No

Judgement: NG
No. of Objects: 0
Time (ms): 0.00

1. **Select "Search Method".**
2. **Set whether or not to detect Perimeter, Projection Width/Height and Principal Axis Angle.**

   Yes (default): Measures the selected item.
   No: Does not measure the selected item.

   ▶ Note

   When setting labeling to "No", Perimeter and Projection Width/Height cannot be detected.
   When setting Principal Axis Angle to “No”, Projection Width/Height cannot be detected.

Changing Other Search Methods (Labeling/Boundary/Fill Holes)

1. **Select "Search Method".**
2. **Change the setting of Labeling, Boundary, or Fill Holes as necessary.**

Extracting Each Data of Multiple Objects (Labeling)

This is a function to detect each Feature data when multiple objects exist within the area.

Yes (default):	Measures feature quantity of each object.
No:	Feature quantity of each object is not measured and only total area, coordinate of the gravity center, and principal axis angle are output.

Decides Whether or not to Detect an Object on the Boundary of an Area (Boundary)

Yes (default):	Detects an object on the area frame.
No:	Ignores an object on the area frame.

▶ Note

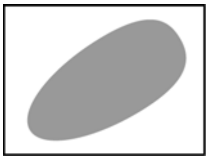
You can set Boundary to “Yes” only when Labeling is set to “Yes”.

Selecting Whether or not to Fill inside an Object with the Target Color (Fill Holes)

If there is a part with different color from the target color inside an object, measurement of coordinate of gravity center or principal axis angle is interfered. To prevent this, processes to fill inside the object with the target color.

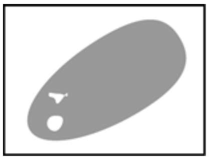
Yes:

Executes Fill Holes.



No (default):

Does not execute Fill Holes.



▶ Note

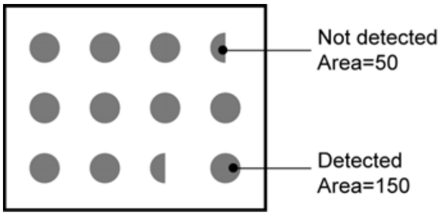
Fill Holes is available when Labeling is set to “Yes”.

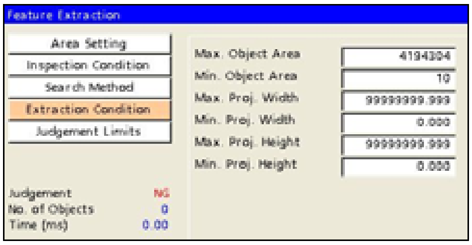
Set the Condition of Objects to Detect (Extraction Condition)

Set the range of area, projection width, and projection height of objects to detect.

Setting example of an area

In the right figure, setting “Min. Object Area” to 100 detects 10 objects.





Max. Object Area 4194304
Min. Object Area 10
Max. Proj. Width 99999999.999
Min. Proj. Width 0.000
Max. Proj. Height 99999999.999
Min. Proj. Height 0.000

Judgement NG
No. of Objects 0
Time (ms) 0.00

1. **Select “Extraction Condition” in “Feature Extraction” setting window.**

2. **Set the range of area, projection width, and projection height of objects to detect.**

   When using no conditions for area, projection width and projection height, changing these is not necessary.

   ▶ Note

   The default value of Minimum Object Area is “1” which indicates that detecting an object with a pixel or more. For a noisy binary image, it is advisable to set Minimum Object Area to larger value to prevent detecting noise as an object.

Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of the number of detected objects. If the number of detected objects is within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG".

1. **Select "Judgement Limits".**

2. **Input the setting values for "OK Judge. Max." and "OK Judge. Min".**

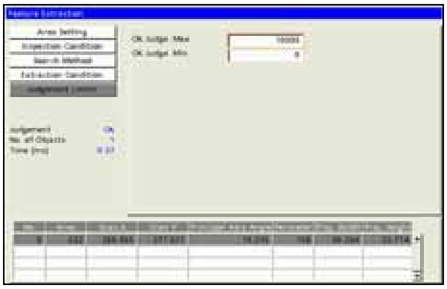
3. **After inputting is completed, press the CANCEL key.**

Running a Test

Confirm if the current settings perform an inspection properly. To observe the image easily, set ““Window Transparency (SETUP menu)” to larger value. (“Changing Window Transparency”, page 342)

1. **Press the TRIG key.**

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.



▶ **Note**

Position adjustment and area size adjustment are also executed at the same time if they are used.

2. **Confirm a judgement result and the number of detected objects.**

The list of detected objects is displayed in the lower part of the setting window.
When selecting this table and highlighting an object data, the mark on the screen window indicating the detect position turns to pink.

▶ **Note**

When 40000 or more areas of specified color are detected regardless of whether or not the extraction condition is met, the judgement result will be NG and detected count will be 0.

In this case, to inspect correctly, adjust the lens aperture and the slice level not to display undesired noises on the image, or set Preprocess to remove undesired noises.

4.7.10 Smart Matching

What Is Smart Matching?

This is a function that searches and detects a similar part to the registered image pattern.

It outputs the detected position and angle, and similarity degree or correlation value. The registered image pattern is a template, and the range to search is a search area.

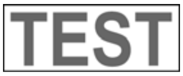
Smart Matching of PV200 can register up to 64* templates per checker. This checker is suitable to detect a target having variable image pattern or to recognize its type.

Subtraction function, which detects difference between the detected part and the template in gray level, can inspect a detailed difference.

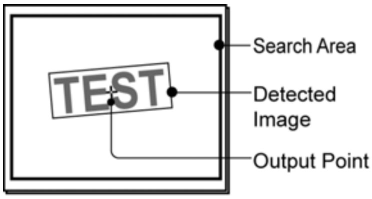
▶ Note

* Templates are saved in the dedicated memory. To check the free space for templates, select “TOOL” > “Information” from the menu bar.

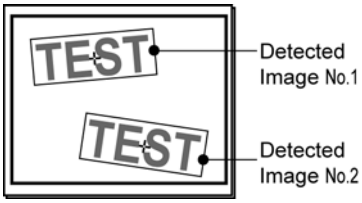
Base Image (Template)



Detected Image



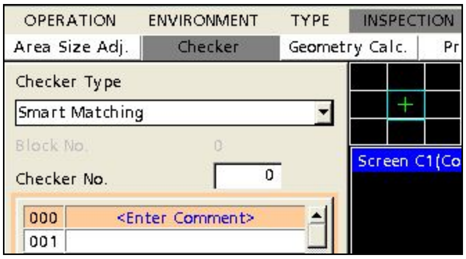
Detected Image (Sorted in ascending order of Y)



Output Data

No. of Objects:	0 to 256
Template No.:	(0 to 63)
Correlation:	0 to 1.000
Coordinate X, Y:	(Output point)
Detection Angle:	-179.999 to 180.000
Subtraction:	Pixels of Max. subtracted Object, No. of Subtracted Objects: 0 to 128

Specifying Checker No.



Checker Type: Smart Matching

Block No. 0

Checker No. 0

000 <Enter Comment>

001

1. **Select “Smart Matching” in "Checker Type".**

2. **Select the checker No. list and specify a checker number to set.**

3. **Press the ENTER key to determine the checker No.**

   “Smart Matching” setting window appears. The gray image is displayed on the screen window regardless of camera type.

Selecting a Camera

Select a camera image to set “Smart Matching” checker.

1. **Select “Area Setting” in “Smart Matching” setting window.**

2. **Select a camera No. in “Camera”.**

   The selected camera image is displayed.

3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

   The gray scale image converted by the selected method is displayed.
   ▼Refer to▼ page 101.

   ▶ Note
   Select a displayed image type (Live/Memory and Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Grayscale Preprocess / Position Adjustment

▶ Note

Position Adjustment function is helpful when position or angle of an inspection object can be detected in advance. In this case, the search area for Smart matching or the range of detect angle can be smaller, so that the processing speed can be faster.

▼Refer to▼ page 101

Setting a Template

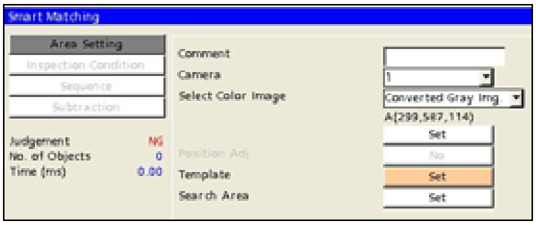
Register an image pattern to detect.
Up to 64 templates can be registered per Smart Matching. When registering multiple templates, the checker inspects based on all the templates and outputs the area with the largest correlation value and the number of the template used to detect the area.

To set a template, you need to capture an image in advance.

1. **Select “Area Setting” in “Smart Matching” setting window.**

2. **Select “Set” for "Template".**

Template setting window is displayed.



Camera: 1
Select Color Image: Converted Gray Img.
A(299,587,114)
Judgement: NG
No. of Objects: 0
Time (ms): 0.00

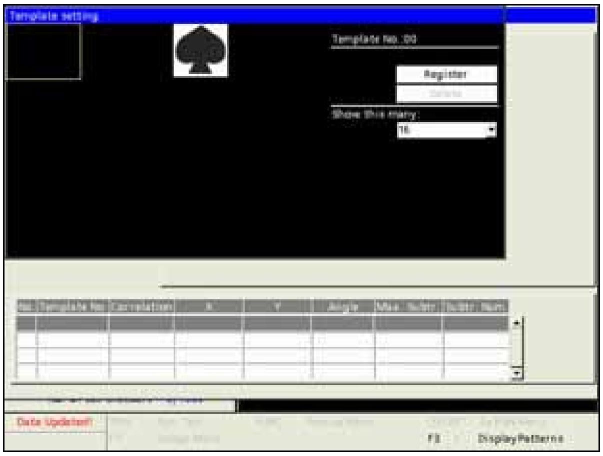
3. **Tilt the ENTER key up/down/left/right to select a template No. Select a template No.0 when registering a template for the first time.**

4. **Select "Register".**

The screen to draw a template area is displayed.

▶ Note

When opening this screen after the execution of an inspection, the image to be displayed may be the one which the current memory image has been moved and rotated. Refer to "Image to be displayed when reregistering a template" (page 132) for details.



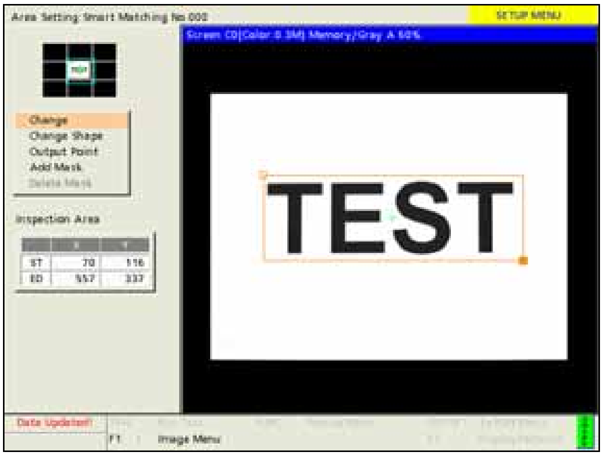
Template No.:00
Show this many: 16

5. **Select a shape of template area from “Change Shape”.**

Select from Rectangle, Ellipse, Circle and Polygon.

6. **Select “Change” and set a template area.**

Refer to section of Drawing an Inspection Area (page 47).



	X	Y
ST	70	116
ED	557	337

▶ Note

The settable maximum size (the size of a circumscribing rectangle of the area) is as follow.

- When using 0.3-Mega Camera: 640 x 480 pixels (full screen)
- When using 2-Mega Camera/4-Mega Camera: 1600 x 1200 pixels

When you want to exclude an area from inspection (Mask area)

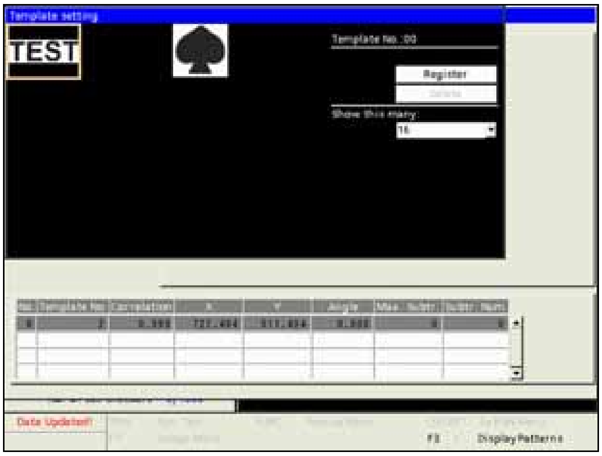
Up to 16 mask areas, where is excluded from inspection (correlation calculation), can be set for a template. Select "Add Mask" in template setting window, specify a shape and draw an area. Refer to section of Setting a Mask Area (page 51) for details.

7. **Select “Output Point” and operate the ENTER key to specify an output point.**

Output point is the point that indicates the location where the image resembling the template was detected. You can place the output point at the desired location. (It can be set also outside template.)
While you are setting it, the coordinate of the current output point is displayed in the information display area. Use it to make the setting.

▶ Note

Selecting “Middle Point” sets an output point in the center of a template from the pop-up menu displayed by pressing the FUNC key.



8. **After setting is completed, press the CANCEL key.**

Return to the template setting window. To set multiple templates, select a template No. and repeat the above procedure.

▶ Note

If there is no feature (or the degree of change in gray level is low) within the specified area, a message will be displayed and the template cannot be registered.

From “Show this many:”, the number of displaying templates can be changed.
You can choose from the following as necessary; 16 (default), 4, and 1.

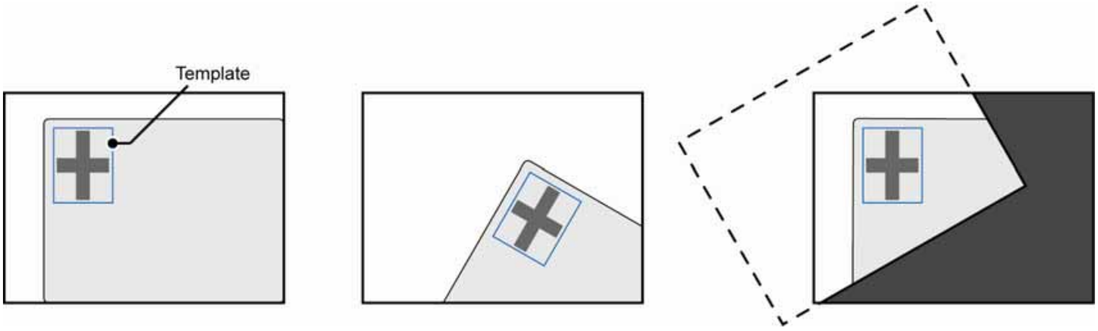
9. **After setting the template, press the CANCEL key.**

The screen returns to “Smart Matching” setting window.

Image to be displayed when reregistering a template

When a template is reregistered after executing an inspection, the image may be displayed in the moved or rotated state. This is because the memory image (fig. 3 below) is displayed after being moved/rotated for the difference between the position/angle when the template has been registered (fig. 1 below) and the position/angle detected when executing the inspection (fig. 2 below).

Displaying the image like this enables the template to be reregsitrated even when the object is inclined. (It is not necessary to replace and recapture the object at the angle when it has been registered.)



1) When setting a template

2) Detection position when executing the inspection (test)

3) Image displayed when reregistering (Dotted line shows the memory image.)

Note

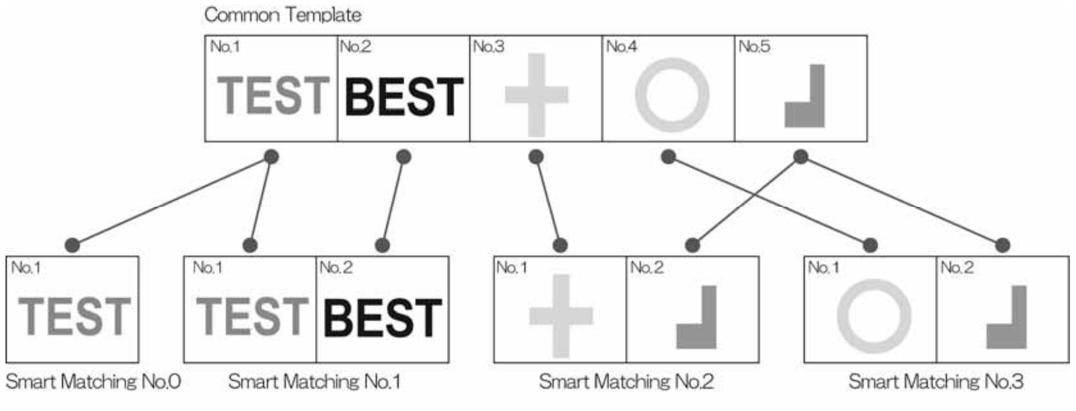
Execute either way of the followings to clear the detection position when you do not want to display the image corrected when reregistering.

- Switching Types
- Turning off the power to PV200
- Changing the condition not to be detected such as setting the minimum correlation value of the first step in Sequence to 1.000 and performing trigger execution.
  (After setting the template, reset the condition to the previous setting.)

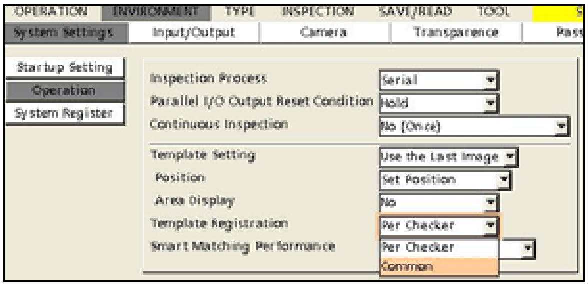
Selecting a Template from Common Image Patterns

Other than templates created in each Smart Matching, PV200 provides with a function that saves common templates to all types, including Position Adjustment and Area Size Adjustment, that can be selected in all Smart Matchings as common using templates.

Common templates can be saved up to 2000 templates in 256 product types.



Setting a Template to Use Commonly



Inspection Process: Serial
Parallel I/O Output Reset Condition: Hold
Continuous Inspection: No (Once)
Template Setting: Use the Last Image
Position: Set Position
Area Display: No
Template Registration: Per Checker
Smart Matching Performance
Per Checker
Common

1. **Select “ENVIRONMENT” > “System Settings” from the menu bar.**
2. **Select "Operation".**
3. **Select “Common” for "Template Registration".**

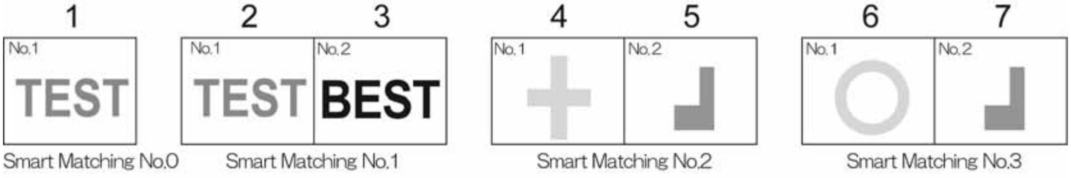
   If templates have already created at this moment, the templates will be registered as common templates automatically.

Note on resetting to "Per Checker”

When you operate to reset to "Per Checker” from the menu or initialize environment settings, an error message may appear and "Common" setting may be held. This is because of the reason described below.

Changing the setting from "Common" to “Per Checker” copies the common templates that are used by checkers to each checker. In “Per Checker” setting, total number of templates is likely to be increased because each checker holds a template separately even for the same image, while multiple checkers use a single template in “Common” setting.

For example, the total number of templates is five in the figure at the previous page. After copying the templates to each checker, the total number is seven as the figure below which is increased by two.



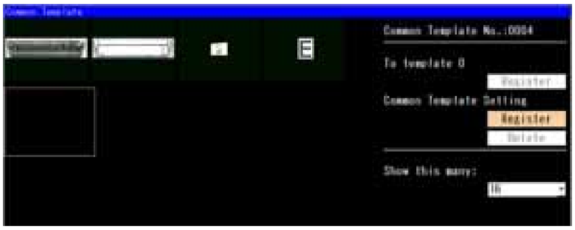
You cannot reset to "Per Checker“ when inadequate memory of PV200 or excessive number of registration prevents copying the templates.

Note that the other settings are initialized even when "Template Registration" remains “Common” due to the above reasons after initializing environment settings.

Creating a New Common Template

1. **Select a template No. in template setting window and then select "Register".**
2. **Select a blank field for common templates.**

   When selecting a registered template, you can update or delete the image pattern.



Common Template No.:0004
To template 0
Common Template Setting
Show this many: 16

3. **Select "Register" for “Common Template Setting”.**

   Template setting window is displayed. Select a shape and set a template area. Refer to page 130 for details.

   Note

   To delete the selected template, select “Delete”.

4. **After drawing is completed, press the CANCEL key.**

The set image pattern is registered as a template.

5. **Select “Register” for "To template #".**

(“#” indicates the number you have specified in step 1.)

Through these steps, you can register the commonly saved template in “Template #”.

Selecting from Saved Common Template List

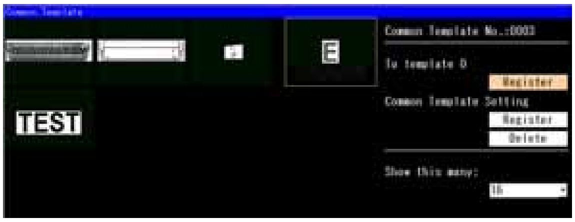
1. **Select a template No. in template setting window.**

A list of commonly saved templates is displayed.

2. **Select a template to use.**

3. **Select “Register” for "To template #".**

(“#” indicates the number you have specified in step 1.)



Through these steps, you can register the commonly saved template in “Template #”.

Deleting Common Templates

This function deletes common templates one by one.

▼Refer to▼

How to delete all common templates: See page 57.

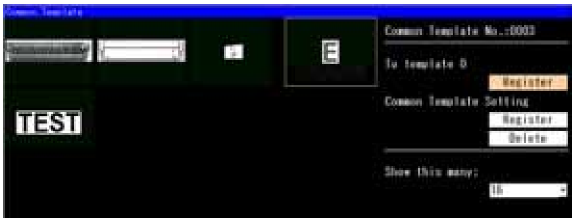
1. **Select a template No. in template setting window.**

A list of commonly saved templates is displayed.

2. **Select a template to delete.**

3. **Select “Delete” for "Common Template Setting".**

Follow the message to delete it.



Condition of Updating Template by External Signals

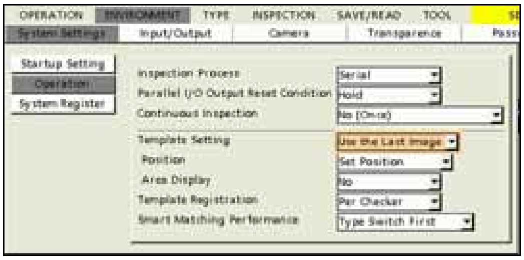
A created template of Smart Matching can be updated (reregistered) by inputting an I/O signal or a command from the external device. How to select conditions to update is described below.

If you do not reregister it by an external command, setting change is not necessary.

▼Refer to▼

Reregistering by command input: page 413.

1. **Select “ENVIRONMENT” > “System Settings” from the menu bar.**



Inspection Process: Serial
Parallel I/O Output Reset Condition: Hold
Continuous Inspection: No (On-ce)
Template Setting: Use the Last Image
Position: Set Position
Area Display: No
Template Registration: Per Checker
Smart Matching Performance: Type Switch First

2. **Select "Operation".**

3. **Set "Template Setting".**

   “Use the Last Image”(Default):
   To reregister using the current memory image which is the last captured inspection image.
   “Capture New Image”:
   To capture a new image to register.

4. **Set "Position".**

   “Set Position” (Default):
   To register the image pattern within the template of selected Smart Matching.
   “Adjusted Position”:
   To execute the Position Adjustment relating to the selected Smart Matching and reregister the image pattern within the template of selected Smart Matching.

5. **Select "Area Display".**

   “No”(Default):
   To reregister in the position of the specified condition.
   “Yes”:
   To display a template area when the position of the specified condition is determined. Inputting a command calling for a registration once more after confirming the display executes registration.

   Now you completed the setting for registration condition.

Operation when setting "Area Display" to “Yes”

When setting "Area Display" to “Yes”, the operation when executing re-registration differs depending on the settings of "Template Setting" and "Position". Regardless of the type of the display image (Live image/Memory image) before executing re-registration, the operations for executing re-registration are as below.

Reentry signal	Use the Last Image		Capture New Image	
	Set Position	Adjusted Position	Set Position	Adjusted Position
First input				Image capture
	Displays latest memory image	Displays latest memory image	Displays live image	Displays the above captured image.
		Executes Position Adjustment, adjusts area.		Executes Position Adjustment, adjusts area.
	Displays area re-registered.	Displays area re-registered.	Displays area re-registered.	Displays area re-registered.
Second input			Image capture	
	Executes re-registration.	Executes re-registration.	Executes re-registration.	Executes re-registration.

Setting a Search Area

Set the range to search the same image pattern as a template.

▶ Note

You cannot set a Mask Area in the search area of Smart Matching checker.

1. **Select “Area Setting” in “Smart Matching” setting window.**

2. **Select "Search Area".**

   “Area Setting” window is displayed.

3. **Draw a search area.**

   Refer to section of Drawing an Inspection Area (page 47).

   ▶ Note

   Settable shape for search area is only rectangle.

4. **After drawing is completed, press the CANCEL key.**

Detecting Rotated Object

If a detecting part is rotated or capturing direction is possible to be unstable, it is necessary to scan within a search area rotating the image pattern registered as a template. To do so, set a rotation angle and angle pitch.

1. **Select "Inspection Condition".**

2. **Specify the value of “Rotation Range” from 0 (no rotation) to +/-180 (rotation of 360-degree).**

   Note that the larger value of rotation angle range you set, the longer time its processing takes.

3. **Specify “Angle - Step”.**

   At first, set a pitch to scan. Select from 8, 4, 2, and 1. Selecting “8” scans Rotation Range by 8 degrees and finely scans around the detected angle.

   ▶ Note

   When setting “Recommendation Setting” from “Sequence”, “Angle - Step” will be automatically replaced to the Recommendation Setting.

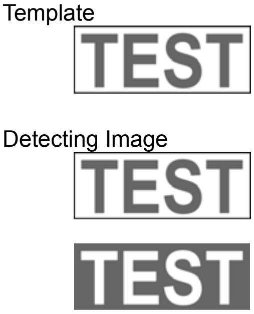
4. **Specify "Angle - Accuracy".**

   This item is to set an angle to scan finely around a detected angle.
   Select either “1 Degree” or “0.001 Degree”. The detected angle is output lastly in the unit set here.
   Setting “0.001 Degree” takes longer process time than “1 Degree.”

5. **After setting is completed, press the CANCEL key.**

Detecting Black/White Reversed Image

To detect an image which has reversed gray level of registered image pattern, use the function of “Detect B/W Reversed Template”. This function allows to perform an inspection without lowering correlation value because of image reversal.

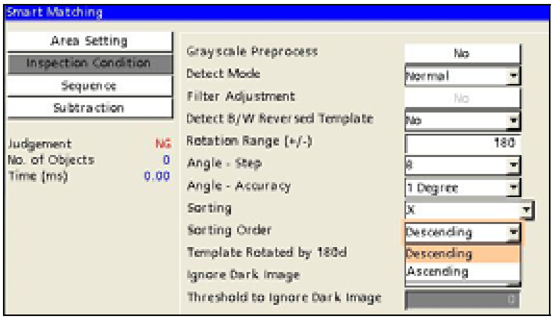


1. **Select "Inspection Condition".**

2. **Select “Yes” for “Detect B/W Reversed Template”.**

Condition to Label Detected Images (Sorting)

When multiple images were detected, the function arranges in a certain rule and numbers them in ascending order from the first object as No.0. This is a function used to output and calculate information on detected images such as coordinate, angle, and correlation value.



Judgement NG
No. of Objects 0
Time (ms) 0.00

Grayscale Preprocess: No
Detect Mode: Normal
Filter Adjustment: No
Detect B/W Reversed Template: No
Rotation Range (+/-): 180
Angle - Step: 8
Angle - Accuracy: 1 Degree
Sorting: X
Sorting Order: Descending
Template Rotated by 180d: Descending / Ascending
Ignore Dark Image
Threshold to Ignore Dark Image: 0

1. **Select “Sorting” and specify information to use in sorting.**

Select from Correlation Value, X, and Y.

2. **Select “Sorting Order” and then select either of Ascending or Descending.**

Ascending: Sorts with the object of small value in the top.
Descending: Sorts with the object of large value in the top.

▶ Note

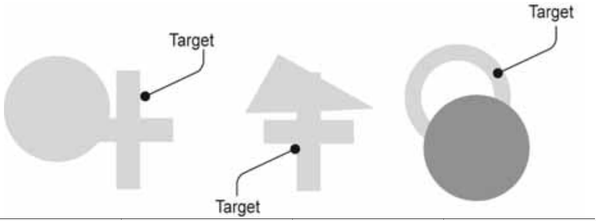
When setting X and Ascending, it sorts in ascending order with the object of the smallest X coordinate in the top. You can confirm the result in the detected result list.

In the Case of Detection Failure

If you cannot detect the part you want to detect as the result of tests, adjust three conditions described below according to the inspection conditions and image status. Using the functions below takes longer time to process compared with the case being not in use.

Detect Mode - Low Contrast

If the difference in brightness is small between an object image and the background, or some parts of object image is chipped or shielded, the checker may not detect it correctly. In such cases, set “Detect Mode” to “Low Contrast” and then specify its intensity (Filter Adjustment).



Feature and Usage of the Object	Detect Target	Filter Adjustment	Processing speed
• Higher contrast, no shielded or chipped part • Type recognition, quality inspection	Normal	---	Fast ↑
• Higher contrast, possible existence of shielded or chipped part • Position detection	Low Contrast	No	
• Lower contrast • Position detection	Low Contrast	Yes	↓ Slow

1. **Select "Inspection Condition".**

2. **Select “Low Contrast” for “Detect Mode”.**

The “Filter Adjustment” button is activated.

Run a test in the current status. If an object cannot be detected stably, make filter adjustment.

Filter Adjustment

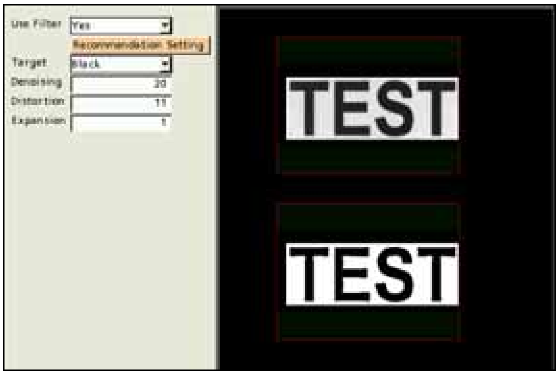
The Filter Adjustment function binarizes an object image and background using multiple items. If desired result cannot be obtained even though you tried auto adjustment (Recommendation Setting), adjust the values of the items. Set the items listed below from the top orderly.

Target (White / Black)
: If a detect target is brighter than the background, select “White”. If an object image is darker than the background, select “Black”.

Denoising (1 - 80)
: Removes unnecessary noises around an object image. As the setting value increases, the more noises are removed.

Distortion (1 - 95)
: Extracts the part having contrast. If some parts of the extracted object are chipped away, increase the setting value. If the object is expanded, decrease the setting value.

Expansion (1 - 4)
: Expands the extracted object. Makes up the chipped or missed parts of the object that cannot be adjusted by using the Distortion function.



Use Filter: Yes
Target: Black
Denoising: 20
Distortion: 11
Expansion: 1

3. **Select the button of "Filter Adjustment".**

Template list is displayed.

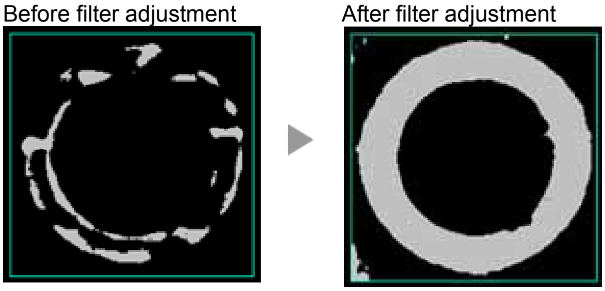
4. **Select a template to adjust filter and then select “Set Filter”.**

Filter adjustment screen is displayed. The upper image is a template and the lower is the image after filter adjustment.

5. **Set “Use Filter” to “Yes”.**

6. **Select "Recommendation Setting".**

Set it in order to binarize an image into target area and background clearly.
If Recommendation Setting cannot binarize it clearly, adjust Denoising, Distortion or Expansion.


Before filter adjustment
After filter adjustment

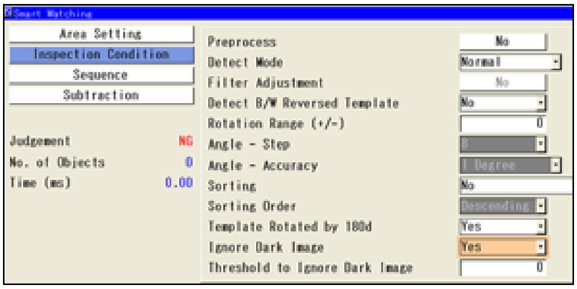
7. **After adjustment is completed, press the CANCEL key.**

The screen returns to “Inspection Condition” setting window.

Template Rotated by 180d

Use this function when running a test with a specified Rotation Range setting detects a180-degree reversed image by mistake, or a 180-degree reversed image is similar to the image pattern registered as a template.

1. **Select "Inspection Condition".**
2. **Select “Yes” for “Template Rotated by 180d”.**



Judgement NG
No. of Objects 0
Time (ms) 0.00

Preprocess No
Detect Mode Normal
Filter Adjustment No
Detect B/W Reversed Template No
Rotation Range (+/-) 0
Angle - Step 8
Angle - Accuracy 1 Degree
Sorting No
Sorting Order Descending
Template Rotated by 180d Yes
Ignore Dark Image Yes
Threshold to Ignore Dark Image 0

Ignore Dark Image

This function is useful to inspect a dark image undesired areas of which are detected.

The function ignores the part that has lower brightness than the set threshold (0 - 255) for the gray values of the area within a template.

1. **Select "Inspection Condition".**
2. **Select “Yes” for “Ignore Dark Image”.**
3. **Enter a value of brightness limit in “Threshold to Ignore Dark Image”.**

Setting a Sequence

Set a sequence to search an image pattern of a template within a search area.

The checker executes a searching on the compressed information of template and search area. The compression rate of the information is lowered every time a searching phase (up to six phases) proceeds. Processing speed is inversely related to compression ratio; the higher compression ratio, the faster processing speed, the lower compression ratio, the slower processing speed.

Specifying Items in “Sequence”

Step

Inspection is performed in up to six steps (1st - 6th) by changing compression ratio and other conditions.

Accuracy

This is compression ratio. There are seven types of compression ratio; 32.16, 8, 4, 2, 1, and S. Accuracy 16, for example, refers to compressing of information of 16 x16 (256) pixels. The smaller value indicates the lower compression. Accuracy value must be smaller as a scanning step proceeds.
Accuracy “1” means that searching is performed without compressing the information. Accuracy “S” means that detection is executed per subpixel. If the accuracy is set to "1" or "S", the steps after that will be erased and no more steps can be added. (You cannot include both "1" and "S" in one sequence. (e.g. Step 4TH=Accuracy 1, Step 5TH=Accuracy S))

Maximum Count

Maximum number of the part to be detected in each step.
Setting an intermediate step to “3” detects 3 parts with higher correlation value than the minimum value in descending order, and then inspects the parts with lower compression ratio in the next step. Setting the final step to “3” judges as “OK” three or more parts are detected, and judges as “NG” if less than three parts or nothing are/is detected.

Minimum Correlation

In a certain step, the checker detects the parts having the higher correlation value than this setting value. If there is no image with higher correlation value than it, the inspection stops at the step and judges as "NG".

Squaring Correlation Value

This is a function that squares correlation values to emphasize them. By squaring them, low values become much lower. Use this function when you want to widen the difference of correlation values between the object to detect and the object not to be detected.

The Items can be Confirmed in Sequence

No. of Objects

Number of the objects that were detected in each step.

Correlation Value*

Correlation value of the objects detected at each step. If multiple parts are detected in each step, the lowest correlation value is displayed.

▶ Note

***Correlation Value for the Low Contrast Function**

In the setting of “Low Contrast” for “Detect Mode”, correlation may be different between the values displayed in Sequence table and the values output as inspection results. This is because the PV corrects the decreased correlation values that were affected by the distorted, chipped or overlapped parts of the object and output them as inspection results. The correlation values in Sequence are the ones that have not been corrected and the values in Result or output to the external devices are the ones that have been corrected. Therefore, the former is lower than the latter. If there are many distorted or chipped parts over the whole object image, the correlation values can be almost the same.

1. **Select "Sequence".**

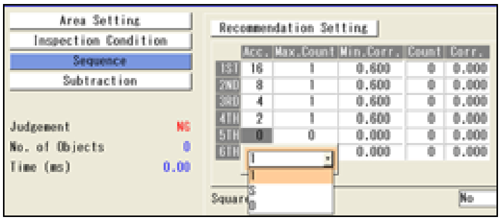
2. **Select "Recommendation Setting".**

   Regarding the current conditions, the recommendation values of sequence is set.
   “Angle - Step” of “Inspection Condition” is also replaced to a recommendation value at the same time.

3. **Set “Square Correlation” to “Yes” as necessary.**

4. **Select the table of sequence and change Accuracy, Max. Count or Min. Correlation as necessary.**

   The checker judges as “OK” when it detected the number of “Max. Count” or more of objects.



Judgement NG
No. of Objects 0
Time (ms) 0.00

	Acc.	Max.Count	Min.Corr.	Count	Corr.
1ST	16	1	0.600	0	0.000
2ND	8	1	0.600	0	0.000
3RD	4	1	0.600	0	0.000
4TH	2	1	0.600	0	0.000
5TH	0	0	0.000	0	0.000
6TH	1		0.000	0	0.000

Square No

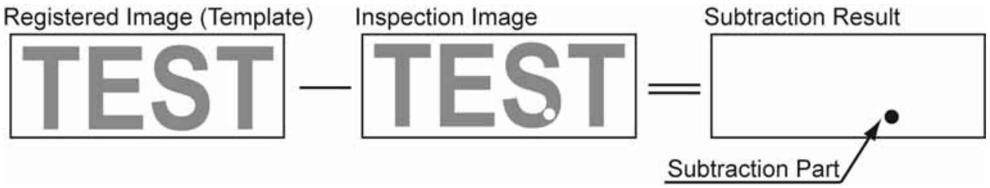
How to Change Sequence

- To select the items, tilt the ENTER key left/right. To select the steps, tilt it up/down.
- To delete a step, select “0” for “Accuracy”. All the steps after that are deleted.
- Maximum Count can be set per step, however, the value of later steps should be smaller than the value of previous steps.
  Example: If setting value of “3RD” is “5”, the value of “4TH” cannot be set to “6” or more. If setting “4TH” to “6”, the values of “1ST” to “3RD” are automatically changed to “6”.

5. **After inputting is completed, press the CANCEL key.**

Using Subtraction Function

Subtraction function extracts a pixel that exceeds a certain degree of the difference in the gray value comparing the detected area and the template. With this feature, the PV can detect up to 128 subtraction parts that are difficult to reflect in the correlation value. It judges the object based on the number of detected subtraction parts.



Items Related to Subtraction

Subtraction Threshold

The checker extracts pixels that exceed the set degree of the difference in the grayscale value or more between the detected image and the template. The lower the Subtraction Threshold value, the stricter extraction standard is.

Filter

Dilates or erodes the pixel clusters extracted under the condition of Subtraction Threshold value, or does so after dilation or erosion. Use the Filter function to enhance the extracted pixel cluster or remove fine noises or dusts.

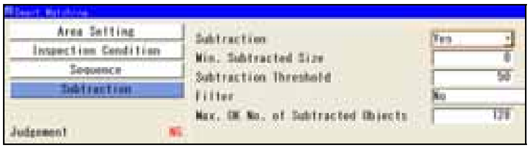
Min. Subtracted Size

The checker detects only the clusters of the filtered extraction pixels having the area value more than the Min. Subtracted Size. For example, not to detect 10-pixel or less of extracted subtraction parts, set Min. Subtracted Size to “11”.

Max. OK No. of Subtracted Objects (0-128)

A tolerance of a detected pixel cluster. If the number of detected pixel clusters is less than the Max. OK No. of Subtracted Objects, the object will be judged as "OK".

1. **Select "Subtraction”.**



Subtraction: Yes
Min. Subtracted Size: 0
Subtraction Threshold: 50
Filter: No
Max. OK No. of Subtracted Objects: 128
Judgement: NG

2. **Select “Yes” for “Subtraction”.**

3. **Enter the values in “Min. Subtracted Size” and “Subtraction Threshold”.**

4. **Select "Filter".**

No (Default)
3x3 (5x5) Erosion: Deletes fine noises.
3x3 (5x5) Erosion -> Dilation: After deleting noises, restore the left parts to the original size.
3x3 (5x5) Dilation -> Erosion: Filter processing to fill holes within the detect area.

5. **Enter the values in “Max. OK No. of Subtracted Objects”.**

Specify tolerance of the number of extracted parts as the result of subtraction. When performing subtraction, this judgement is a judgement of checker.

▶ Note

When the result of No. of Objects exceeds 128, it becomes “255” automatically and the object is judged as NG.

6. **After the setting is completed, press the CANCEL key.**

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set “Window Transparency (SETUP menu)” to larger value. (“Changing Window Transparency”, page 342)

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

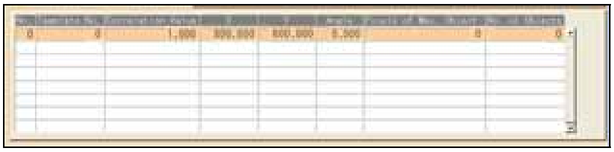
▶ Note

Position adjustment and area size adjustment are also executed if they have been set.

2. Check data of detected area list.

▶ Note

- The list of detected objects is displayed in the lower part of the setting window. When selecting this table and highlighting each No., the mark on the screen window indicating the detected area turns to pink.
- The value of “255” in the “No. of Objects” column indicates the result exceeds 128.



Smart Matching Performance

This is the function that speeds up the processing of Smart Matching. The function takes more time of type switch than without the function.

The function has the limit of the number of Smart Matching ("Number of checkers" in the right table) to allow speeding up the process. This number varies depending on the settings of template size, inspection sequence, rotation range, and angle step.

Template size	Rotation range	Angle - step	Number of checkers*
128 x 128	±90	8	10
	±180	8	6
384 x 384	±90	4	5
	±180	4	3

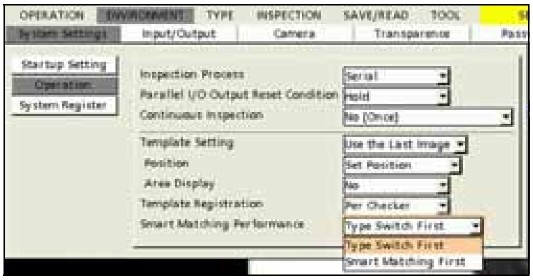
*In the case of setting one template per Smart Matching checker.

Check the processing time of inspection and type switch on your actual device before you use the function.

1. Select “ENVIRONMENT” > “System Settings” from the menu bar.

2. Select "Operation".

3. Select “Type Switch First" or "Smart Matching First" in “Smart Matching Performance”.



Inspection Process: Serial
Parallel I/O Output Reset Condition: Hold
Continuous Inspection: No (Once)
Template Setting: Use the Last Image
Position: Set Position
Area Display: No
Template Registration: Per Checker
Smart Matching Performance: Type Switch First

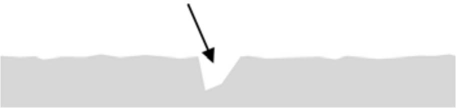
4.7.11 Flaw Detection

What Is Flaw Detection?

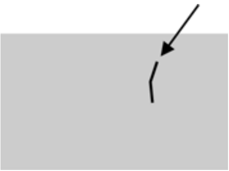
Flaw Detection detects fine flaws, burs, cracks, and foreign objects (, which are generally called as “flaw” in this manual). The checker calculates gray average value within the segmented area (cell) on a line, an arc, or a circumference, or in a rectangle. If the PV200 detects an area more than a certain level of difference in average gray, the device judges it as a flaw.

It is useful to detect flaws, burs, missing edges or contamination.

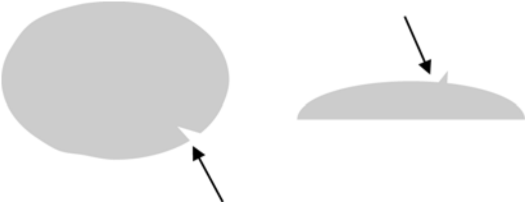
On the edge of a rectangular face



On the surface of an image



On the edge of a circle



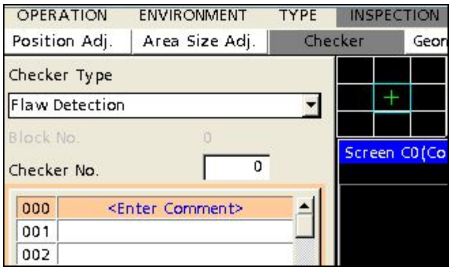
Output Data

	Line	Plane	Ellipse
No. of Objects:	0 - 255	0 - 511	0 - 511
Flaw size:	1 - 256	1 - 256	1 - 3600*
First Cell of Flaw:	0 - 255	0 - 65535	0 - 3599
Coordinate X and Y of first cell of flaw			

▶ Note

* When setting "Detect Mode" to "Gray Range", it may be 3601 - 3854 depending on the settings of "Num. of Cells for Calc. Range" and "Num. of Cells per Shift".

Specifying Checker No.



Checker Type: Flaw Detection

Block No. 0

Checker No. 0

000	<Enter Comment>
001	
002	

1. **Select “Flaw Detection” in "Checker Type".**

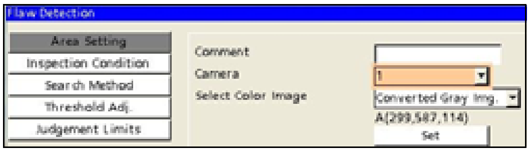
2. **Select the checker No. list and specify a checker number to set.**

3. **Press the ENTER key to determine the checker No.**

   “Flaw Detection” setting window is displayed. The gray image is displayed on the screen window regardless of camera type.

Selecting a Camera

Select a camera image to set “Flaw Detection”.



Comment:
Camera: 1
Select Color Image: Converted Gray Img.
A(299,587,114)

1. **Select “Area Setting” in “Flaw Detection” setting window.**

2. **Select a camera No. in “Camera”.**

   The selected camera image is displayed.

3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

   The gray scale image converted by the selected method is displayed.
   Refer to page 101

   Note
   Select a displayed image type (Live/Memory and Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Grayscale Preprocess / Position Adjustment

Refer to page 101

Setting an Inspection Area

Set a range to detect a flaw.

1. **Select “Area Setting” in “Flaw Detection” setting window.**

2. **Select "Area (Set)".**

   “Area Setting” window is displayed.

3. **Select a shape of inspection area from “Change Shape”.**

   Select from Line, Plane, and Ellipse.

4. **Select “Change” and draw an area.**

   The setting procedure differs depending on the shape in Flaw Detection.

5. **After drawing is completed, press the CANCEL key.**

Using Area Size Adjustment

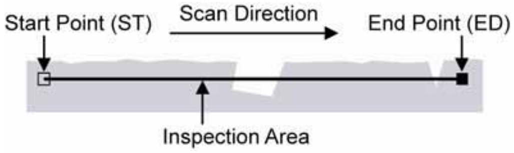
Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker.

Refer to Chapter 4.9, page 215 about Area Size Adjustment and the setting procedure.

Drawing an Area: In the case of Area Shape = Line

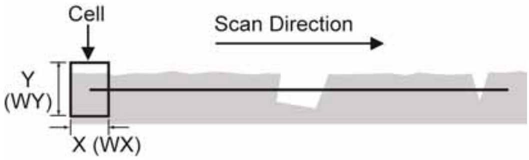
1. **Set a start point (ST) and an end point (ED).**

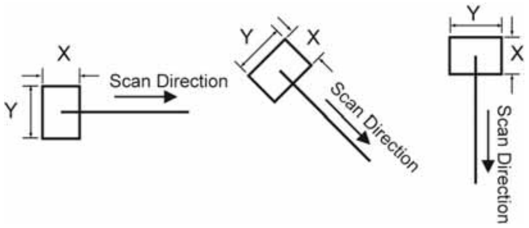
   You can set an area in the vertical and oblique directions as well as in the horizontal direction.



2. **Set the size of a cell (W) which is a rectangle calculating the average brightness.**

   Note
   The widths in X and Y directions of a cell are defined as the figures shown right.



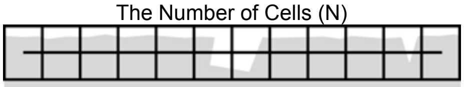


3. **Set the number of cells (N).**

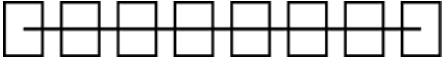
   Settable number of cells: 3 - 256
   Set the number of cells in order to inspect the object thoroughly from the start point to the end point and not to overlap cells each other as the figure shown on the right.
   If the cells overlap each other, the checker repeatedly scans the parts where the cells are overlapping, resulting in increasing inspection time.

   Note
   Changed area size by Area Size Adjustment function does not change the number of cells and cell size. Specify the number of cells in order to inspect thoroughly even if an area size will become larger.

The Number of Cells (N)



The lower figure is an example of occurrence of area that cannot be inspected due to lack of cells.



	X (Left/right key of the keypad).	Y (Up/down key of the keypad).
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
N	Number of cells	

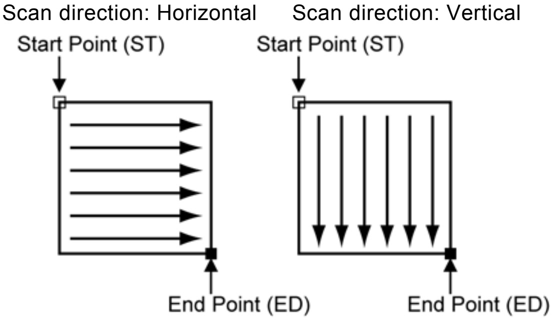
In the case of Area Shape = “Plane”

1. Set a start point and an end point.

Set a start point (STX, STY) and an end point (EDX, EDY). PV scans from the start point to the end point.

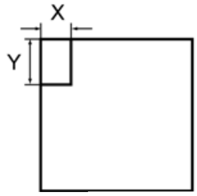
Note

If the scan direction is set to “Horizontal/Vertical”, PV scans in both directions.


Scan direction: Horizontal

Scan direction: Vertical

2. Set the size of a cell which is a rectangle calculating the average brightness.



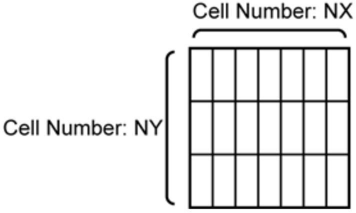
3. Set the number of cells.

Settable number of cells:
- Number of cells X = 3 - 256
- Number of cells Y = 3 - 256

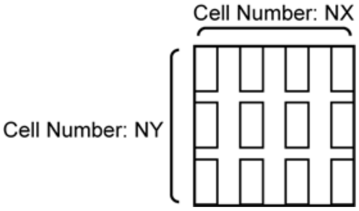
Set the number of cells in order to inspect the object thoroughly from the start point to the end point in both directions of X and Y, and not to overlap cells each other as the figure shown on the right. If the cells overlap each other, the checker repeatedly scans the parts where the cells are overlapping, resulting in increasing inspection time.

Note

Changed area size by Area Size Adjustment function does not change the number of cells. Specify the number of cells in order to inspect thoroughly even if an area size will become larger.

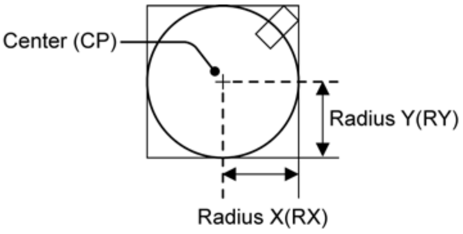


The lower figure is an example of occurrence of area that cannot be inspected due to lack of cells.



	X (Left/right key of the keypad).	Y (Up/down key of the keypad).
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
N	Number of cells in X	Number of cells Y

In the case of Area Shape = “Ellipse”

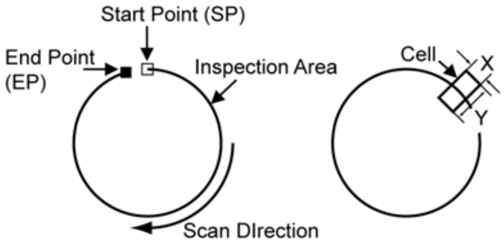


1. **Set the coordinates of the center of a circle as CPX and CPY, and set the radius in the X and Y directions of a circle as RX and RY.**

An inspection area (circle) and the rectangle circumscribing around it are displayed.

2. **Tilt the ENTER key left/right to set a start point (SPX, SPY) and an end point (EPX, EPY).**

If the coordinates of the start point equal to those of the end point, all circumference of the circle is scanned.
Scan direction is always clockwise but counterclockwise.



3. **Set the size of a cell (W) which is a rectangle calculating the average brightness.**

To change Width-X, tilt the Enter key left/right, to change Width-Y, tilt it up/down.

4. **Set the number of cells (N).**

Settable number of cells: 3 - 3600
Set the number of cells in order to inspect the object thoroughly from the start point to the end point and not to overlap cells each other as the figure shown on the right.
If the cells overlap each other, the checker repeatedly scans the parts where the cells are overlapping, resulting in increasing inspection time.

▶ Note

Changed area size by Area Size Adjustment function does not change the number of cells and cell size. Specify the number of cells in order to inspect thoroughly even if an area size will become larger.

	X (Left/right key of the keypad).	Y (Up/down key of the keypad).
CP	X coordinate of the center of the circle	Y coordinate of the center of the circle
R	Diameter of the circle X	Diameter of the circle Y
SP	X coordinate of the start point	Y coordinate of the start point
EP	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
N	Number of cells	

How to exclude from inspection (Mask area)

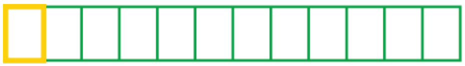
Mask areas, where checker does no inspection, can be set in an inspection area.

For Flaw Detection, set a first cell and an end cell of the range to be excluded from inspection. The number of mask areas is not limited.

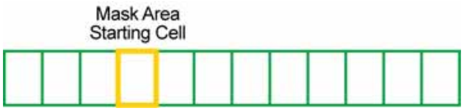
Adding a Mask Area

1. **Select "Add Mask".**

   The border of the first cell from the start point is displayed in orange.

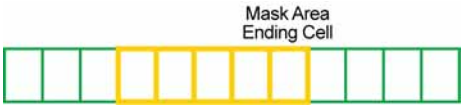


2. **Select the start cell of the mask area.**



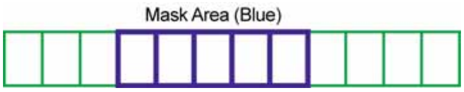
3. **Move the cursor to the end cell of the mask area.**

   The borders of the cells from start to end in the mask area are displayed in orange.



4. **On the end cell, press the ENTER key.**

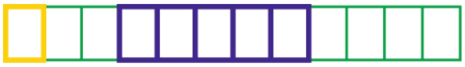
   The mask area you have set is displayed in blue.



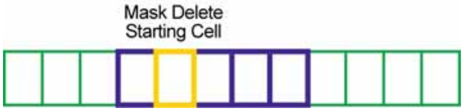
Deleting a Mask Area

1. **Select "Delete Mask".**

   The border of the first cell from the start point is displayed in orange.

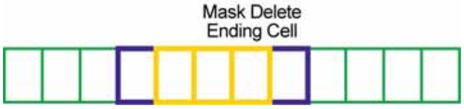


2. **Select the start cell of the mask area to delete.**



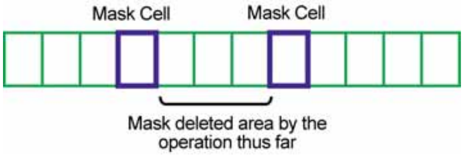
3. **Move the cursor to the end cell of the mask area.**

   The borders of the cells from start to end in the mask area are displayed in orange.



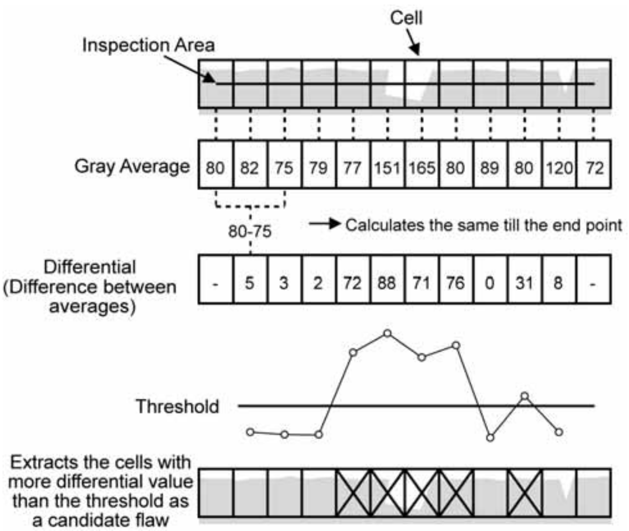
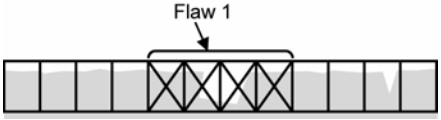
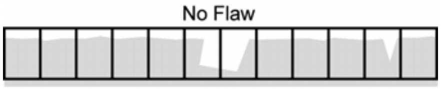
4. **On the end cell, press the ENTER key.**

   The mask area is cancelled and the borders of the cells of the area are displayed in green.

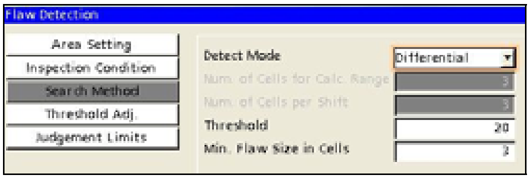


Inspecting in “Differential” Mode

Principle of “Differential Mode” of Flaw Detection

Process description	Image	
The checker calculates the brightness (average gray value) of each rectangular area, which is called cell, created in a certain size within the inspection area. If the calculated average brightness of the cells is more than the “threshold value” you will set later, the PV extracts the cell as a candidate flaw (see the figure shown on the right). As you increase the threshold value, the PV regards the area of larger difference in brightness as a candidate flaw, whereas as you decrease the threshold value, the PV regards even an area having slight difference in brightness as a candidate flaw.	 Cell Inspection Area Gray Average 80 82 75 79 77 151 165 80 89 80 120 72 80-75 Calculates the same till the end point Differential (Difference between averages) - 5 3 2 72 88 71 76 0 31 8 - Threshold Extracts the cells with more differential value than the threshold as a candidate flaw	
The checker judges whether to regard the candidate flaw as a flaw based on the number of the cells in the candidate flaw. If the number of cells in the candidate flaw is more than the number of cells that have been set as “Flaw Size”, the candidate will be judged as a flaw.	If flaw size = 3	
	If flaw size = 5	

Setting Procedure



Flaw Detection

Detect Mode: Differential
Num. of Cells for Calc. Range: 3
Num. of Cells per Shift: 3
Threshold: 20
Min. Flaw Size in Cells: 3

1. **Select "Search Method" in “Flaw Detection” setting window.**

2. **Select “Differential” for “Detect Mode”.**

3. **Set “Threshold” and “Min. Flaw Size in Cells”.**

   Threshold (1 - 255)
   The minimum value of brightness to extract the cells comprising a candidate flaw. The checker extracts the cells with larger gray range than this setting value.

   Min. Flaw Size in Cells (1 - 256)
   Flaw size in cell unit.
   Set the minimum number of the cells in a candidate flaw. The checker decides a candidate flaw consisting of the more than the minimum number of cells you have set here as a flaw.

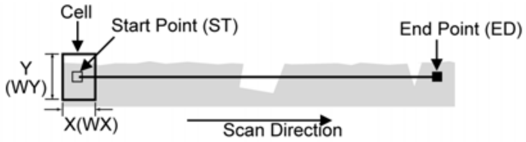
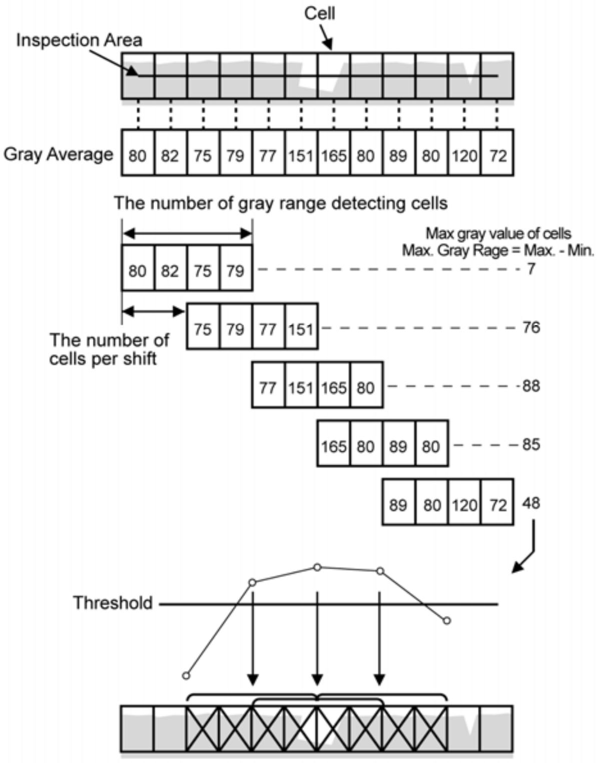
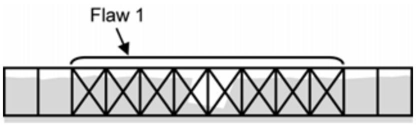
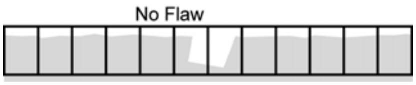
4. **After setting is completed, press the CANCEL key.**

Inspecting in “Gray Range” Mode

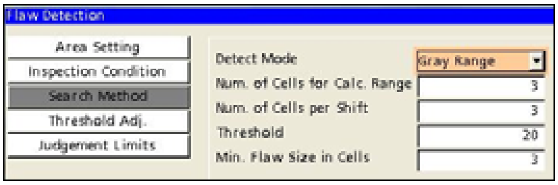
Principle of “Gray Range Mode” of Flaw Detection

If the PV failed to detect any flaw after testing in Differential mode, try to test again after switching to Gray Range mode.

Gray Range mode is effective to inspect the object with a surface of uneven brightness, but it will take longer time to process than Differential mode.

Process description	Image
The checker calculates the brightness (average gray value) of each rectangular area, which is called cell, created in a certain size within the inspection area.	 Cell Start Point (ST) End Point (ED) Y (WY) X(WX) Scan Direction
The checker groups the cells and calculates the maximum gray range in the brightness of the grouped cell. The function calculates maximum gray range of each group made by shifting the cells by the setting value for “No. of Cells per Shift”, and then identifies the cells comprising the group gray range of which is the value of “Threshold” or more as a candidate flaw. **The number of grouped cells** The cells are grouped according to the setting value for “Num. of Cells for Calc. Range”. If the setting value for “Num. of Cells for Calc. Range” is “4”, four cells are grouped (see the figures shown on the right). **The number of cells per shift** This is the number of shifting cells to group them from the start point to the end point in the area. If the setting value for “Num. of Cells per Shift” is “2”, the PV calculates maximum gray range of each group made by shifting two cells till the end of the cells. (See the figures on the right.)	 Cell Inspection Area Gray Average 80 82 75 79 77 151 165 80 89 80 120 72 The number of gray range detecting cells Max gray value of cells Max. Gray Rage = Max. - Min. 80 82 75 79 7 75 79 77 151 76 77 151 165 80 88 165 80 89 80 85 89 80 120 72 48 The number of cells per shift Threshold A part where greater gray range than threshold is detected will be extracted as flaw candidate
Threshold As you increase the threshold value, the PV identifies the cells having larger gray range as a candidate flaw, whereas you decrease the threshold value, the PV identifies even the cells having lower gray range as a candidate flaw.	
The checker judges whether to regard the candidate flaw as a flaw based on the number of the cells in the candidate flaw. If the number of cells in the candidate flaw is more than the number of cells that have been set as “Flaw Size”, the candidate will be judged as a flaw.	If flaw size = 3  If flaw size = 10 

Setting Procedure



Detect Mode: Gray Range
Num. of Cells for Calc. Range: 3
Num. of Cells per Shift: 3
Threshold: 20
Min. Flaw Size in Cells: 3

1. **Select "Search Method" in “Flaw Detection” setting window.**

2. **Select “Gray Range” for “Detect Mode”.**

   “Num. of Cells for Calc. Range” and ”Num. of Cells per Shift” become settable.

3. **Set “Num. of Cells for Calc. Range” and ”Num. of Cells per Shift”.**

   Num. of Cells for Calc. Range (2 - 256): The number of cells to be grouped.
   Num. of Cells per Shift (1 - 255): The number of shifting cells to group the cells.

4. **Set “Threshold” and “Min. Flaw Size in Cells”.**

   ▼Refer to▼
   For details on threshold and minimum flaw size in cells, refer to “Inspecting in Differential Mode”, page 149.

5. **After setting is completed, press the CANCEL key.**

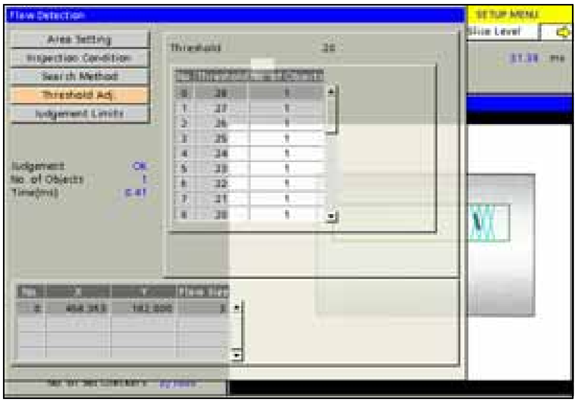
How to Find Appropriate Value for “Threshold”

With “Threshold Adjustment”, you can check the number of flaws to be detected when changing threshold value. This feature is effective if you do not know what threshold can detect the desired flaw.

After that, you can set the adjusted threshold as inspection condition.

1. **Select “Thresh.Adj.”.**

   After a message appears, number of flaws to be detected for each threshold is displayed in descending order of threshold by six rows.
   By tilting the ENTER key up/down, you can display data in after the seventh row.
   ▶ Note
   Tilting the ENTER key and pressing the SHIFT key moves the cursor faster.



2. **Move the cursor to each threshold and check the number and the positions of flaws that are detected according to the selected threshold.**

   You can confirm the flaw detected according to the threshold in the screen window.
   The current setting value for threshold is displayed above the table.

   ▶ Note
   To observe the image easily, set “Window Transparency (SETUP menu)” to larger value. (How to change window transparency: Refer to page 342)
   Otherwise, press the F1key to display the screen window in the front and confirm it.

3. **Select a threshold value to set.**

   When the dialog message appears, select “Yes” to save the threshold.
   The current threshold displayed above the table is changed. The threshold that has been set in Search Method is also updated.

4. **After setting is completed, press the CANCEL key.**

Setting Judgement Limits

Set a tolerance (maximum and minimum values) of the number of detected flaws. If the number of detected flaw is within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG".

1. **Select "Judgement Limits".**

2. **Input the setting values for "OK Judge. Max." and "OK Judge. Min".**

3. **After inputting is completed, press the CANCEL key.**

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set “Window Transparency” to larger value. (“Changing Window Transparency”, page 342)

1. **Press the TRIG key.**

   When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

   ▶ Note

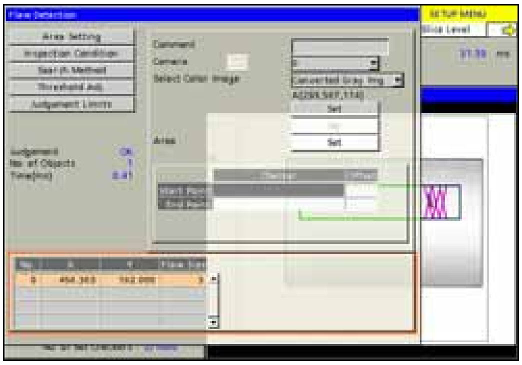
   Position adjustment and area size adjustment are also executed at the same time if they are used.

2. **Check data of detected area list.**

   No.: Flaw number
   X: The center X coordinate of the first cell from the start point in a flaw
   Y: The center Y coordinate of the first cell from the start point of a flaw
   Flaw Size: The number of cells making up a flaw

   ▶ Note

   The list of detected areas is displayed in the lower part of the setting window.
   When selecting this table and highlighting each No., the mark indicating the flaw on the screen window turns to pink.

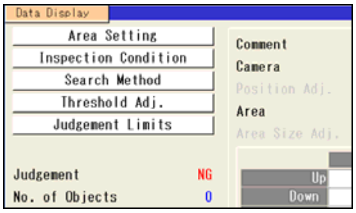


Checking Gray Level and Differential Value of Cells

You can observe gray level (average) and differential value of each cell.

1. **Press the FUNC key on Flaw Detection setting window.**

   The pop-up menu appears.



Judgement NG
No. of Objects 0

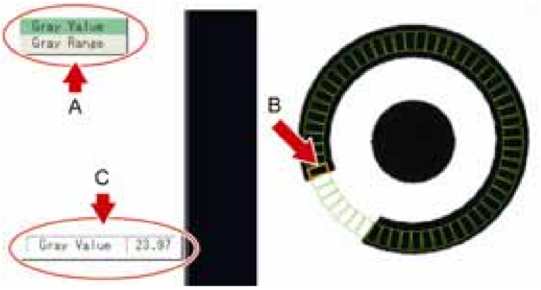
2. **Select “Data Display”.**

   The Data display window appears.

3. **Select “Gray Value” or “Differential”. (See A shown on the right figure.)**

4. **Tilt the ENTER key left/right to select the cell to check its information. (See B on the right figure)**

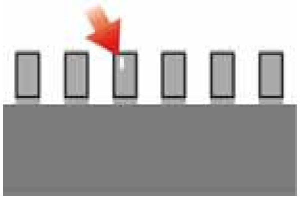
   The gray value or differential value of the selected cell is displayed. (See C on the right figure)



4.7.12 Connector (Binary Window) and Connector (Gray Window)

What are Connector (Binary Window) and Connector (Gray Window)?

These are the functions that mainly perform appearance inspection such as foreign objects detection on IC pins.



Connector (Binary Window) measures areas of multiple Binary Window cells set on the inspection line and outputs the measured areas. Connector (Gray Window) measures gray average based on gray level of all pixels in multiple Gray Window cells set on the inspection line and outputs the gray average.

These two checkers have different inspection methods as above, however, the setting procedures are the same.

Output Data

Connector (Binary Window)

Area of each cell	
Judgement of each cell:	If the detected area of each cell is within the allowable range you have set, the object will be judged as "OK", if it is outside the allowable range, the object will be judged as "NG".
Judgement:	When judgments of all cells are “OK”, judgment of the checker will be “OK”.

Connector (Gray Window)

Gray average of each cell:	0 - 255
Judgement of each cell:	If the detected gray average of each cell is within the allowable range you have set, the object will be judged as "OK", if it is outside the allowable range, the object will be judged as "NG".
Judgement:	When judgments of all cells are “OK”, judgment of the checker will be “OK”.

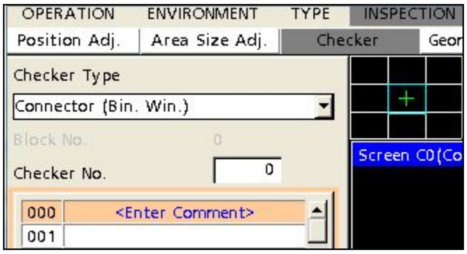
Specifying Checker No.

1. **Select “Connector (Binary Window)” or "Connector (Gray Window)" in "Checker Type".**

2. **Select the checker No. list and specify a checker number to set.**

3. **Press the ENTER key to determine the checker No.**

“Connector (Binary Window)” or "Connector (Gray Window)" setting window is displayed.



Checker Type: Connector (Bin. Win.)

Block No. 0

Checker No. 0

000 <Enter Comment>

001

Selecting a Camera

Select a camera image to set a checker.

1. **Select "Area Setting".**

2. **Select a camera No. in “Camera”.**

The selected camera image is displayed.

3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

The gray scale image converted by the selected method is displayed.
▼Refer to▼ page 101

▶ Note
Select a displayed image type (Live/Memory or Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Grayscale Preprocess / Slice Level Group / Position Adjustment

▼Refer to▼ page 101

Setting Inspection Area

▶ Note
You cannot set a Mask Area.

1. **Select "Area Setting".**

2. **Select "Set" of "Area Setting".**

“ Area Setting” window is displayed.

3. **Move the area to inspecting area by operating the ENTER key and press the ENTER key to fix the position.**

4. **Move the start point and fix it. Then, move the end point and fix it.**

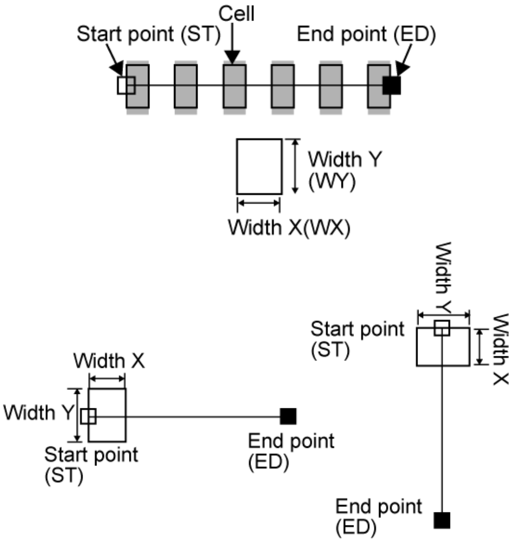
5. **Set the size (W) of cells which inspect appearance for each pin.**

Set a cell for a pin.

▶ Note
The widths in X and Y directions of a cell are defined in accordance with the position of start point and end point as the figures shown on the right.

6. **Tilt the ENTER key left/right to specify the number of cells (N), and press the ENTER key to fix it.**

Set the number of cells to the same number as of pins.



	X (ENTER key, left/right)	Y (ENTER key, up/down)
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
N	Number of cells (Max. 100)	

Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of gray average and area measured in each cell.

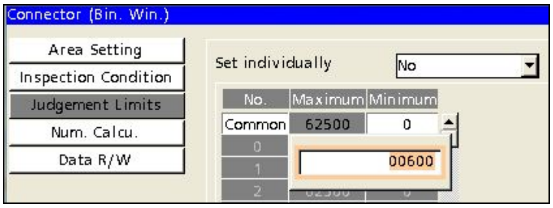
If the detected data are within the tolerance, the object will be judged as "OK", if they are outside of it, the object will be judged as "NG". When judgments of all cells are “OK”, judgement of the checker will be “OK”.

The maximum/minimum value can be set in two ways, common setting and individual setting. The common setting sets the same value for all cells and the individual setting sets separate values. When you want to set criteria for OK judgement by cells, use individual setting.

1. Select "Judgement Limits".

2. Press the TRIG key to execute a test.

The area of each cell is displayed for your guide to set maximum/minimum values.



Set individually: No

No.	Maximum	Minimum
Common	62500	0

00600

3. To set values individually, select “Yes” for “Set individually”.

Select "No" not to employ Individual Setting.

4. Select the table of maximum/minimum values.

5. To employ the common setting, select the row of “Common” and enter a value.

To use the individual setting, select a cell number and enter a value.

After the setting is completed, press the CANCEL key.

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set “Window Transparency (SETUP menu)” to a larger value. (See “Changing Window Transparency”, page 342)

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

▶ Note

Position adjustment is also executed at the same time if it is used.

2. Check data of the result list.

Connector (Binary Window)

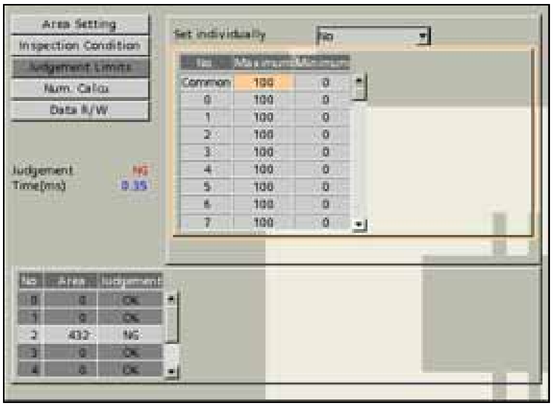
No.:	Binary Window cell No.
Area:	Area of each cell
Judgement:	Judgement of each cell

Connector (Gray Window)

No.:	Gray Window cell No.
Gray Average:	Gray average of each cell
Judgement:	Judgement of each cell

▶ Note

When you highlight each No., the selected cell turns to pink on the screen window.



Set individually: No

No.	Maximum	Minimum
Common	100	0
0	100	0
1	100	0
2	100	0
3	100	0
4	100	0
5	100	0
6	100	0
7	100	0

Judgement NG
Time(ms) 0.35

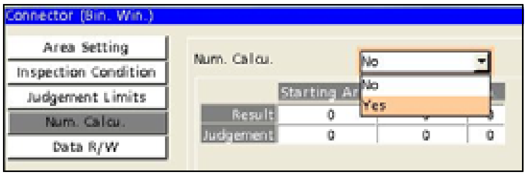
No.	Area	Judgement
0	0	OK
1	0	OK
2	432	NG
3	0	OK
4	0	OK

Registering Inspection Results in Numerical Calculation

The detected Area of cells (for Connector (Binary Window)) or Gray Average (for Connector (Gray Window)) and Judgement can be registered into Numerical Calculation from the checker setting window. Although you can register them also in Numerical Calculation setting window, information of many cells can be registered efficiently with less operation from the checker setting window.

1. **Select "Num. Calcu." in checker setting window.**

2. **Select "Yes" for "Num. Calcu."**

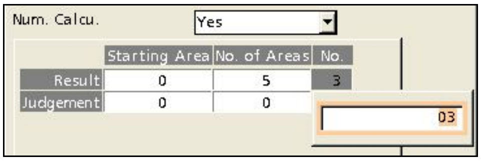


3. **Select the setting table and select a data type to register.**

Result:	Area or Gray average of each cell
Judgement:	Judgement of each cell

4. **Specify Starting Area, Number of Areas, and No.**

Starting Area:	Cell No. of the first cell to register.
No. of Areas:	The number of cells to register
No.:	No. of the first Numerical Calculation that is to be registered.



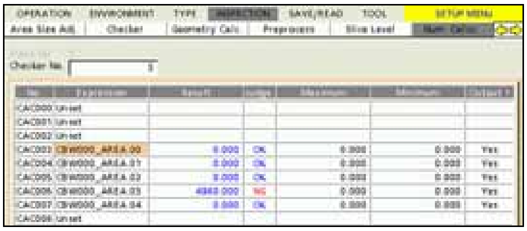
The example shown above is the setting where the results of cell No.0 to 4 are being registered into Numerical Calculation No.3 to 7.

▶ Note

In the setting table, always "0" are displayed. Even after registering the data into Numerical Calculation, the table shows "0" again.
The table cannot display the current registration status of Numerical Calculation.

5. **Press the CANCEL key to go back to the checker selecting window.**

The data is registered at this timing.
When the destination Numerical Calculation No. is already set an expression, a message is displayed. Selecting "Yes" overwrites the expression.

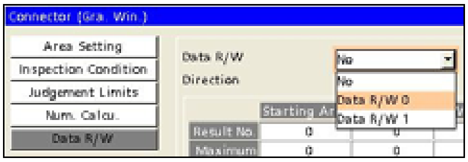


Registering into Data R/W

The detected Area of cells (for Connector (Binary Window)) or Gray Average (for Connector (Gray Window)), Judgement Limits, and Judgement can be registered into Data R/W from the checker setting window. Although you can register them also in Data R/W setting window, information of many cells can be registered efficiently with less operation from the checker setting window.

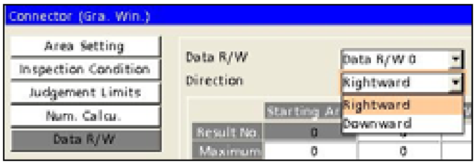
1. **Select "Data R/W" in the checker setting window.**

2. **Select a sheet of Data R/W to register data in "Data R/W".**



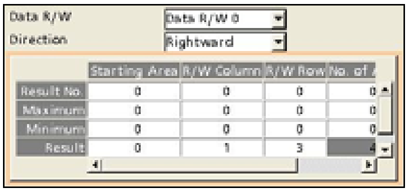
3. **Select a direction to arrange the data in "Rightward/Downward".**

Rightward:	Registers the data from the specified position to the right cell.
Downward:	Registers the data from the specified position to the lower cell.



4. **Select the setting table and select a data type to register.**

Result No.:	Cell No. of connector checker
Maximum:	Maximum value of cell judgement limits
Minimum:	Minimum value of cell judgement limits
Result:	Area or Gray average of each cell
Judgement:	Judgement of each cell


Data R/W: Data R/W 0
Direction: Rightward

	Starting Area	R/W Column	R/W Row	No. of
Result No.	0	0	0	0
Maximum	0	0	0	0
Minimum	0	0	0	0
Result	0	1	3	4

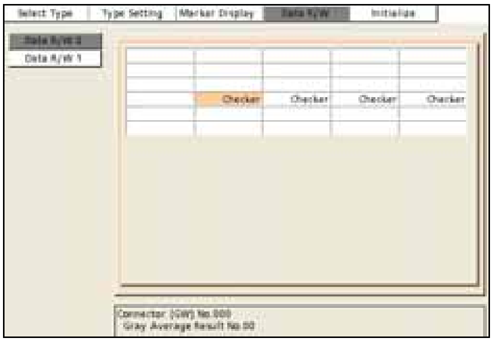
Note

In the setting table, always "0" are displayed.
Even after registering the data into Data R/W, the table shows “0” again.
The table cannot display the current registration status of Data R/W.

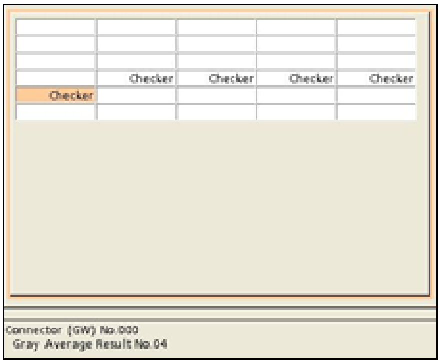
5. **Specify Starting Area, Number of Areas, and No.**

Starting Area:	Cell No. of the first cell to register.
R/W Row: **R/W Column:**	The position on a Data R/W sheet of the first data.
No. of Areas:	Number of connector checker cells data of which are registered in Data R/W sheet.

The example shown above is the setting where Judgements of cell No.0 to 3 are registered into row No.3 and column No.1 to 4 in Data R/W 0. The data are registered as below.



When Number of Areas is set to 5 under the condition above, the data that cannot be included in the specified row are stored in the next row from the first cell.



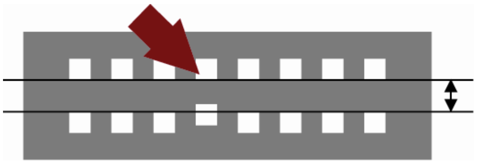
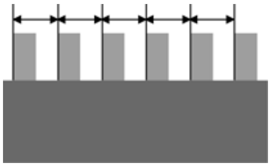
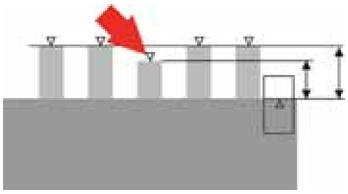
6. **Press the CANCEL key to go back to the checker selecting window.**

The data is registered at this timing.
When the destination cell of the Data R/W sheet is already set an expression, the data is overwritten. Note that the confirmation message does not appear.

4.7.13 Connector (Gray Edge)

What is Connector (Gray Edge)?

This checker measures gaps of IC pins, pitch and float of leads, and parts size (outside/inside diameters). It uses multiple Gray Edge checkers on a line in the area to detect edges of pins and an object, and helps to inspect on a connector IC with many pins. In the same method of Gray Edge checker, it detects a size of an object such as edges of pins and chip parts. Three modes are provided. Use them according to your purpose.

Detect Example	**Output Data**
Execution Mode = Gap Detects a gap between pins. 	• Each gap • X coordinate, Y coordinate and differential value of two pins making up a gap • Maximum value, minimum value, and average of gaps • Judgement The checker judges based on the set tolerance of detected gaps. When all gaps are within the tolerance range, the object is judged as OK. • Judgement of each gap
Execution Mode = Pitch 	• Each Pitch • X coordinate, Y coordinate and differential value of pins (edges) • Maximum value, minimum value, and average of pitches • Judgement of pitches The checker judges if the detected pitches are within the set tolerance. (Total Judgement, Judgement of each pin)
Execution Mode = Float Detects a tip of each pin and a standard position. The difference between them is the base distance of a float. If the distance is short, it is judged as a float. In this manual, this base distance is “Float”. 	• Float of each pin • X coordinate, Y coordinate and differential value of each pin • Maximum value, minimum value, average, and distance difference* of floats • Judgement The checker judges if the detected floats are within the set tolerance. (Total Judgement, Judgement of each pin) • Distance Difference Judgement The checker judges if the detected distance difference is within the set tolerance. (Total Judgement, Judgement of each pin) • Total Judgement If the float judgement and Distance Difference total judgement are both OK, total judgement will be OK.

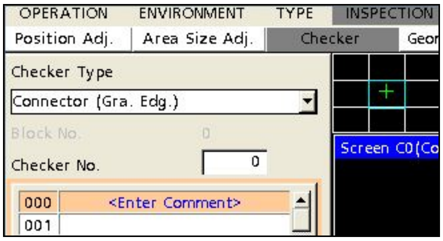
Specifying Checker No.

1. **Select “Connector (Gra. Edg.)” in "Checker Type".**

2. **Select the checker No. list and specify a checker number to set.**

3. **Press the ENTER key to determine the checker No.**

   “Connector (Gra. Edg.)” setting window is displayed. The gray image is displayed on the screen window regardless of camera type.



Checker Type
Connector (Gra. Edg.)
Checker No. 0

Selecting a Camera

Select a camera image to set Connector (Gray Edge) checker.

1. **Select “Area Setting” in “Connector (Gra. Edg.)” setting window.**

2. **Select a camera No. in “Camera”.**

3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

   The gray scale image converted by the selected method is displayed.
   Refer to page 101

   Note
   Select a displayed image type (Live/Memory or Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Grayscale Preprocess / Position Adjustment

Refer to page 101

Selecting an Execution Mode and Checker Direction

Connector (Gray Edge) checker has three execution modes. Select one of them according to your inspection purpose.

Checker Direction is to set a start point and an end point of an area horizontally or vertically. Changing either of Execution Mode or Checker Direction clears an inspection area. Set them before drawing an area.

1. **Select “Inspection Condition” in “Connector (Gra. Edg.)” setting window.**

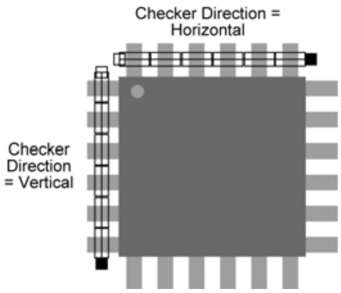
2. **Select one of three modes for “Execution Mode”.**

When the dialog message appears, select “Yes”.

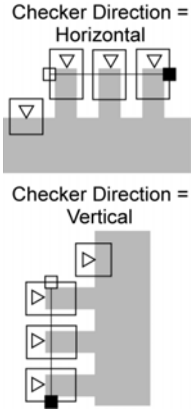
3. **Select “Horizontal” or “Vertical” in "Checker Direction".**

When the dialog message appears, select “Yes”.
Now, selecting Execution Mode and Checker Direction is complete.

Execution Mode = Pitch



Execution Mode = Float



In the case of Execution Mode = Gap

The procedure described below is for area setting and other inspection conditions when Execution Mode is set to “Gap”.

Setting an Inspection Area

▶ Note

You cannot set a Mask Area in Connector checker.

1. **Select “Area Setting” in “Connector (Gra. Edg.)” setting window.**

2. **Select "Area (Set)".**

“Area Setting” window is displayed. In Gap mode, two sets of areas (Area 0, Area 1) must be set.
The orange area displayed in the window when opening it is Area 0.

3. **Move the Area 0 to inspecting area by operating the ENTER key. And then, press the ENTER key to fix the position.**

4. **Move the start point of Area 0 and fix it. Then, move the end point and fix it.**

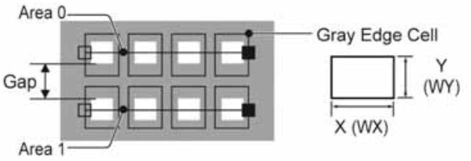
In the lower left on the screen, the coordinates of the start point and the end point of Area 0, and size and the number of Gray Edge cells are displayed. Use them to make setting. (See the right table)

	X (ENTER key, left/right)	Y (ENTER key, up/down)
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
N	Number of cells (Max. 100)	

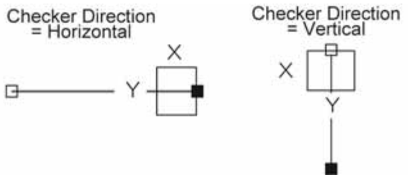
5. **Set the size (W) of Gray Edge cells which detect edges in width measuring area.**

▶ Note

The widths in X and Y directions of a cell are defined as the figures shown on the right.



6. **Tilt the ENTER key left/right to specify the number of cells, and press the ENTER key to fix it.**



7. **Tilt the ENTER key up/down to select Area 1.**

Follow the same procedure of Area 0.
Cell size and the number of cells are shared by Area 0 and 1. Changing the values during Area 1 setting changes the value of Area 0. (You cannot set different values.)

Setting Edge Conditions

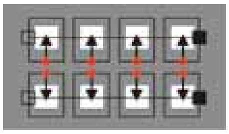
Specify the condition of detecting edges and scanning.

1. Select "Inspection Condition".

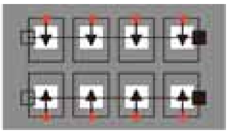
2. Set "Detect Direction".

Set the direction in order to search edges from the side with fewer noises.

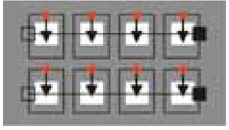
- Inside -> Outside



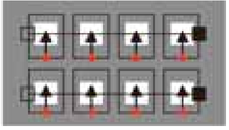
- Outside -> Inside



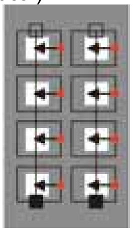
- Top -> Bottom (Checker Direction =Horizontal)



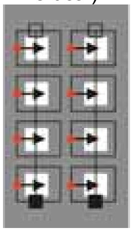
- Bottom -> Top (Checker Direction =Horizontal)



- Right -> Left (Checker Direction =Vertical)



- Left -> Right (Checker Direction =Vertical)



▼Refer to▼

For the information of the following conditions, refer to the chapter of Gray Edge checker (page 117).

- Inspection Condition - "Scan Method", "Edge Condition", "Detected Position"
- Search Method

(As for Edge Condition, set in "Edge Condition 0" and "Edge Condition 1" for Area 0 and 1 respectively.)

Deciding Differential Threshold

Decide a threshold value of differential in detecting area. Only the areas with differential value which is higher than this threshold are subjected to detect.

The threshold can be set in two ways, common setting and Individual setting. The common setting sets the same value for all Gray Edge cells and the Individual setting sets separate values. Use the Individual setting if pins have different brightness or only some of pins are dark due to lighting condition.

1. Select "Thresh.Adj.".

2. Press the TRIG key to execute a test.

The detected edge differentials are displayed. Use them to set the threshold.

3. To set threshold of Gray Edge cells individually, select "Yes" for "Set Individually".

Select "No" not to employ Set Individually.

4. Select the threshold setting table.

"Thre.0" and "Diff.0" are the settings for Area0, and "Thre.1" and "Diff.1" are the settings for Area 1.

5. To employ the common setting, select the row of "Common" and enter a value.

To use the Individual setting, select Gray Edge cell number and enter a threshold.

6. Press the TRIG key to execute a test.

Press the F1key to display the image and confirm that all parts are detected stably.

Setting Judgement Limits

Set a tolerance (maximum and minimum values) of the values of detected gaps. If the detected widths are within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG". When all widths are detected and judgements of them are “OK”, judgement of the checker will be “OK”.

1. **Select "Judgement Limits".**

2. **Input the setting values for "Max. Judge, Pitch" and "Min. Judge. Pitch".**

   Even when using "Gap" as the execution mode, these items are displayed as "Max. Judge. Pitch" and "Min. Judge. Pitch".

3. **After inputting is completed, press the CANCEL key.**

In the case of Execution Mode = Float

The procedure described below is for area setting and other inspection conditions when Execution Mode is set to “Float”.

Setting an Inspection Area

▶ Note

You cannot set a Mask Area in Connector checker.

1. **Select “Area Setting” in “Connector (Gra. Edg.)” setting window.**

2. **Select "Area (Set)".**

   “Area Setting” window is displayed. In Float mode, two areas (Area 0, Area 1) must be set. Area 0 detects a tip of pin and Area 1 detects base position of float such as a foot of pin. An area displayed in orange when selecting the window is Area 0.

3. **Move the Area 0 to inspecting area by operating the ENTER key and press the ENTER key to fix the position.**

4. **Move the start point of Area 0 and fix it. Then, move the end point and fix it.**

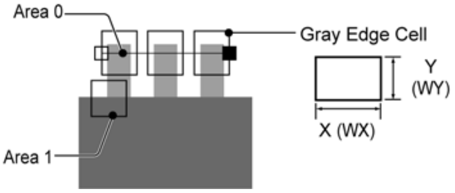
   In the lower left on the screen, the coordinates of the start point and the end point of Area 0, and size and the number of Gray Edge cells are displayed. Use them to make setting. (See the right table)

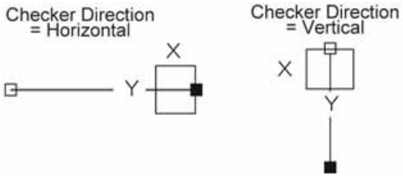
	X (ENTER key, left/right)	Y (ENTER key, up/down)
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
N	Number of cells (Max. 100)	

5. **Set the size (W) of Gray Edge cells which detect edges in width measuring area.**

   ▶ Note

   The widths in X and Y directions of a cell are defined as the figures shown on the right.





6. **Tilt the ENTER key left/right to specify the number of cells, and press the ENTER key to fix it.**

7. **Tilt the ENTER key up/down to select Area 1.**

   In the same steps for setting Area 0, move and set a start point and set an end point.

   ▶ Note

   The relative position of the start point and the end point has no effect on edge detection. Set "Detect Direction" in “Inspect Condition”.

Setting Edge Conditions

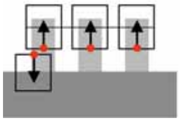
Specify the condition of detecting edges and scanning.

1. **Select "Inspection Condition".**

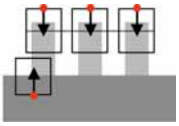
2. **Set "Detect Direction".**

Set a Detect Direction which is suitable for the captured image. For the image shown below, setting “Outside -> Inside” detects edges correctly.

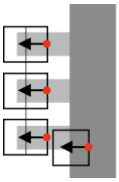
- Inside -> Outside



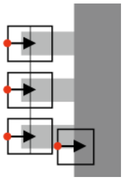
- Outside -> Inside



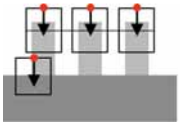
- Right -> Left
  (Checker Direction
  = Vertical)



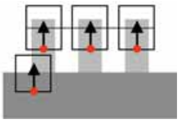
- Left -> right
  (Checker Direction
  = Vertical)



- Top -> Bottom
  (Checker Direction
  = Horizontal)



- Bottom -> Top
  (Checker Direction
  = Horizontal)



Note

For the information of the following conditions, refer to the chapter of Gray Edge checker (page 117).

- Inspection Condition - "Scan Method”, “Edge Condition", “Detected Position”
- Search Method

(As for Edge Condition, set in "Edge Condition 0" and "Edge Condition 1" for Area 0 and 1 respectively.)

Deciding Differential Threshold

Decide a threshold value of differential in detecting area. Only the areas with differential value which is higher than this threshold are subjected to detect.

The threshold can be set in two ways, common setting and individual setting. The common setting sets the same value for all Gray Edge cells and the individual setting sets separate values. Use the individual setting if pins have different brightness or only some of pins are dark due to lighting condition.

1. **Select “Thresh.Adj.”.**

2. **Press the TRIG key to execute a test.**

The detected edge differentials are displayed. Use them to set the threshold.

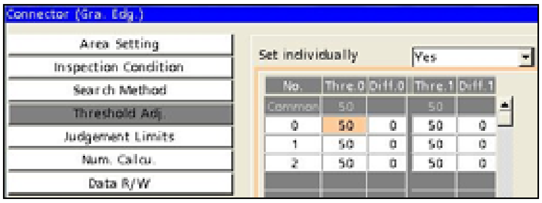
3. **To set threshold of Gray Edge cells individually, select “Yes” for “Set Individually”.**

Select "No" not to employ individual Setting.

4. **Select the threshold setting table.**

5. **To employ the common setting, select the row of “Common” and enter a value.**

To use the individual setting, select Gray Edge cell number and enter a threshold.
“Thre.1” and “Diff.1” are respectively threshold and differential value of Area 1 which detects the base of a float.



Connector (Gra. Edg.)

Set individually: Yes

No.	Thre.0	Diff.0	Thre.1	Diff.1
Common	50		50	
0	50	0	50	0
1	50	0	50	0
2	50	0	50	0

6. **Press the TRIG key to execute a test.**

Press the F1key to display the image and confirm that all parts are detected stably.

Setting Judgement Limits

Set a tolerance (maximum and minimum values) of the values of detected floats and “Distance Difference”. If the floats and distance difference are within the tolerance, the object will be judged as "OK", if they are out of it, the object will be judged as "NG". When judgement of floats and distance difference are both “OK”, judgement of the checker will be “OK”.

▶ Note

“Distance Difference” is a difference between floats of adjacent pins. For example, the distance difference of No.0 is the difference between the floats of No.0 and No.1.

1. **Select "Judgement Limits".**

2. **Input the setting values for "Max. Judge. Pitch" and "Min. Judge. Pitch".**

   Even when using "Float" as the execution mode, these items are displayed as "Max. Judge. Pitch" and "Min. Judge. Pitch".

3. **Input the setting values for "Max. Distance Difference" and "Min. Distance Difference".**

   Enter maximum/minimum values for distance difference.

4. **After inputting is completed, press the CANCEL key.**

In the case of Execution Mode = Pitch

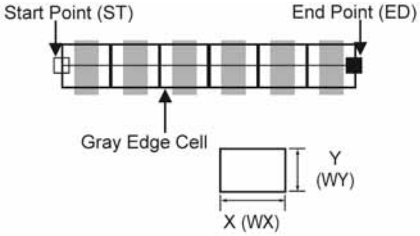
The procedure described below is for area setting and other inspection conditions when Execution Mode is set to “Pitch”.

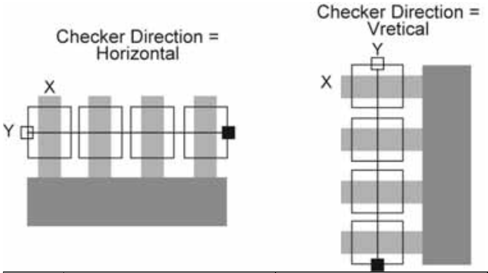
Setting an Inspection Area

▶ Note

You cannot set a Mask Area in Connector checker.

1. **Select “Area Setting” in “Connector (Gra. Edg.)” setting window.**
2. **Select "Area Setting".**
   “Area Setting” window is displayed.
3. **Move the area to inspecting area by operating the ENTER key and press the ENTER key to fix the position.**
4. **Move the start point and fix it. Then, move the end point and fix it.**
   The position of the start point is a start point of scan of the first Gray Edge.
5. **Set the size (W) of Gray Edge cells which detect edges of pins.**
   Set the size to surround a pin with a cell.
   ▶ Note
   The widths in X and Y directions of a cell are defined as the figures shown on the right.
6. **Tilt the ENTER key left/right to specify the number of cells, and press the ENTER key to fix it.**
   Set the number of cells to the same as the number of pins to be measured.





	X (ENTER key, left/right)	Y (ENTER key, up/down)
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
N	Number of cells (Max. 100)	

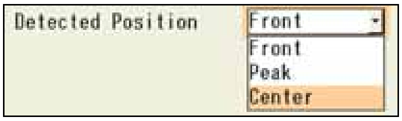
Setting Edge Conditions

For the information of the conditions listed below, refer to the chapter of Gray Edge checker (page 117).

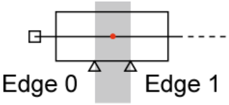
- Inspection Condition - "Scan Method”, “Edge Condition", and Front and Peak of “Detected Position”
- Search Method

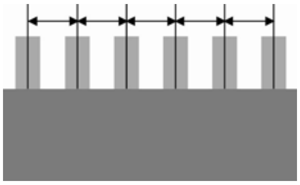
About Detected Position: Center

“Center” setting detects two points in a cell and outputs the middle point of them as detect position and the distance between the middle points of each cell as Pitch.



The detected point closer to the start point is Edge 0 and the other is Edge 1. Set edge conditions for each edge, Edge Condition 0 and Edge Condition 1.





Setting Edge Threshold

Decide a threshold value of differential in detecting area. Only the areas with differential value which is higher than this threshold are subjected to detect.

The threshold can be set in two ways, common setting and individual setting. The common setting sets the same value for all pins and the individual setting sets separate values. Use the individual setting if pins have different brightness or only some of pins are dark due to lighting condition.

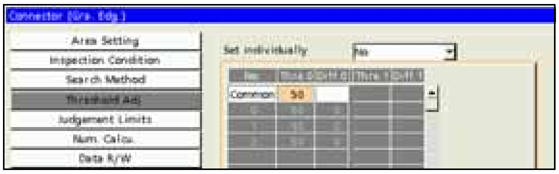
1. **Select “Thresh.Adj.”**

2. **Press the TRIG key to execute a test.**

   The detected edge differentials are displayed. Use them to set the threshold.

3. **To set threshold of pins individually, select “Yes” for “Set Individually”.**

   Select "No" not to employ Individual Setting.



Set individually No

Common 50

4. **Select the threshold setting table.**

5. **To employ the common setting, select the row of “Common” and enter a value.**

   To use the Individual setting, select pin number (Gray Edge cell number) and enter a threshold.

6. **Press the TRIG key to execute a test.**

   Press the F1key to display the image and confirm that all pins are detected stably.

Setting Judgement Limits

Set a tolerance (maximum and minimum values) of the pitch values of detected pins. If the detected pitches are within the tolerance, the object will be judged as "OK", if it is out of it, the object is judged as "NG". When judgements of all pitches are “OK”, judgement of the checker will be “OK”.

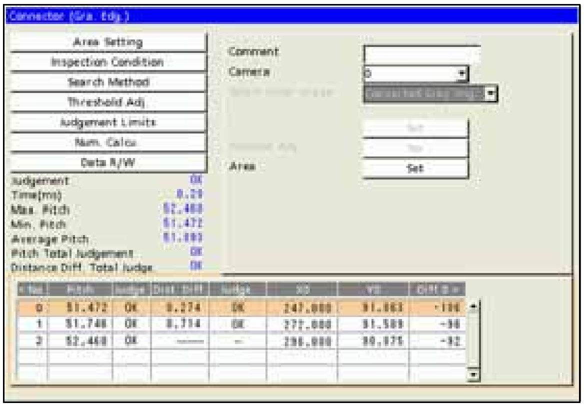
1. **Select "Judgement Limits".**

2. **Input the setting values for "Max. Judge. Pitch" and "Min. Judge. Pitch".**

3. **After inputting is completed, press the CANCEL key.**

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set “Window Transparency (SETUP menu)” to a larger value. (“Changing Window Transparency”, page 342)



Camera: 0

Judgement: OK
Time(ms): 0.29
Max. Pitch: 52.460
Min. Pitch: 51.472
Average Pitch: 51.893
Pitch Total Judgement: OK
Distance Diff. Total Judge: OK

No.	Pitch	Judge	Dist. Diff	Judge	X0	Y0	Diff.0
0	51.472	OK	0.274	OK	247.000	91.063	-196
1	51.748	OK	0.714	OK	272.000	91.589	-98
2	52.460	OK	------	--	296.000	90.875	-92

1. **Press the TRIG key.**

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

▶ Note

Position adjustment is also executed at the same time if it is used.

2. **Check data of detected area list.**

No.:	Gray Edge cell No.
Pitch;	Data of Pitch, Gap or Float. (Regardless of execution modes, the name is fixed to “Pitch”.)
Judgement:	Judgement of each pin (or width)
Distance Difference:	Distance Difference of “Float” (Available only in the case of Execution Mode = Float)
Judgement:	Judgement of Distance Difference of “Float” (Available only in the case of Execution Mode = Float)
X0, Y0, Diff.0:	Coordinates and differential value of edges detected with Area 0.
X1, Y1, Diff.1:	Coordinates and differential value of edges detected with Area 1.

▶ Note

- When Calibration is employed, the data is displayed after calibration.
- When highlighting each No., Gray Edge cells displayed on the screen window turn to pink.

Registering Inspection Results in Numerical Calculation

The detected coordinate and differential value of cells and judgement can be registered into Numerical Calculation from the checker setting window. Although you can register them also in Numerical Calculation setting window, information of many cells can be registered efficiently with less operation from the checker setting window.

Data that can be registered into Numerical Calculation from Connecter (Gray Edge) setting window

- Pitch
- Pitch Judgement
- Distance Difference
- Distance Difference Judgement
- X coordinate 0
- Y coordinate 0
- Differential value 0
- X coordinate 1
- Y coordinate 1
- Differential value 1

The setting procedure is the same as Connector (Binary Window) and Connector (Gray Window). Refer to page 156 for details.

Registering into Data R/W

The detected pitch, distance difference, and judgement limits of cells and judgement can be registered into Data R/W from the checker setting window. Although you can register them also in Data R/W setting window, information of many cells can be registered efficiently with less operation from the checker setting window.

Data that can be registered into Data R/W from Connecter (Gray Edge) setting window

- Result No.: Cell No. of the first cell to register
- Maximum: Max. Judge. Pitch
- Minimum: Min. Judge. Pitch
- Max. Dist. Differ.: Max. Distance Difference
- Min. Dist. Differ.: Min. Distance Difference
- Pitch
- Pitch Judgement
- Distance Difference
- Distance Difference Judgement
- X coordinate 0
- Y coordinate 0
- Differential value 0
- X coordinate 1
- Y coordinate 1
- Differential value 1

The setting procedure is the same as Connector (Binary Window) and Connector (Gray Window). Refer to page 157 for details.

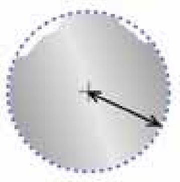
4.7.14 Smart Edge (Circle)

What is Smart Edge (Circle)?

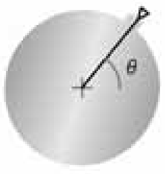
Smart Edge (Circle) is a function to output the center point, radius or diameter of a round object by detecting edges of the object with a number of cells. It is suitable for the detection of a missing edge and burr of a round object, angle of a convex (or concave) part, the inspection of circularity and the calculation of the angle of the diameter position of an ellipse. For a ring-shaped object, detecting the outer and inner circles both enables the detection of the difference between the centers of the two circles or the ring width.

The central coordinate or radius of a circle can be also detected when a whole object cannot be captured or for the angle of a chamfered object.

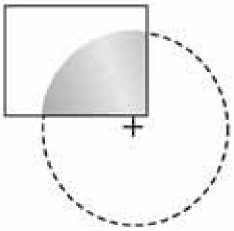
Inspection example



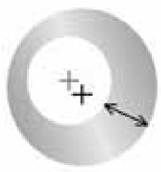
- Detection of radius, diameter



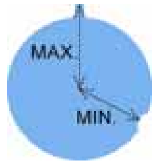
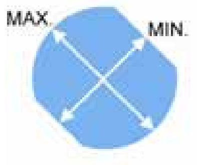
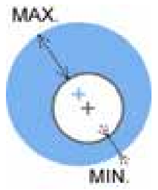
- Detection of angles of measured maximum and minimum values.



- Capturing only a part of a circle can detect the circle.



- Ring width and center points of inner and outer circles

Detect Mode		Output Data
Measure Radius  	Detects the radius from the center point of a detected virtual circle to the edge. This mode is effective to detect a missing edge and burr, and the position and angle of a projection as the left figure. Circularity inspection is also performable based on a radius value.	• Virtual circle (Centeral coordinate, Radius) • Radius, Diameter or Width, and the maximum, minimum, average and standard deviation • Circularity • Maximum angle, minimum angle (Radius, Diameter or Width) • Detected data of each cell Radius, Diameter or Width Deviation(Detect Mode: Measure Radius only), Coordinate, Differential • Used edge count, Unused edge count
Measure Diameter  	Detects the diameter based on the edge coordinates of a circle detected with two opposite cells . Circularity inspection is also performable based on a radius value.	
Measure Width  	Inspects ring-shaped objects. Measures the difference between the edges of outer and inner circles, and outputs it as "Width". This mode is suitable for inspecting the misalignment of center of concentric circle as the central coordinates of two circles are detected. Circularity inspection is also performable based on a radius value.	

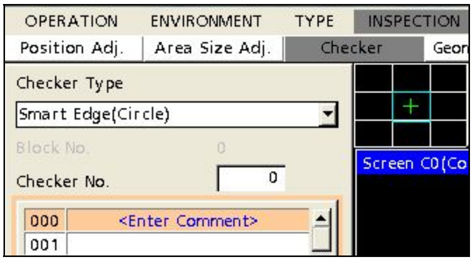
Specifying Checker No.

1. **Select “Smart Edge (Circle)” in "Checker Type".**

2. **Select the checker No. list and specify a checker number to set.**

3. **Press the ENTER key to determine the checker No.**

   “Smart Edge (Circle)” setting window appears. The gray image is displayed on the screen window regardless of camera type.



Checker Type: Smart Edge(Circle)

Block No. 0

Checker No. 0

000 <Enter Comment>

001

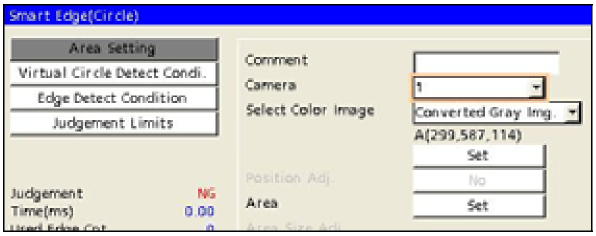
Selecting a Camera

Select a camera image to set “Smart Edge (Circle)” checker.

1. **Select “Area Setting” in “Smart Edge (Circle)” setting window.**

2. **Select a camera No. in “Camera”.**

   The image of the selected camera is displayed.



Comment:

Camera: 1

Select Color Image: Converted Gray Img.

A(299,587,114)

Judgement NG

Time(ms) 0.00

Used Edge Cnt 0

3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

   The gray scale image converted by the selected method is displayed.

   ▼Refer to▼ page 101

   ▶ Note

   Select a displayed image type (Live/Memory and Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Position Adjustment

Position Adjustment is helpful when the position of an inspection object may shift largely or an angle can be detected in advance for an ellipse object.

Select a Position Adjustment checker that has been already set. Refer to page 205 for details of position adjustment.

1. **Select "Position Adj." in Area Setting window.**

   The list of position adjustment is displayed.

   ▶ Note

   If a position adjustment checker is not created, “Position Adj.” cannot be selected.

2. **Select a Position Adjustment No. from the list.**

▶ Note

When selecting a checker number for Position/Rotation Adjustment or Rotation Adjustment, the criterion values for maximum and minimum angles or the label for the horizontal axis of the graph vary depending on the setting of "Base Angle". Refer to page 182 for details.

Selecting a Grayscale Preprocess Group

Set a preprocess filter to apply on an image captured by a camera as necessary.

1. **Select “Virtual Circle Detect Condition” > "Grayscale Preprocess".**

   “Preprocess” window is displayed.

2. **Select a Grayscale preprocess group (A to P) in “Grayscale Preprocess”.**

   ▶ Note

   For details of grayscale preprocess, refer to page 86.

3. **After setting is completed, press the CANCEL key.**

   Return to “Virtual Circle Detect Condition” setting window. The selected preprocess group is displayed.

Execution Sequence of Smart Edge (Circle)

Process sequence		Related parameters
Detection of edges of circle		• Area Setting (p.177) • Edge Detect Condition (p.179)
▼		
Detection of virtual circle	Calculates the central coordinate and radius of virtual circle.	• Detection Method • Edge ratio used (p.180) • Execution Mode
▼		
Detection of radius, diameter or width	Detects according to Detect Mode.	• Detect Mode (p.172)
▼		
Detection of each data (see the right column) and circularity of radius, diameter or width.	Max. value, min. value, average value, standard deviation, angle of max./min. value	• Denoising (p.184) • Base Angle (p.182)
▼		
Judgement	Each judgement condition	• Judgement Limits: Each Max., Min. values (p.186)

Setting Detect Mode

1. **Select “Virtual Circle Detect Condition” > "Detect Mode".**

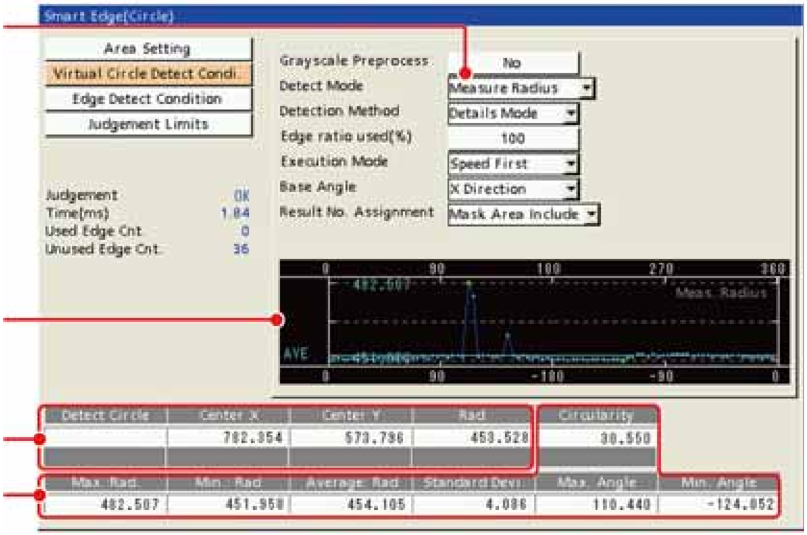
2. **Select a desired Detect Mode from the list.**

Depending on the selected Detect Mode, detected data items to be displayed at the bottom of the screen vary.

Detect Mode

- Measure Radius
- Measure Diameter
- Measure Width

▼Refer to▼
About graphs: page 175


Smart Edge(Circle)

Grayscale Preprocess: No
Detect Mode: Measure Radius
Detection Method: Details Mode
Edge ratio used(%): 100
Execution Mode: Speed First
Base Angle: X Direction
Result No. Assignment: Mask Area Include

Judgement OK
Time(ms) 1.84
Used Edge Cnt 0
Unused Edge Cnt 36

Displayed data (1)

Detect Circle	Center X	Center Y	Rad	Circularity
	782.354	573.796	453.528	30.550

Displayed data (2)

Max. Rad.	Min. Rad	Average Rad	Standard Devi	Max. Angle	Min. Angle
482.507	451.958	454.105	4.086	110.440	-124.852

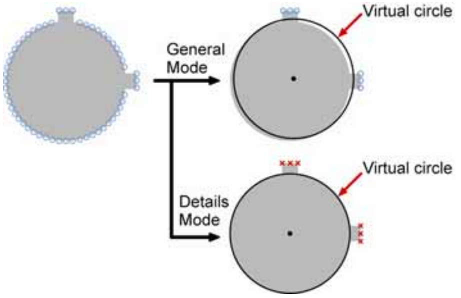
About Data to be displayed

			Detect Mode		
			Measure Radius	Measure Diameter	Measure Width
(1)	Virtual circle	a)	Center coordinate (X, Y)		Center coordinate (X, Y) of inner circle Center coordinate (X, Y) of outer circle
			Radius		Radius of inner circle Radius of outer circle
(2)	Measure-ment value	b)	Max. radius	Max. diameter	Max. width
			Min. radius	Min. diameter	Min. width
			Average radius	Average diameter	Average width
		c)	(Radius) Standard deviation	(Diameter) Standard deviation	(Width) Standard deviation
		d)	Circularity		Circularity of inner circle Circularity of outer circle
		e)	Max. radius angle	Max. diameter angle	Max. width angle
			Min. radius angle	Min. diameter angle	Min. width angle

a) Virtual circle

Virtual circle is a true circle(*) that is calculated with the coordinate values of the edges of an object detected by each cell.

Two detection methods are available. "General Mode" which uses the coordinate values of all detected edges and "Details Mode" which does not use the coordinate values of convex or concave of an object for calculating the virtual circle.



▶ Note

*) When Calibration is employed, virtual circle (true circle) is detected with the values after calibration. When Factor X and Factor Y are different, it is displayed as an ellipse according to the ratio. (Because the image displayed on the screen is the state before calibration.)

b) Maximum, minimum and average of measurement values

Calculates the radius, diameter or width using the edges detected by each cell. Then, calculates the maximum, minimum and average values for the remaining data except the data judged as noises.

The criterion to judge data as noises is decided by "Denoising" function.

As the graph displayed on the screen (described below) shows the maximum and minimum values before denoising, the values of the graph may be different from the output values.

▼Refer to▼

About Denoising function: Page 184

c) Standard deviation

It is the value that the variation in values of radius, diameter or width is quantified. It is calculated by the formula mentioned on the right.

This formula is for the case of "Detect mode: Measure Radius".

For the case of "Measure Diameter" or "Measure Width", replace the "Radius" in the right formula with "Diameter" or "Width".

The larger value indicates the greater variation.

$$\sqrt{\frac{\text{Sum of ("Measurement: Radius" of each cell - "Average: Radius")}^2}{\text{No. of data ("Used edge count")}}}$$

▶ Note

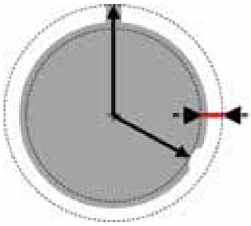
The calculation method for "Standard Deviation" used for Denoising function is different.

d) Circularity

Detects the difference between the maximum radius and minimum radius as circularity.

When Detect Mode is "Measure Diameter" or "Measure Width", circularity is also calculated by detecting the radius, maximum radius and minimum radius.

(However, when Detect Mode is "Measure Diameter" or "Measure Width", the maximum radius and minimum radius are not displayed on the screen.)



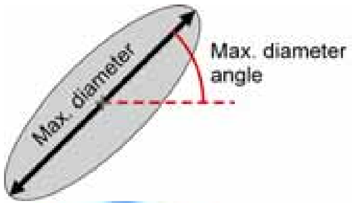
e) Maximum angle and Minimum angle

Angle between the base angle and the position of the maximum/minimum value of radius, diameter or width.

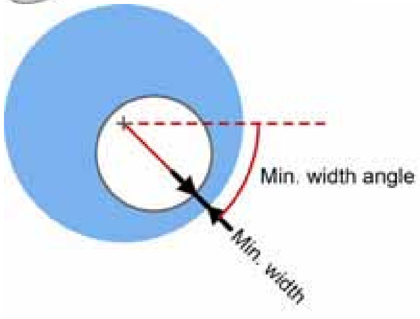
Note

The base angle (Dotted line position in the right figure) used for calculating angles is selectable.
Refer to page 182 for details.

Example)
Max. diameter angle



Min. width angle

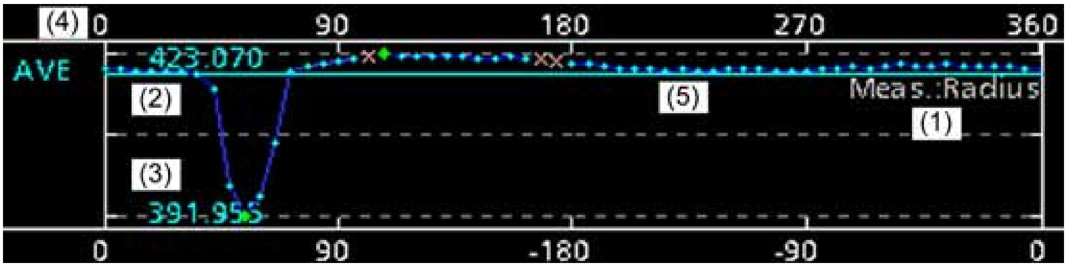


About Graphs and Cell results to be displayed

Measurement values of each cell obtained from test results are displayed as graphs in Smart Edge (Circle). The graph shows the status of edge detection for each cell or whether they are within edge threshold as marks.

It is also possible to shows a list of the status of edge detection or detection data for all cells.

About graph

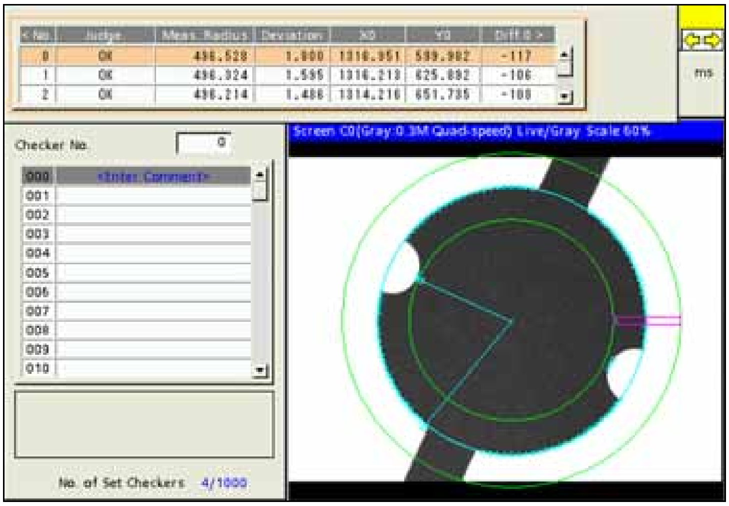


(1)	Graph type	It shows a graph of radius data when Detect Mode is "Measure Radius". It shows a graph of diameter data when selecting "Measure Diameter", and a graph of width data when selecting "Measure Width". When threshold has been set in Edge Detect Condition, a graph of differential is shown. However, a graph of radius is shown regardless of the set detect mode when setting "Edge Detect Condition" or setting "Judgement Limits" > "Denoising".
(2) (3)	Maximum value Minimum value	The maximum and minimum values of radius. This is the value of radius (diameter/width) that is calculated based on the coordinate of edge detected by each cell before applying various parameters such as Judgement Limits. It may be different from the maximum measurement or minimum measurement displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen is the value after applying the denoising function.)
(4)	Angle label	0 to 360 degree for "Measure Radius" and "Measure Width". 0 to 180 degree for "Measure Diameter". The positions and results of edges detected by each cell are displayed from the start angle in order. The position at 0 degree and the lower label varies depending on the start angle, end angle, setting value of "Base Angle" and adjustment angle for Position/Rotation Adjustment.
(5)	Result of each cell	It shows detected positions of each cell. It also shows detection results or maximum and minimum measurement values as marks.

Mark	Color	Description	Cell result list (*) Display of judgement field
●	Yellow green	Min. Measurement	OK/NG
●	Yellow green	Max. Measurement	OK/NG
×	Red	Edge: Undetected	Undetected
×	Blue	Excluded edge by denoising	Excluded
◆	Light blue	Judgment: OK	OK
◆	Red	Judgement: NG	NG

*) Next page

Checking result and data of each cell



< No.	Judge.	Meas. Radius	Deviation	X0	Y0	Diff.θ >
0	OK	496.528	1.000	1316.951	599.982	-117
1	OK	496.324	1.595	1316.213	625.882	-106
2	OK	496.214	1.486	1314.216	651.735	-108

Checker No. 0

Screen C0(Gray:0.3M Quad-speed) Live/Gray Scale 60%

No. of Set Checkers 4/1000

Press the FUNC key and select "Cell Result" from the pop-up-menu.

Cell number, judgement, measurement values, deviation, coordinate and differential are listed for all the set cells. The selected cell is displayed in pink on the screen window.

Tilt the ENTER key up/down to display the data of the desired cell.

▶ Note

- In the case of Width Measurement, both data of outer and inner circles is displayed.
- Tilt the SHIFT and ENTER keys to change the page.

Judgement

Four types of characters are displayed in "Judge." field after the test depending on the edge detection result of cells or judgement result.

	"Judge." field	Edge Detection	Edge coordinate was used for calculating measurement value.	Measurement value (radius, diameter or width) is within the max. and min. values of Judgement Limits.	Mark in graph
1	OK	○ (Detected)	○	○ (Judgement: OK)	◆ **(Light blue)**
2	NG	○ (Detected)	○	× (Judgement: NG)	◆ **(Red)**
3	Excluded	○ (Detected)	× (Excluded by "Denoising")	---	× **(Blue)**
4	Undetected	× (Undetected)	---	---	× **(Red)**

Deviation

This value is the difference between the radius (Measurement value) and the radius of virtual circle. It is displayed only when Detect Mode is set to "Measure Radius".

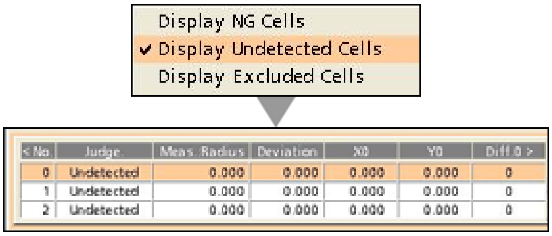
Displaying only the cells of a specific judgement result

It is possible to display only the cell data of a specific result such as the cells judged as NG or the NG and excluded cells.

Press the FUNC key when displaying the cell result list and select the type of the cells to be displayed from the pop-up menu.

The selected result type is checked, and only the cells of the checked type are displayed in the list.

Selecting again deletes the check marks and restores the display.



< No.	Judge	Meas. Radius	Deviation	X0	Y0	Diff.0 >
0	Undetected	0.000	0.000	0.000	0.000	0
1	Undetected	0.000	0.000	0.000	0.000	0
2	Undetected	0.000	0.000	0.000	0.000	0

It is possible to select not only one type but also several types.

For example, when NG cells, undetected cells and excluded cells are all checked, the cells other than the cells judged as OK are displayed.

Setting Inspection Area

Set the position and size of the area and the size of cells to detect edges of a circle by the cells.

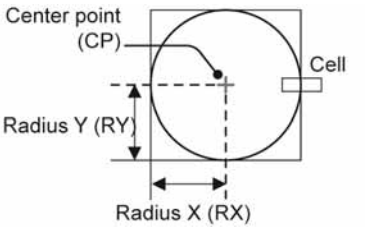
1. **Select “Area Setting” in “Smart Edge (Circle)” setting window.**

2. **Select "Area Setting".**

   “Area Setting” window is displayed.
   A cell to detect the edge of an object circularly arranged is displayed on the screen window.

3. **Select "Change".**

4. **Move the entire area by operating the ENTER key and set the center of the circle (CPX, CPY).**

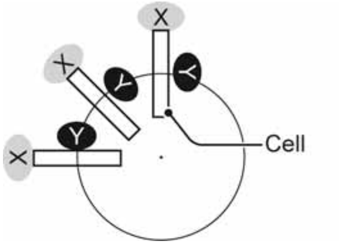


5. **Set the size of the area.**

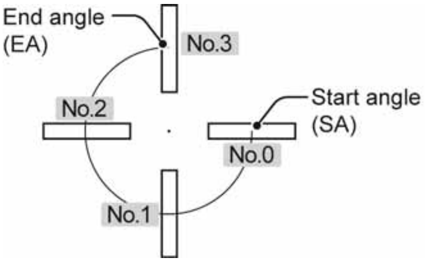
   The area size is expressed by radius (RX, RY).
   To change Width-X, tilt the Enter key left/right, to change Width-Y, tilt it up/down.

6. **Set the size of the cell (WX, WY).**

   To change Width-X, tilt the Enter key left/right, to change Width-Y, tilt it up/down.
   The cell scans from the outside to inside of the circle or from the inside to outside. This scan direction is Width-Y.



Example)



7. **Tilt the ENTER key left/right to set a start angle (SAX)and an end angle (EAX).**

   When Detect Mode is "Measure Diameter", an end angle cannot be specified as it is not possible to measure only a part of the circle.
   The sell at the start angle is set to No.0 and cell numbers are assigned to the end angle.

8. Set a pitch of the angle to arrange the cells (cell pitch) in 0.1 degree (*1).

When it is set to 10.0 (Default), 36 cells are arranged at every 10 degree for measuring whole circumference.
Set it to a smaller value to arrange more cells.

When a negative value is specified, cell numbers are assigned from the start cell counterclockwise.

▶ Note

If the number of cells increases and they overlaps each other, only two cells are displayed from the start angle.
*1) In Diameter measurement mode, the number of cells must be always even. Therefore, it may not be specified by 0.1 degree.

	X (Left/right key of the keypad)	Y (Up/down key of the keypad)
CP	X coordinate of the center of the circle	Y coordinate of the center of the circle
R	Radius of the circle X	Radius of the circle Y
W	Width-X of cell	Width-Y of cell
SA	Start Angle	
EA	End Angle	
AP	Cell pitch (+/-90, except 0)	

* Tilting the arrow keys (left/right/up/down) pressing the SHIFT key enables to specify SA, EA and AP by 0.1 degree.

* In Diameter measurement mode, there is no EA: End angle.

9. After setting the cell pitch is completed, press the CANCEL key.

How to exclude from inspection (Mask area)

Mask areas, where checker does no inspection, can be set in an inspection area. Set a start point and an end point of a cell to be excluded from inspection. The number of mask areas is not limited. Follow the same steps used for "Flow Detection" checker.

▼Refer to▼ Page 148

Assignment of cell numbers

Cell numbers are assigned to the arranged cells from the start angle. When a mask area has been set, it is also possible not to assign a cell number to the mask area (to skip the cell in the mask area).

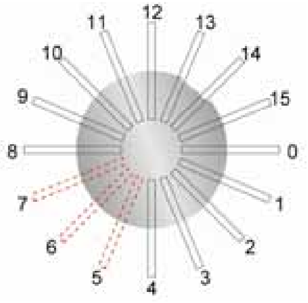
1. Select "Virtual Circle Detect Condition".

2. Select either "Mask Area Include" or "Mask Area Exclude" in "Result No. Assignment".

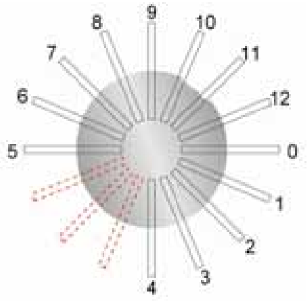
Mask Area Include (Default):
Assign cell numbers to the cells masked.
Mask Area Exclude:
Not assign cell numbers to the cells masked.

The right figure shows an example of the difference in the results of cell number assignment when the lower-left three cells (dotted line) are masked.

Mask Area Include

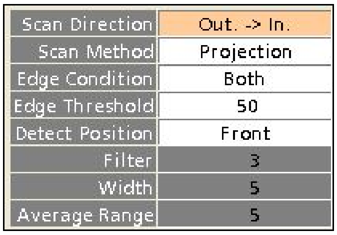


Mask Area Exclude



Edge Detect Condition

Set conditions of detecting edges of an object.



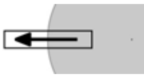
Scan Direction	Out. -> In.
Scan Method	Projection
Edge Condition	Both
Edge Threshold	50
Detect Position	Front
Filter	3
Width	5
Average Range	5

1 **Select "Edge Detect Condition".**

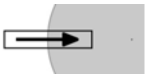
The list of the conditions for detecting edges and the graph is displayed.
When Detect Mode is "Measure Width", two sets of conditions are provided. Setting these conditions enables the 2 edges of the outer circle and inner circle to be detected with different conditions.

2. **Set "Scan Direction".**

In. -> Out.



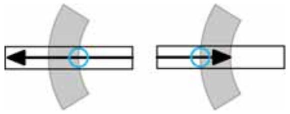
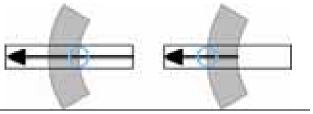
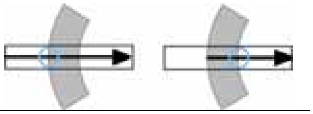
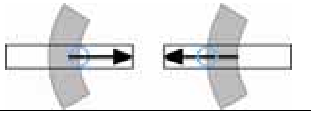
Out. -> In.



In. -> Out.:
Scans from the center of the circle to the outside.
Out. -> In.:
Scans from the outside of the circle to the center.

▶ Note

In the case of Width Measurement
Edges of the outer circle and inner circle are detected with one cell.

Inside	Outside	Scan Method	
In. -> Out.	Out. -> In.	Scans the inner edges from the center of the circle to the outside, and scans the outer edges from the outside to the center. At this time, if the outer edge is detected at the position closer to the center than the inner edge, the edges are undetected.	
In. -> Out.		Scans the edges of the inner circle, and starts the scan of the edges of the outer circle from that position.	
Out. -> In.		Scans the edges of the outer circle, and starts the scan of the edges of the inner circle from that position.	
Out. -> In.	In. -> Out.	Scans the edges of the inner circle from the center of the cell, and starts the scan of the edges of the outer circle from that position.	

3. **Set "Scan Method", "Edge Condition", "Edge Threshold" and "Detect Position".**

These edge detect conditions are the same as Gray Edge checker. Refer to page 117.

Scan Method: Projection / Single
Edge Condition: Light -> Dark/ Dark-> Light/ Both
Edge threshold: 50 (Default)
Detect Position: Front/Peak/Rear

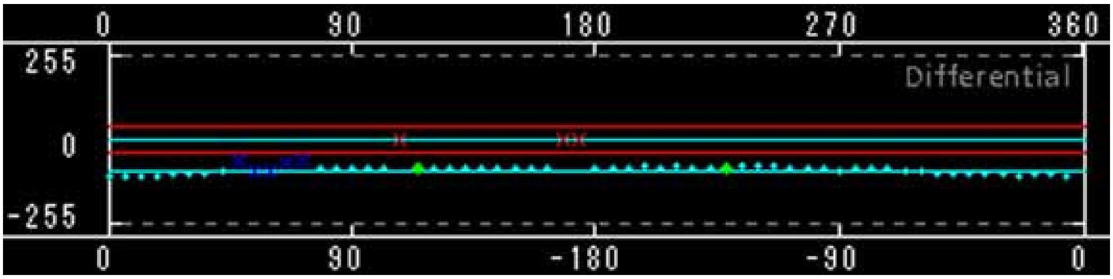
The following items are available only when selecting "Single".
Filter, Width, Average Range

4. **Press the TRIG key to run a test and confirm if the edges of the circle are detected.**

How to read a graph when setting a threshold

Pointing the cursor to "Edge Threshold" displays the graph of differentials of edges.

Decide the appropriate threshold referring to the detection result and differential of each cell in "Cell Result" and this graph.



Vertical axis:	It indicates differential. When Edge Condition is "Both", it is -255 to 255. When "Light->Dark", 0 to -255. When "Dark->Light", 0 to 255.
Red line:	It indicates threshold. When "Edge Condition" is set to "Dark->Light", the edges with the differentials over the red line that is drawn above Differential 0 are detected. When "Edge Condition" is set to "Light->Dark", the edges with the differentials below the red line that is drawn under Differential 0 are detected. When "Edge Condition" is set to "Both", the two lines are displayed.
Light blue line:	It indicates the average of differential. When Edge Condition is "Both", the both averages of the detected edges for "Light->Dark" and edges for "Dark->Light" are displayed.

▼Refer to▼

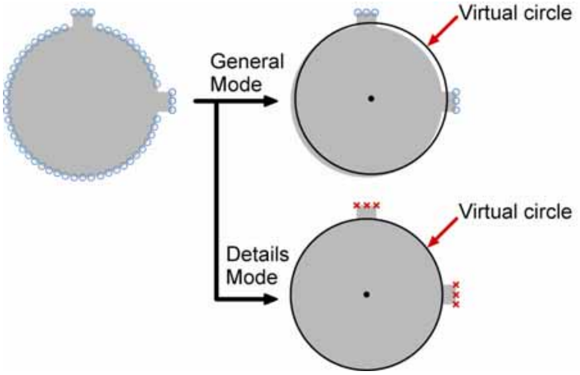
Refer to "About Graph" (p.175) for the details of marks and items other than those above.

Setting Virtual Circle Detect Condition

Set the method for detecting a virtual circle. Set "Detection Method", "Edge ratio used" and "Execution Mode".

1. **Select "Virtual Circle Detect Condition" ". > "Detection Method".**

"Detection Method" is a parameter to decide whether or not to use all the edge coordinates detected by each cell for calculating a virtual circle.

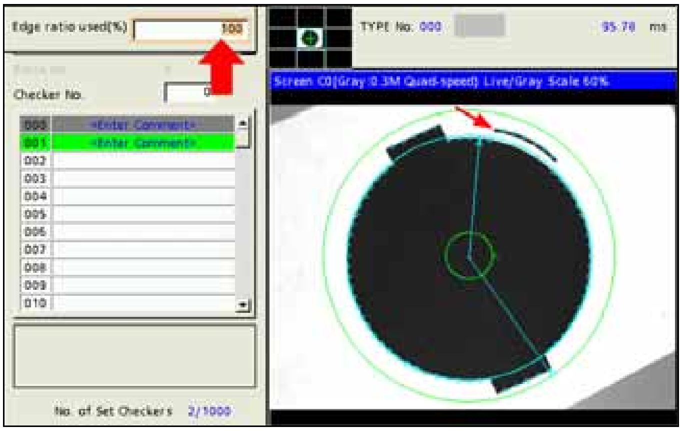


General Mode:
Detects a virtual circle using all edge coordinates. However, as the figure on the right, if the edge coordinates of projections are also used for detecting a virtual circle, the center of the virtual circle may shift.

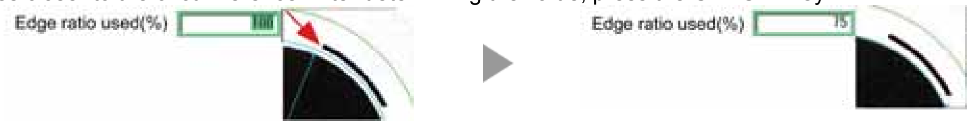
Details Mode (Default):
When an object has projections or concave surface, using this mode enables those edge coordinates not to use for calculating a virtual circle.
First, detects a virtual circle using all the edge coordinates, and then detects the final virtual circle only using the edge coordinates in "Edge ratio used" from those with a smaller error for the first virtual circle.
Select "Details Mode" to set "Edge ratio used".

2. **Select "Edge ratio used(%)".**

The menu for setting "Edge ratio used" appears in the upper left of the screen. The screen window can be checked.
Default: 80 (%)



When "Edge ratio used" is 100, all the detected edges are indicated with "○"(light blue). It shows that they are used for detecting the virtual circle. Decrease the value of Edge ratio used and run the test. The mark for the edges unused for the virtual circle changes to "×" (red), and the line showing the virtual circle comes closer to the circumference. After determining the value, press the CANCEL key.

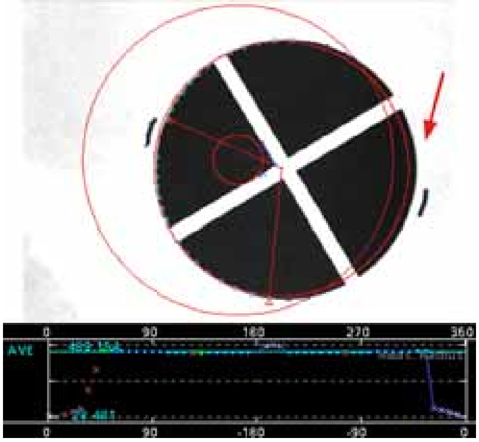


3. **Select "Execution Mode".**

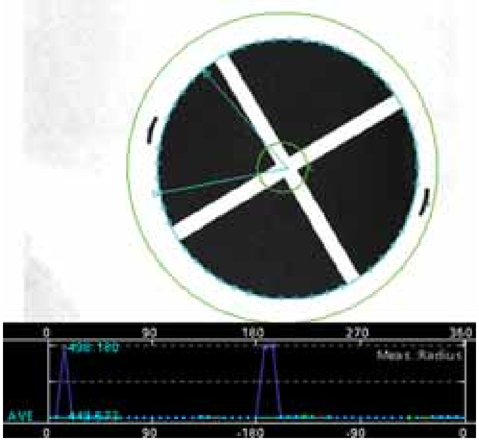
[Default: Speed First]
This parameter is effective when a part of a circle is out of the inspection area due to the position shift of the object.
If a part of the circle is out of the inspection area, the number of detected edge coordinates may reduce or a different spot from the edge of the target circle may be detected. As a result, the correct virtual circle may not be detected or the center of the detected virtual circle may not be correctly detected.

In such case, set the mode to "Accuracy First". The inspection area will be adjusted to the central coordinate of a virtual circle after the detection, and the virtual circle will be detected again. In other words, the position adjustment is performed by the checker itself.
However, the number of detection of virtual circle in "Accuracy First" mode is more than "Speed First" mode, and so the inspection time is longer.

Speed First (Default)



Accuracy First



Setting Base Angle

Select a base angle from the following three types for detecting the angles of the maximum and minimum values of radius, diameter or width. This setting affects the display of the lower horizontal axis of the graph that is displayed on the setting window.

1. **Select “Virtual Circle Detect Condition” > "Base Angle".**

2. **Select from “X Direction”, “Rotation Adjustment Angle” or "Start Angle".**

   X Direction (Default):
   Outputs an angle using the right side of X axis as 0 degree. An angle is expressed in -180 to +180.
   It is not affected by the "Start Angle" specified in Area Setting or the adjustment angle in "Position Adjustment".
   The lower horizontal axis of the graph is indicated from the value that is Start angle + Adjustment angle.

   Rotation Adjustment Angle:
   Outputs an angle using Rotation adjustment angle as a base. An angle is expressed in -180 to +180.
   The lower horizontal axis of the graph is indicated from Start angle.

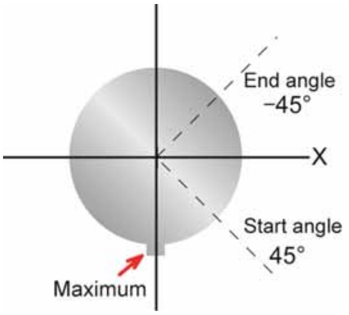
   Start Angle:
   Detects an angle using "Start Angle" specified in the area as 0 degree. An angle is expressed in 0 to 360.
   If the number for Position/Rotation Adjustment or Rotation Adjustment checker is specified for "Position Adjustment" in Area Setting, the start angle after rotation adjustment is 0 degree.

   ▶ Note
   Example) When Start angle is 45 degree and Adjustment angle is 30 degree, 75 degree is used as a base angle as the start angle is located at the position of 75 degree.
   The lower horizontal axis of the graph is always indicated from 0 degree.

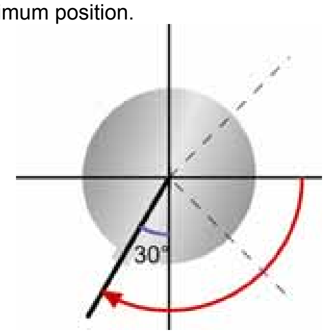
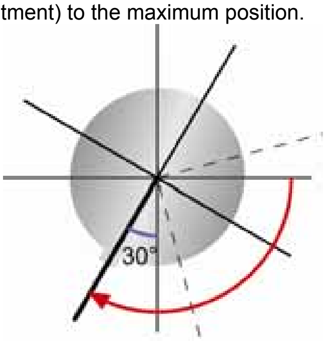
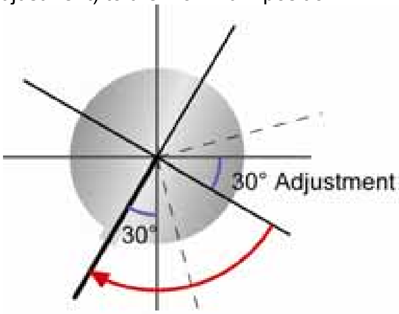
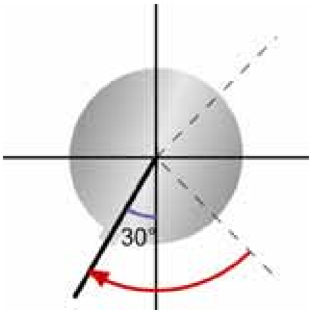
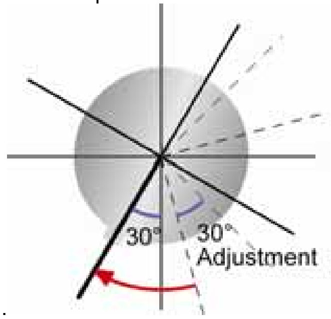
Output example of angle

Condition

Start Angle: 45 degree
End Angle: -45 degree
Max. value (Max. angle): Projection



Detection angle

	Position/Rotation Adjustment, Rotation Adjustment	
	No	Yes: Adjustment angle = 30 degree
X Direction	120 degree Detects from the right side of X axis to the maximum position. 	120 degree Detects from the right side of X axis (before adjustment) to the maximum position. 
Rotation Adjustment Angle		90 degree Detects from the right side of X axis (after adjustment) to the maximum position. 
Start Angle	75 degree Detects from start angle to the maximum position. 	45 degree Detects from start angle (after adjustment) to the maximum position 

Setting Judgement Condition

Perform judgement for the following four conditions respectively. When all the conditions are met, the judgement result of the checker will be OK.

- Measurement: Radius, Measurement: Diameter, Measurement: Width
- Standard deviation (Standard deviation calculated from the result of measurement)
- Circularity
- Unused Edge Count

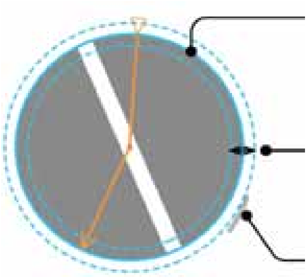
Setting Denoising function

About Denoising function

Measurement values are calculated using the edges detected by each cell. However, if cells detect projections, concaves on the surface of the object or noises existing around it as edges, using this function enables those edges not to be used for calculating measurement values. This is "Denoising Function".

Only the edges within a distance or standard deviation specified based on the radius of a virtual circle are used for the calculation of measurement values.

Figure 1

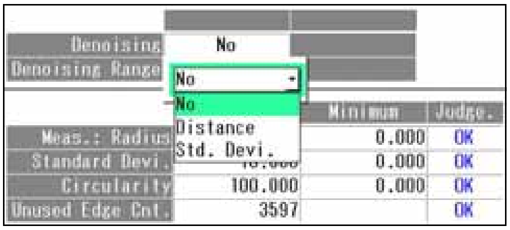

Virtual circle
Range of edge positions used for calculation measurement values
Example of edges excluded by Denoising function.

About Unused Edge Count

In Denoising function, edges excluded from edges to be used for calculation and cells which cannot detect edges are called "unused edge". Edges used for calculating measurement values are called "used edge". The number of each edge is displayed in the left of the screen together with the judgement result of checker.

1. **Select "Judgement Limits" > "Denoising".**

2. **Use either "Distance" or "Std. Devi." for performing "Denoising".**



Denoising	No	
Denoising Range	No	

		Minimum	Judge.
Meas.: Radius		0.000	OK
Standard Devi.	[illegible]	0.000	OK
Circularity	100.000	0.000	OK
Unused Edge Cnt.	3597		OK

Distance:
Uses the edges within the distance specified in "Denoising" based on the radius of a virtual circle for the calculation of measurement values.
(Area within the dotted line in Figure 1)

Standard Deviation:
Calculates the standard deviation from the radius of a virtual circle and the edge coordinates detected by each cell, and uses the edges within the value calculated by the formula mentioned on the right.
(Area within the dotted line in Figure 1)

"Radius of virtual circle +/- Standard deviation * Denoising range"

The "Standard deviation" used here is calculated based on the radius of a virtual circle.

It is different from the "Standard Deviation" displayed on the screen (that is a criterion for judgement).

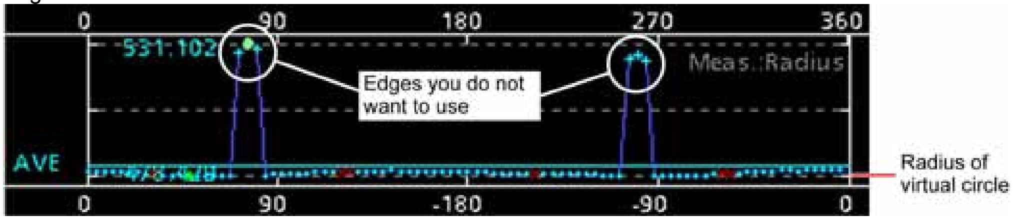
3. Set "Denoising Range".

Set the denoising range checking the graph or the result of each cell (Cell Result).

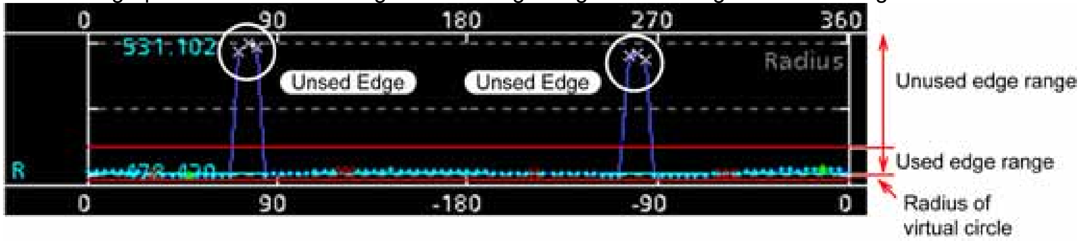
▼Refer to▼

Refer to page 176 for details of Cell Result.

The figure below shows an example that Denoising is not used. Multiple edges in the two areas are targeted for measurement.



Using Denoising function displays a line to divide the range of unused edges from the range of used edges as below.
Enter a value in Denoising Range and press the ENTER key to move this line.
Check the graph and make the setting to let the target edges in the range of unused edges.

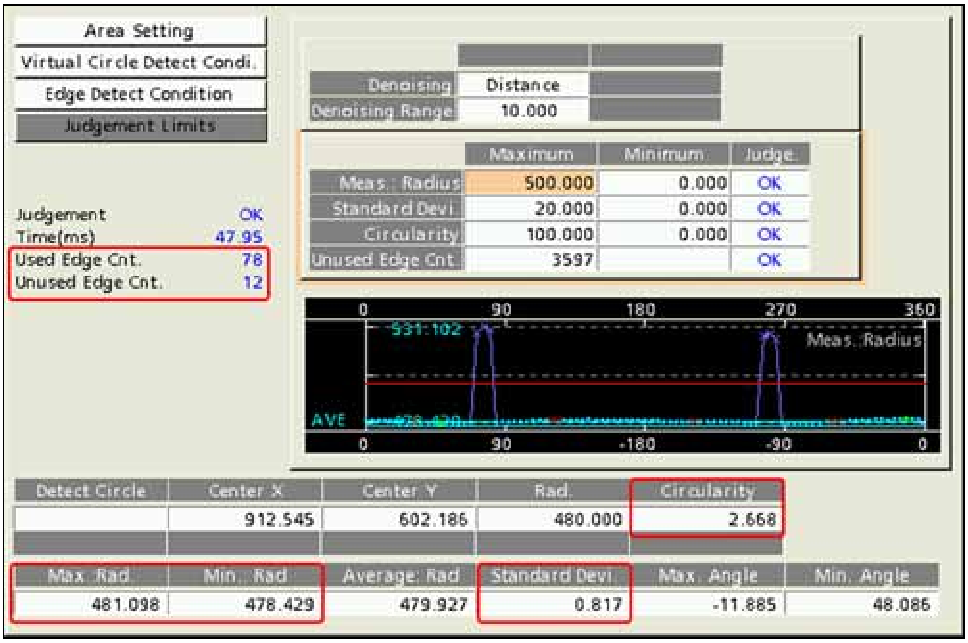


Setting the denoising range to a larger value expands "Used edge range".

▶ Note

The "x" mark (red) in the graph indicates the cell that detects no edge.
Although it is displayed in the used edge range, it is counted as an unused edge.

Setting Judgement Limits



Judgement OK
Time(ms) 47.95
Used Edge Cnt. 78
Unused Edge Cnt. 12

Denoising: Distance
Denoising Range: 10.000

	Maximum	Minimum	Judge
Meas. : Radius	500.000	0.000	OK
Standard Devi.	20.000	0.000	OK
Circularity	100.000	0.000	OK
Unused Edge Cnt.	3597		OK

Detect Circle	Center X	Center Y	Rad.	Circularity
	912.545	602.186	480.000	2.668

Max. Rad.	Min. Rad.	Average: Rad	Standard Devi.	Max. Angle	Min. Angle
481.098	478.429	479.927	0.817	-11.885	48.086

1. **Select the table of maximum/minimum values in "Judgement Limits" setting window.**

2. **Specify the maximum and minimum measurement values of radius (diameter/width).**

   As the maximum and minimum measurement values are displayed at the bottom of the screen, make the setting checking it.
   In addition, red lines indicating the maximum and minimum values are displayed in the graph. Confirm them and set.

3. **Specify the maximum and minimum values of standard deviation and circularity.**

   As the current value of each condition is displayed at the bottom of the screen, make the setting checking it.

4. **Specify the maximum value for "Unused Edge Count".**

   The current value of the unused edge count (test result) is displayed on the left of the screen. Confirm it and set.
   The default for the maximum number of settable cells is 3597.

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image or checker pattern easily, set “Window Transparency (SETUP menu)” to a larger value.
(“Change Window Transparency (SETUP Menu)”, page 342)

1. **Press the TRIG key.**

   When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

   ▶ Note
   Position adjustment and area size adjustment are also executed if they have been set.

2. **Check data of detected area list.**

   Check the graph, data of virtual circle, measurement data and judgement result to be displayed on the screen.

Error messages when running a test

If Smart Edge (Circle) is not performed properly when running a test, error numbers and messages are displayed in the checker list.

Error No.	Message	Cause
0040	Virtual circle cannot be calculated.	• When the number of detected edges is 2 or less: • When the center of virtual circle is not within the range of -9,999.999 to +9,999.999. • When all the detected edges are located on the same line:
0041	Edge required for measurement cannot be detected.	• When edge count is 0 after denoising: • When no combination of edges to be paired cannot be detected when Detect Mode is Diameter measurement or Width measurement:

4.7.15 Smart Edge (Line)

What is Smart Edge (Line)?

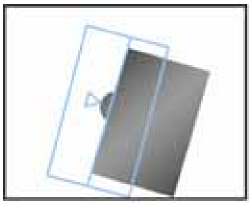
Smart Edge (Line) is a function to calculate an approximate line using the coordinate values detected with a number of cells.

Detecting the line of the edge face enables the detection of the angle of the object even if the object has a rough face.
The mode for measuring the width of the object is also available.

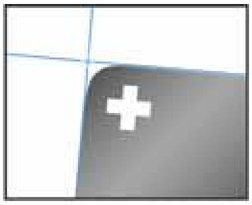
Inspection example

Detect Mode: Measure Deviation, Measure Distance

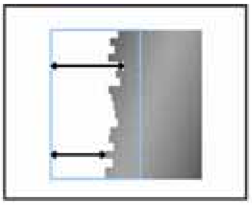
Detect Mode:
Measure Width



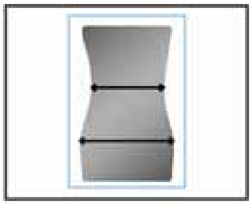
- Detection of the position of a projection
- Angle of an object



Detection of a corner (Combination of Smart Edge (Line) and Geometry Calculation)



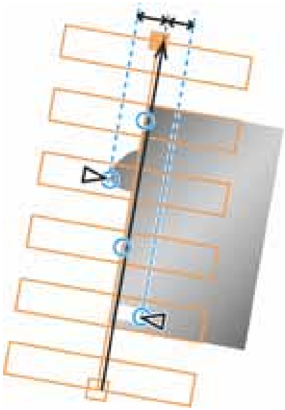
Distance difference from Base Position (Measure Distance)



- Width measurement
- Detection of the max. and min. values, and output of the position

Output Data

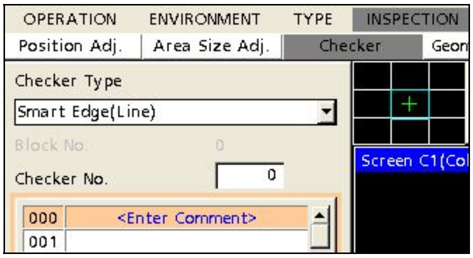
Approximate Line	• Coordinates (Start point, End point) • Angle • Line element (a, b, c) • Linearity
Measurement (Deviation, Distance, Width)	• Max. measurement, Position of max. measurement • Min. measurement, Position of min. measurement • Average Measurement • Standard Deviation
Each cell	• Coordinate of edge, Differential, Measurement
Judgement	• (Total) Judgement Result, Measurement Judgement, Standard Deviation Judgement, Linearity Judgement, Unused Edge Count Judgement
Used Edge Count	
Unused Edge Count	



Specifying Checker No.

1. **Select “Smart Edge (Line)” in "Checker Type".**
2. **Select the checker No. list and specify a checker number to set.**
3. **Press the ENTER key to determine the checker No.**

   “Smart Edge (Line)” setting window appears. The gray image is displayed on the screen window regardless of camera type.

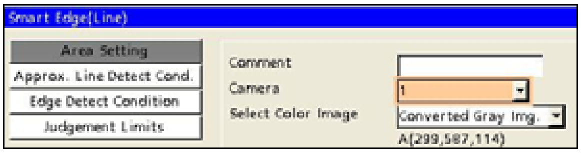


Checker Type
Smart Edge(Line)
Block No. 0
Checker No. 0
000 <Enter Comment>
001

Selecting a Camera

Select a camera image to set “Smart Edge (Line)” checker.

1. **Select “Area Setting” in “Smart Edge (Line)” setting window.**



Comment
Camera: 1
Select Color Image: Converted Gray Img.
A(299,587,114)

2. **Select a camera No. in “Camera”.**

The image of the selected camera is displayed.

3. **Select how to convert a color image in "Select Color Image". (when using a color camera)**

The gray scale image converted by the selected method is displayed.
Refer to page 101

Note
Select a displayed image type (Live/Memory and Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Selecting Position Adjustment

Position Adjustment is helpful when position of an inspection object may move largely. Select a Position Adjustment checker that has been already set. Refer to page 205 for details of position adjustment.

1. **Select "Position Adj." in Area Setting window.**

The list of position adjustment is displayed.

Note
If a position adjustment checker is not created, “Position Adj.” cannot be selected.

2. **Select a Position Adjustment No. from the list.**

Note

When selecting a checker number for Position/Rotation Adjustment or Rotation Adjustment, the base angle vary depending on the setting of "Base Angle".

Base Angle: Refer to page 198.

Selecting a Grayscale Preprocess Group

Set a preprocess filter to apply on an image captured by a camera as necessary.

1. **Select “Approximate Line Detect Condition” > "Grayscale Preprocess".**

“Preprocess” window is displayed.

2. **Select a Grayscale preprocess group (A to P) in “Grayscale Preprocess”.**

Note
For details of preprocess, refer to page 86.

3. **After setting is completed, press the CANCEL key.**

Return to “Approximate Line Detect Condition” setting window. The selected preprocess group is displayed.

Execution Sequence of Smart Edge (Line)

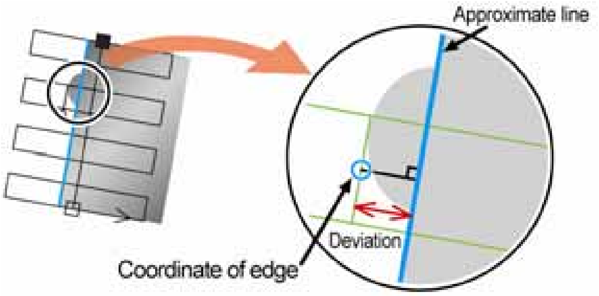
		Related parameters
Detection of edges of target area		• Area Setting (page 195) • Edge Detect Condition (page 179)
Detection of approximate line		• Detection Method • Edge ratio used • Base Angle (Detection Method, Edge ratio used: page 197)
Detection of deviation, distance or width	Detects according to Detect Mode.	• Detect Mode (page 190)
Detection of each data of deviation, distance or width (see the right column)	Maximum, Minimum, Average values and Standard deviation	• Denoising (page 199)
Detection of linearity of approximate line	Difference between Max. and Min. deviations	
Judgement	Each judgement condition	• Judgement Limits: Each Max., Min. values (page 200)

Setting Detect Mode

Smart Edge (Line) detects the edge of the end face of an object, and detects the coordinate values, angle and linearity of the approximate line to be detected from the coordinate value. In addition, the following measurements are performed in each inspection mode.

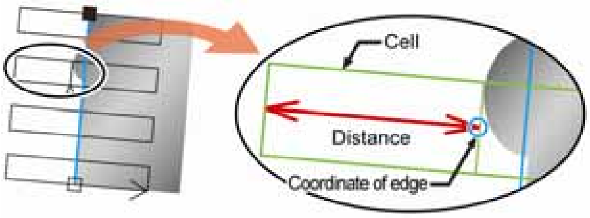
Measure Deviation

Measures the edge detected in each cell and the length of a perpendicular to the approximate line through the edge (distance between the edge and the approximate line). This is "Deviation".



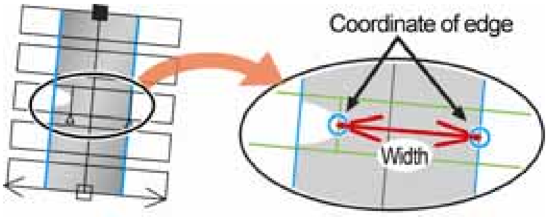
Measure Distance

Measures the distance between the start point of scan in each cell and the detected edge.



Measure Width

Detects the distance between the two edges detected in one cell as width.



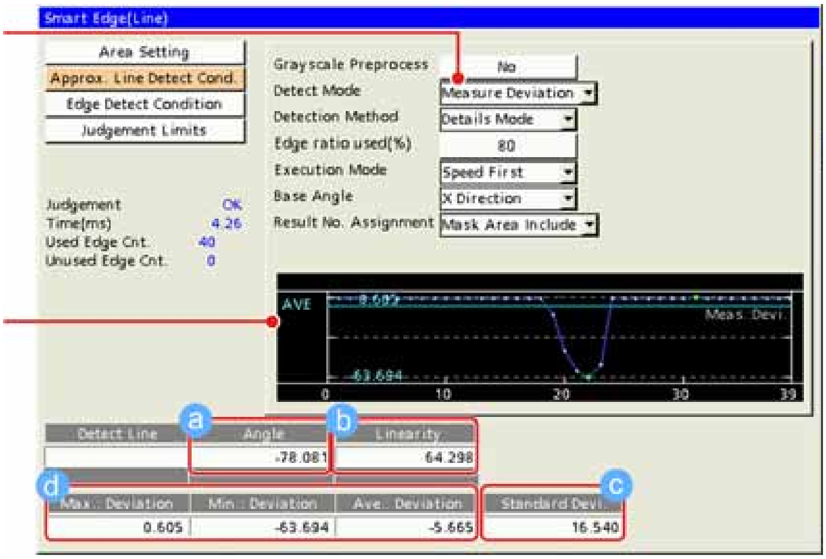
1. **Select “Approximate Line Detect Condition” > "Detect Mode".**

2. **Select a desired Detect Mode from the list.**

Depending on the selected Detect Mode, detected data items to be displayed at the bottom of the screen vary.

Detect Mode

- Measure Deviation
- Measure Distance
- Measure Width


Smart Edge(Line)

Grayscale Preprocess: No
Detect Mode: Measure Deviation
Detection Method: Details Mode
Edge ratio used(%): 80
Execution Mode: Speed First
Base Angle: X Direction
Result No. Assignment: Mask Area Include

Judgement OK
Time(ms) 4.26
Used Edge Cnt. 40
Unused Edge Cnt. 0

Detect Line	Angle	Linearity
	-78.081	64.298

Max. Deviation	Min. Deviation	Ave. Deviation	Standard Devi.
0.605	-63.694	-5.665	16.540

▼Refer to▼
Graph: Refer to page 193.

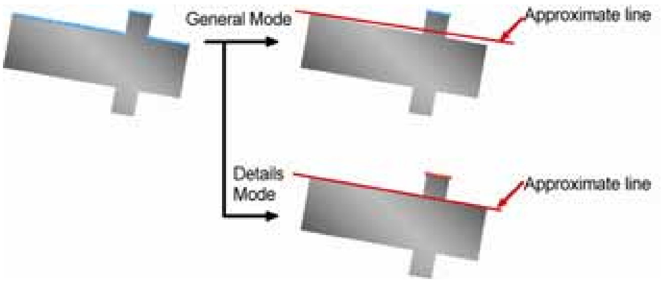
About Data to be displayed

	Measure Deviation	Measure Distance	Measure Width
(a)	Angle of approximate line		Angles of approximate lines 0 and 1
(b)	Linearity of approximate Line		Linearity of approximate lines 0 and 1
(c)	Standard deviation of deviations	Standard deviation of distance	Standard deviation of width
(d)	Max. deviation	Max. distance	Max. width
	Min. deviation	Min. distance	Min. width
	Average deviation	Average distance	Average width

About Detected Line (Approximate Line)

It is a line that is calculated with the coordinate values of the edges of an object detected by each cell.

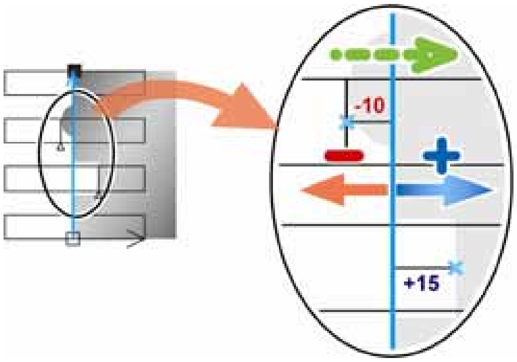
Two detection methods are available. "General Mode" which uses the coordinate values of all detected edges and "Details Mode" which does not use the coordinate values of convex or concave of an object for calculating the line.



About Positive and Negative of Deviation Data

The deviation data detected when Detect Mode is "Measure Deviation" is positive or negative depending on the scan direction (of the cell). When the scan direction (upper dashed arrow) is from left to right, the right area across the approximate line is positive and left area is negative as the right figure

When the scan direction is the other way, the positive and negative areas are also inverted.



What are Maximum, Minimum and Average Measurement Values?

Calculates the deviation, distance or width using the edges detected by each cell. Then, calculates the maximum, minimum and average values for the remaining data except the data judged as noises.

The criterion to judge data as noises is decided by "Denoising" function.

As the graph displayed on the screen (described below) shows the maximum and minimum values before denoising, the values of the graph may be different from the output values.

▼Refer to▼ About Denoising function: page 199

What is Standard Deviation?

It is the value that the variation in values of deviation, distance or width is quantified. It is calculated by the formula mentioned on the right.

The larger value indicates the greater variation.

The right formula is for the case of "Detect mode: Measure Distance". For the case of "Measure Deviation" or "Measure Width", replace the "Distance" in the right formula with "Deviation" or "Width".

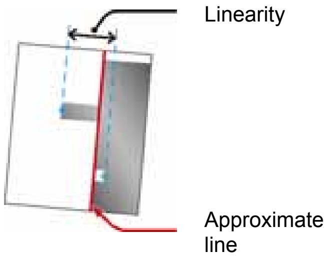
$$\sqrt{\frac{\text{Sum of ("Measurement: Distance" of each cell - "Average: Distance")2}}{\text{No. of data ("Used edge count")}}}$$

▶ **Note**

The calculation method for "Standard Deviation" used for Denoising function is different.

What is Linearity?

Linearity is the difference between the maximum and minimum values of the deviation for an approximate line.
In case of the "Measure Distance" mode and "Measure Width" mode, linearity is also calculated in the same method as the "Measure Deviation" mode.

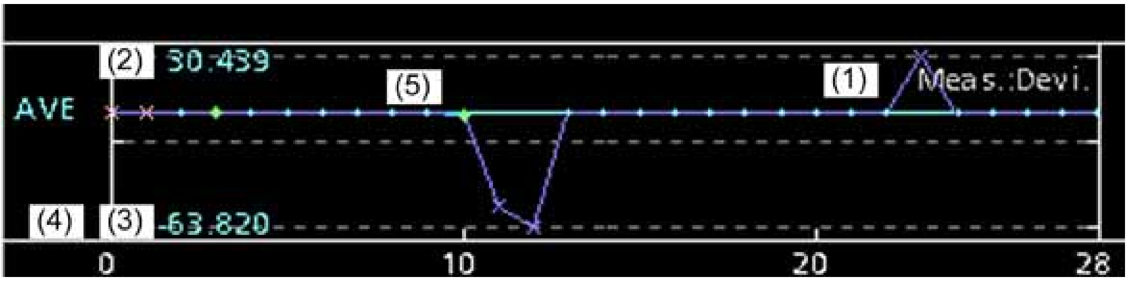


About Graphs and Cell results to be displayed

Measurement values of each cell obtained from test results are displayed as graphs in Smart Edge (Line). The graph shows the status of edge detection for each cell or whether they are within edge threshold as marks.

It is also possible to show a list of the status of edge detection or detection data for all cells.

About Graphs

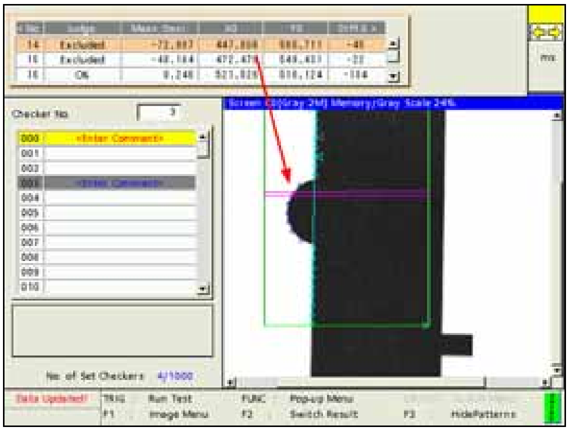


(1)	Graph type:	It shows a graph of deviation data when Detect Mode is "Measure Deviation". It shows a graph of distance data when selecting "Measure Distance", and a graph of width data when selecting "Measure Width". When threshold has been set in Edge Detect Condition, a graph of differential is shown. However, a graph of deviation is shown regardless of the set detect mode when setting "Edge Detect Condition" or setting "Judgement Limits" > "Denoising".
(2) (3)	Maximum: Minimum:	The maximum and minimum values of measurements. This is the value of measurement (deviation, distance, width) that is calculated based on the coordinate of edge detected by each cell before applying various parameters such as Judgement Limits. It may be different from the maximum measurement or minimum measurement displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen is the value after applying the denoising function.)
(4)	Horizontal axis:	Cell No. (Max. 3000)
(5)	Result of each cell:	It shows detected positions of each cell. It also shows detection results or maximum and minimum measurement values as marks.

Mark	Color	Description	Cell result list (*) Display of judgement field
●	Yellow green	Min. Measurement	OK/NG
●	Yellow Green	Max. Measurement	OK/NG
×	Red	Edge: Undetected	Undetected
×	Blue	Excluded edge by denoising	Excluded
◆	Light blue	Judgment: OK	OK
◆	Red	Judgement: NG	NG

*)Next page

Checking result and data of each cell



Press the FUNC key and select “Cell Result” from the pop-up menu.

Cell number, judgement, measurement values, coordinate and differential are listed for all the set cells. The selected cell is displayed in pink on the screen window.

Tilt the ENTER key up/down to display the data of the desired cell.

▶ Note

- In case of the "Measure Width" mode, two sets of data are displayed for one cell as two approximate lines are detected.
- Tilt the SHIFT and ENTER keys to change the page.

Judgement

Four types of characters are displayed in "Judge." field after the test depending on the edge detection result of cells or judgement result.

	Judgement field	Edge Detection	Edge coordinate was used for calculating measurement value.	Measurement value is within the max. and min. values of Judgement Limits	Mark in graph
1	OK	○ (Detected)	○	○ (Judgement: OK)	◆ (Light blue)
2	NG	○ (Detected)	○	× (Judgement: NG)	◆ (Red)
3	Excluded	○ (Detected)	× (Excluded by "Denoising")	---	× (Blue)
4	Undetected	× (Undetected)	---	---	× (Red)

Displaying only the cells of a specific judgement result

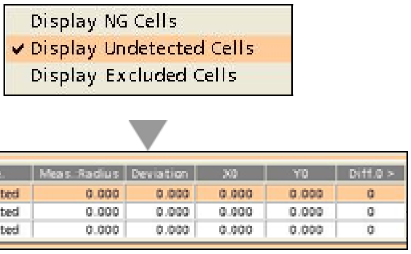
It is possible to display only the cell data of a specific result such as the cells judged as NG or the NG and excluded cells.

Press the FUNC key when displaying the cell result list and select the type of the cells to be displayed from the pop-up menu.

The selected result type is checked, and only the cells of the checked type are displayed in the list. Selecting again deletes the check marks and restores the display.

It is possible to select not only one type but also several types.

For example, when NG cells, undetected cells and excluded cells are all checked, the cells other than the cells judged as OK are displayed.



< No.	Judge.	Meas. Radius	Deviation	X0	Y0	Diff.0 >
0	Undetected	0.000	0.000	0.000	0.000	0
1	Undetected	0.000	0.000	0.000	0.000	0
2	Undetected	0.000	0.000	0.000	0.000	0

Setting Inspection Area

Set the position and size of the area and the size of cells to detect edges of the object by the cells.

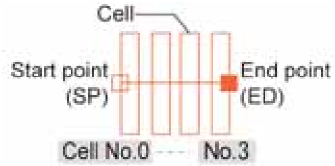
1. **Select “Area Setting” in “Smart Edge (Line)” setting window.**

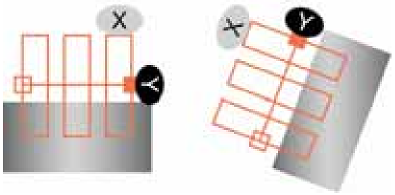
2. **Select "Area Setting" > "Change".**

3. **Move the whole area by operating the ENTER key and press the ENTER key.**

4. **Specify "Start point (ST)" and "End point (ED)".**

   The start point is on the left and the end point is on the right in the default condition.
   Set the start point and end point along the edges to be detected.
   When the edges to be detected are located vertically, set the start point at the bottom and the end point at the top.
   The cell at the start point is set to No.0 and cell numbers increase to the end point. Note that the scan direction of the cells vary depending on the positions of start and end points.
   The scan direction is set in "Edge Detect Condition".





5. **Set the size of the cell (WX, WY).**

   To change Width-X, tilt the Enter key left/right, to change Width-Y, tilt it up/down.
   The width parallel to the start and end points is Width-X, and the right-angled direction is Width-Y.

6. **Tilt the ENTER key left/right to specify the number of cells (N), and press the ENTER key to fix it.**

   Set the cells with no space between them from the start point to the end point. The part with a space between cells cannot be inspected.

	X (Left/right key of the keypad)	Y (Up/down key of the keypad)
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
N	Number of cells (Max. 3000)	

▶ Note

If the number of cells increases and they overlaps each other, only two cells are displayed from the start point.
If the cells are fully or partly covered with other cells, the scans are repeated in those areas. Although the inspection is conducted thoroughly, note that the processing time takes longer as the number of cells increases.

7. **After setting the number of cells is completed, press the CANCEL key.**

How to exclude from inspection (Mask area)

Mask areas, where checker does no inspection, can be set in an inspection area. Set the first cell and end cell to be excluded from inspection. The number of mask areas is not limited. Follow the same steps used for "Flow Detection" checker.

▼Refer to▼ page 148

Assignment of cell numbers

Cell numbers are assigned to the arranged cells from the start point. When a mask area has been set, it is also possible not to assign a cell number to the mask area (to skip the cell in the mask area).

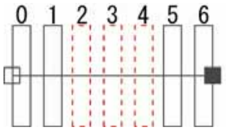
1. **Select "Approximate Line Detect Condition".**

2. **Select either "Mask Area Include" or "Mask Area Exclude" in "Result No. Assignment".**

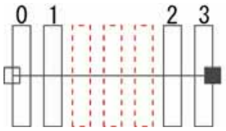
Mask Area Include (Default): Assign cell numbers to the cells masked.
Mask Area Exclude: Not assign cell numbers to the cells masked.

The right figure shows an example of the difference in the results of cell number assignment when the three cells (dotted line) are masked.

Mask Area Include



Mask Area Exclude

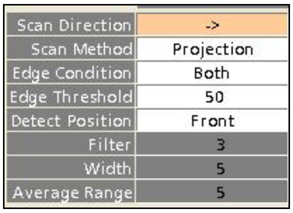


Edge Detect Condition

Set conditions of detecting edges of an object.

1. **Select "Edge Detect Condition".**

The list of the conditions for detecting edges and the graph is displayed.
When Detect Mode is "Measure Width", two sets of conditions (Condition 0 and Condition 1) are provided. Setting these conditions enables the two edges to be detected with different conditions to detect the width.
The edges of Line 0 are detected with Condition 0 and the edges of Line 1 is detected with Condition 1.



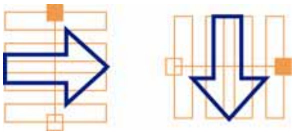
Scan Direction	->
Scan Method	Projection
Edge Condition	Both
Edge Threshold	50
Detect Position	Front
Filter	3
Width	5
Average Range	5

2. **Set "Scan Direction".**

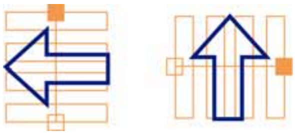
[->]: If the start point is regarded as the position at six o'clock, it scans in the direction of three o'clock from nine o'clock.
[<-]: If the start point is regarded as the position at six o'clock, it scans in the direction of nine o'clock from three o'clock.

Selecting the scan direction displays the guide indicating the relation between the start and end points in the inspection area and the selected direction on the screen.

When selecting -> (Right-pointing arrow)

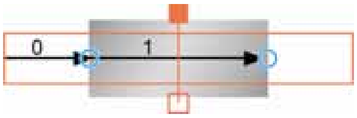
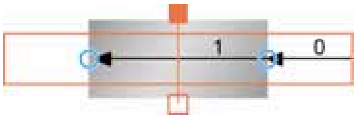
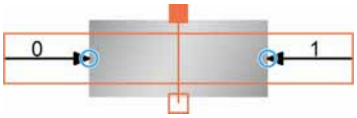
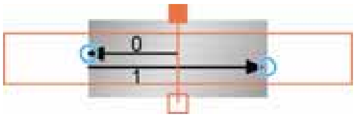


When selecting <- (Left-pointing arrow)



▶ Note

When Detect Mode is "Measure Width", two edges are detected with one cell.
The following is the example that the start point of the area is regarded as the position at six o'clock.

Condition 0	Condition 1	Scan Method	
->	->	Condition 0 and 1 scans edges in the same direction. Edges are scanned in the direction of three o'clock from nine o'clock with Condition 0. Then, edges are scanned with Condition 1 from the edge detection point of Condition 0.	
<-	<-	Condition 0 and 1 scans edges in the same direction. Edges are scanned in the direction of nine o'clock from three o'clock with Condition 0. Then, edges are scanned with Condition 1 from the edge detection point of Condition 0.	
->	<-	Condition 0 and 1 scans edges in opposite directions. Edges are scanned in the direction of three o'clock from nine o'clock with Condition 0, and in the direction of nine o'clock from three o'clock with Condition 1.	
<-	->	Condition 0 and 1 scans edges in opposite directions. Edges are scanned in the direction of nine o'clock from the center of a cell. Then, edges are scanned with Condition 1 in the direction of three o'clock from the edge detection point of Condition 0.	

3. **Set "Scan Method", "Edge Condition", "Edge Threshold" and "Detect Position".**

   These edge detect conditions are the same as Gray Edge checker. Refer to page 117.

   [Scan Method]: Projection / Single
   [Edge Condition]: Both / Light -> Dark / Dark-> Light
   [Edge Threshold]: Default: 50
   [Detect Position]: Front / Peak / Rear
   [Filter], [Width], [Average Range] (Only when selecting "Single".)

4. **Press the TRIG key to run a test and confirm if the edges to detect the approximate line are detected.**

How to read graphs when setting thresholds

It is the same as Smart Edge (Circle). Refer to page 175. However, the horizontal axis of the graph for Smart Edge (Line) is cell numbers.

Setting Approximate Line Detect Condition

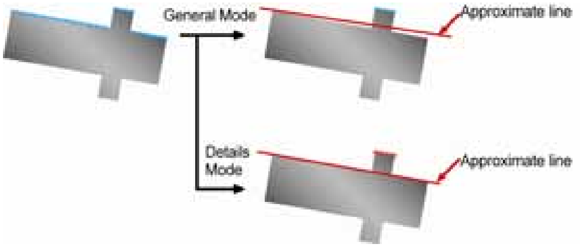
Set the method for detecting an approximate line. Set "Detection Method", "Edge ratio used" and "Execution Mode".

1. **Select “Approximate Line Detect Condition” > "Detection Method".**

   This is a parameter to decide whether or not to use all the edge coordinates detected by each cell for calculating an approximate line.

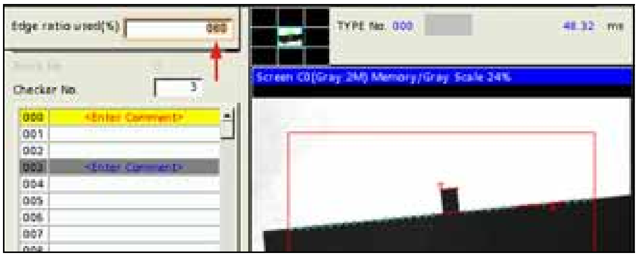
   General Mode:
   Detects an approximate line using all edge coordinates.
   However, if there is a projection or concave in the detected area, the approximate line may shift as the edge coordinates in those parts are also used for the detection.

Details Mode (Default):
When an object has projections or concave surface, using this mode enables those edge coordinates not to use for calculating an approximate line. First, detects an approximate line using all the edge coordinates, and then detects the final approximate line only using the edge coordinates in "Edge ratio used" from those with a smaller error for the first approximate line.
Select "Details Mode" to set "Edge ratio used".



2. Select "Edge ratio used(%)".

The menu for setting "Edge ratio used" appears in the upper left of the screen. The screen window can be checked. The "o" mark indicates used edges and the "x" mark indicates unused edges. Set the value checking the screen.
Default: 80 (%)



Edge ratio used(%) 080

Checker No. 3

TYPE No. 000

48.32 ms

Screen C0(Gray 2M) Memory/Gray Scale 24%

3. Select "Execution Mode".

Default: “Speed First”
When selecting "Accuracy First", the inspection area is tilted to be at right angles to the detected approximate line after the detection, and the approximate line is detected again. Compared to "Speed First", detecting edges more accurately calculates an approximate line with less error. However, the inspection time in "Accuracy First" is longer than the one in "Speed First".

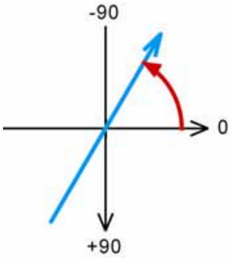
Setting Base Angle

Select a base angle from the following four types for detecting the angle of the approximate line.

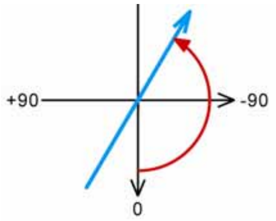
1. Select “Approximate Line Detect Condition” > "Base Angle".

2. Select from “X Direction”, "Y Direction", “Rotation Adjustment Angle” or "Area".

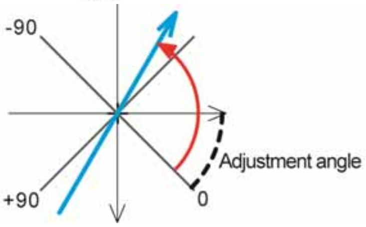
X Direction (Default):
Outputs an angle regarding the position at three o'clock as 0 degree.



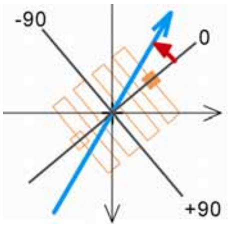
Y Direction:
Outputs an angle regarding the position at six o'clock as 0 degree.



Rotation Adjustment Angle:
Outputs an angle using Rotation adjustment angle as a base.



Area:
Set the position of the end point of the inspection area to 0 degree using the slanted angle of the inspection area as a base.



▶ Note

- The bold line (blue) is the approximate line.
- The above figures show the examples when Calibration Scale is not used or when Calibration Scale is used and "Rightward - Downward" is selected for Coordinate Axis (positive direction).
  Changing the setting of Coordinate Axis may change the value of the detected angle.

Setting Judgement Condition

Perform judgement for the following four conditions respectively. When all the conditions are met, the judgement result of the checker will be OK.

- Measurement: Deviation, Measurement: Distance or Measurement: Width
- Standard deviation (Standard deviation calculated from the result of measurement)
- Linearity
- Unused Edge Count

Setting Denoising function

About Denoising function

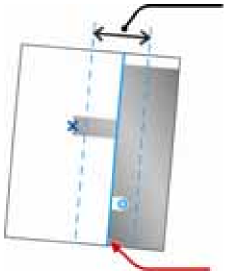
Measurement values are calculated using the edges detected by each cell. However, if cells detect projections, concaves on the surface of the object or noises existing around it as edges, using this function enables those edges not to be used for calculating measurement values. This is "Denoising Function".

Only the edges within a distance or standard deviation specified based on an approximate line are used for the calculation of measurement values.

About Unused Edge Count

In Denoising function, edges excluded from edges to be used for calculation and cells which cannot detect edges are called "unused edge", and edges used for calculating measurement values are called "used edge". The number of each edge is displayed in the left of the screen together with the judgement result of checker.

Figure 1

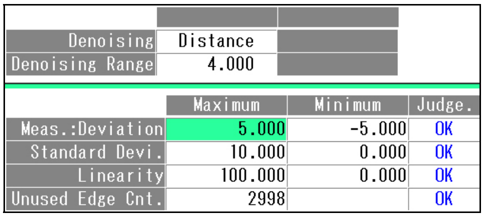


Range of edge positions used for calculation measurement values

Approximate line

1. **Select “Judgement Limits” > "Denoising".**

2. **Use either "Distance" or "Std. Devi." for performing "Denoising".**



Denoising	Distance	
Denoising Range	4.000	

	Maximum	Minimum	Judge.
Meas.:Deviation	5.000	-5.000	OK
Standard Devi.	10.000	0.000	OK
Linearity	100.000	0.000	OK
Unused Edge Cnt.	2998		OK

Distance:
Use the edges within the distance specified in "Denoising" based on an approximate line for the calculation of measurement values.
(Area within the dotted line in Figure 1)

Standard Deviation:
Calculates the standard deviation from an approximate line and the edge coordinates detected by each cell, and uses the edges within the value calculated by the formula mentioned on the right.
(Area within the dotted line in Figure 1)

"Position of approximate line +/- Standard deviation * Denoising range"

The "Standard deviation" used here is calculated based on each coordinate value of an approximate line.

It is different from the "Standard Deviation" displayed on the screen (that is a criterion for judgement).

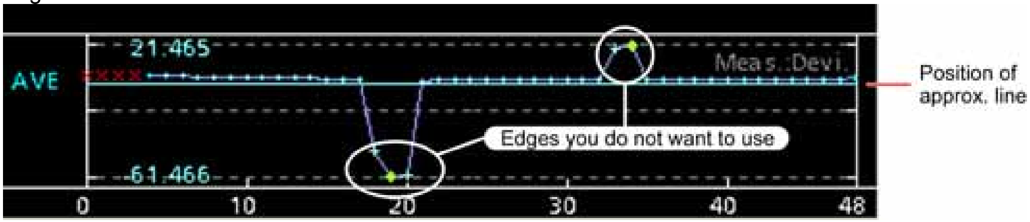
3. **Set "Denoising Range".**

Set the denoising range checking the graph or the result of each cell (Cell Result).

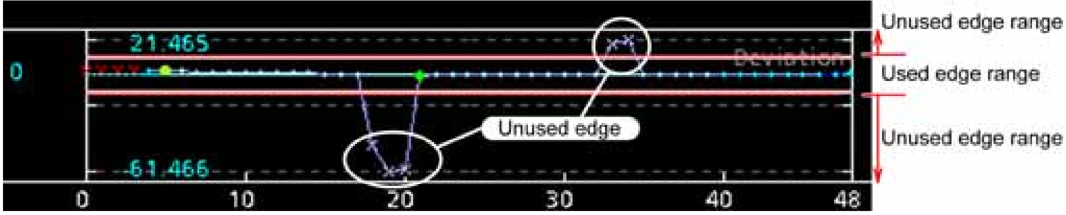
▼Refer to▼

Refer to page 193 for details of Cell Result.

The figure below shows an example that Denoising is not used. Multiple edges in the two areas are targeted for measurement.



Using Denoising function displays lines above and below the approximate line which divides the range of unused edges from the range of used edges.
Changing the value of the denoising range makes the space between the lines wider or narrower.
Check the graph and make the setting to let the target edges in the range of unused edges.



Setting the denoising range to a larger value expands "Used edge range".

▶ Note

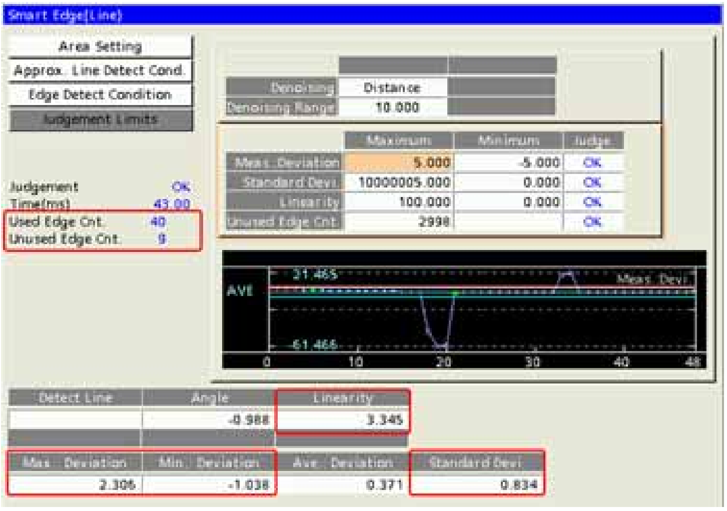
- The "x" mark (red) in the graph indicates the cell that detects no edge. Although it is displayed in the used edge range, it is counted as an unused edge.
- The graph of "Deviation" is always displayed here regardless of the inspection mode.

Setting Judgement Limits

1. **Select the table of maximum/minimum values in "Judgement Limits" setting window.**

2. **Specify the maximum and minimum measurement values of deviation (distance/width).**

As the maximum and minimum measurement values are displayed at the bottom of the screen, make the setting checking it.
In addition, red lines indicating the maximum and minimum values are displayed in the graph. Confirm them and set.



Judgement OK
Time(ms) 43.00
Used Edge Cnt. 40
Unused Edge Cnt. 9

Denoising	Distance
Denoising Range	10.000

	Maximum	Minimum	Judge
Meas. Deviation	5.000	-5.000	OK
Standard Devi.	10000005.000	0.000	OK
Linearity	100.000	0.000	OK
Unused Edge Cnt.	2998		OK

Detect Line	Angle	Linearity
	-0.988	3.345

Max. Deviation	Min. Deviation	Ave. Deviation	Standard Devi.
2.306	-1.038	0.371	0.834

3. **Specify the maximum and minimum values of standard deviation and linearity.**

As the current value of each condition is displayed at the bottom of the screen, make the setting checking it.

4. **Specify the maximum value for "Unused Edge Count".**

Default: 2998
The current value of the unused edge count (test result) is displayed on the left of the screen. Confirm it and set.

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image or checker pattern easily, set “Window Transparency (SETUP menu)” to a larger value. (“Change Window Transparency (SETUP Menu)”, page 342)

1. **Press the TRIG key.**

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

▶ Note

Position adjustment and area size adjustment are also executed if they have been set.

2. **Check data of detected area list.**

Check the graph, data of approximate line, measurement data and judgement result to be displayed on the screen.

Error messages when running a test

If Smart Edge (Line) is not performed properly when running a test, error numbers and messages are displayed in the checker list.

Error No.	Message	Cause
E0040	The approximate line cannot be calculated.	When the detected edge count is less than 2
E0041	Edge required for measurement cannot be detected.	• When all edges are excluded with the denoising function • When there is no cell that two cells are detected in Width measurement mode

4.7.16 Color Window

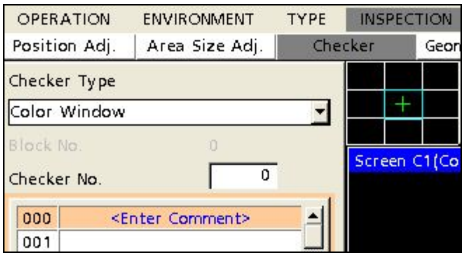
What is Color Window?

Color window calculates the maximum, minimum, average and standard deviation values based on the gray values of R, G and B of every pixel in the inspection area on a color image captured by a color camera, and then judges as OK/NG using the values.
For further information, refer to the User's Manual Color Operation Guide.

Output Data

Each max. value of R,G,B:	If the pixels of white (R,G,B) = (255,255,255) and black (R,G,B) = (0,0,0) exist in the inspection area, each maximum value of RGB is 255 and minimum value is 0.
Each min. value of R,G,B:	
Each average value of R,G,B:	
Each standard deviation of R,G,B:	
Judgement results of each color:	Outputs the following three types of judgement results for each color respectively. - Gray Value: If the gray value of each color is within the allowable range you have set, the object is judged as "OK", if it exceeds the allowable range, the object is judged as "NG". - Gray Average: If the gray average of each color is within the allowable range you have set, the object is judged as "OK", if it exceeds the allowable range, the object is judged as "NG". - Gray Standard Deviation: If the gray standard deviation of each color is within the allowable range you have set, the object is judged as "OK", if it exceeds the allowable range, the object is judged as "NG".
Judgement:	When judgements of R, G and B (Gray value, Gray average, Gray standard deviation) are all "OK", judgement of the checker will be "OK".

Specifying Checker No.



Checker Type: Color Window

Block No. 0

Checker No. 0

000 <Enter Comment>

001

1. **Select “Color Window” in "Checker Type".**

2. **Select the checker No. list and specify a checker number to set.**

3. **Press the ENTER key to determine the checker No.**

The "Color Window" setting window is displayed. The color image is displayed on the screen window.

Selecting a Camera

Select a camera image to set “Color Window” checker.

1. **Select “Area Setting” in “Color Window” setting window.**

2. **Select a camera No. in “Camera”.**

The image of the selected camera is displayed. Although a gray camera can be selected, the checker cannot be executed. Be sure to select a color camera, otherwise checker execution will result in an error.

▶ Note

Select a displayed image type (Live/Memory) or magnification in “Image Menu” opened by pressing the F1 key.

Setting Inspection Area

Set an area to measure R, G and B values.

1. **Select “Area Setting” in “Color Window” setting window.**

2. **Select "Area Setting".**

   “Area Setting” window is displayed.

3. **Select a shape of inspection area from “Change Shape”.**

   Select from Rectangle, Ellipse, Circle and Polygon.

4. **Select “Change” and draw an area.**

   For details, refer to page 47 “Specifying an Inspection Area”.

5. **After drawing is completed, press the CANCEL key.**

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker.

Refer to Chapter 4.9, page 215 about Area Size Adjustment and the setting procedure.

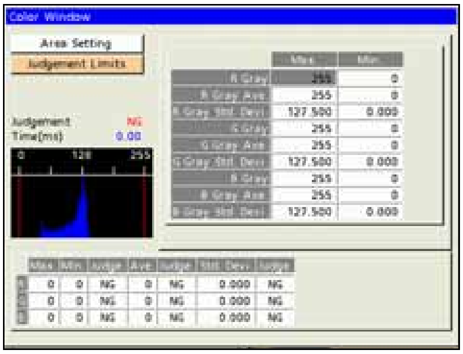
When you want to exclude an area from inspection (Mask area)

Up to 16 mask areas, where checker does no inspection, can be set in an inspection area.
Select "Add Mask" in “Area Setting”, specify a shape, and draw an area. Refer to section of Setting a Mask Area (page 51) for details.

Setting Judgement Condition

Perform judgement for the following three conditions on three color elements (R, G, B) respectively. When judgements of all conditions are "OK", judgement of the checker will be "OK".

Gray Value:	Judges using the maximum and minimum values of the target color element.
Gray Average:	Judges using the average value of the target color element.
Gray Standard Deviation:	Judges using the standard deviation of the target color element.



Judgement NG
Time(ms) 0.00

	Max	Min
R Gray	255	0
R Gray Ave	255	0
R Gray Std. Devi	127.500	0.000
G Gray	255	0
G Gray Ave	255	0
G Gray Std. Devi	127.500	0.000
B Gray	255	0
B Gray Ave	255	0
B Gray Std. Devi	127.500	0.000

	Max	Min	Judge	Ave.	Judge	Std. Devi.	Judge
[illegible]	0	0	NG	0	NG	0.000	NG
[illegible]	0	0	NG	0	NG	0.000	NG
[illegible]	0	0	NG	0	NG	0.000	NG

1. **Select “Judgement Limits”.**

2. **Set the maximum and minimum values of "R Gray", "R Gray Ave." and "R Gray Std. Devi.".**

   As the maximum, minimum, average values and standard deviation of R are displayed at the bottom of the screen, make the setting checking them. A luminance graph showing the gray level distribution of R is also displayed at this time.

   ▶ Note

   The magnification of the vertical axis of luminance graph can be changed. Refer to page 86 on how to change it.

3. **Set the maximum and minimum values of "G Gray", "G Gray Ave." and "G Gray Std. Devi.".**

4. **Set the maximum and minimum values of "B Gray", "B Gray Ave." and "B Gray Std. Devi.".**

5. **After drawing is completed, press the CANCEL key.**

Running a Test and Confirming Result

Set an area to measure R, G and B values.

1. **Press the TRIG key.**

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

▶ Note

Position adjustment and area size adjustment are also executed if they have been set.

2. **Check data of the result list.**

Check the maximum, minimum, average values, standard deviation and judgement result to be displayed on the screen.

Error messages when running a test

If Color Window is not performed properly when running a test, error numbers and messages are displayed in the checker list.

Error No.	Message	Cause
E0080	The operation cannot be executed with the selected camera.	The selected camera is a gray camera.

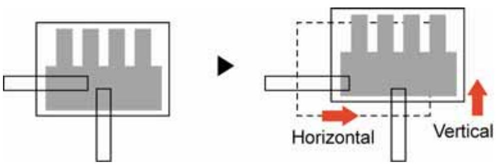
4.8 Adjusting Area Position (Position Adjustment)

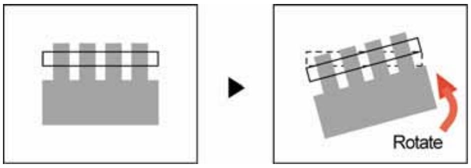
4.8.1 What Is Position Adjustment?

If positions of checker areas are fixed, inspections cannot be executed properly when an object moved only a short distance.

Position Adjustment allows inspecting properly even if an object is displaced, by detecting the current position of the object and reflecting its shift amount from the base position to checkers.

You can set up to 1000 position adjustment checkers per type (when 10 blocks are used).





PV200 has multiple types of position adjustments to detect the position and the rotation angle of an object.

Position Adjustment (Horizontal/vertical shift amount)

After each checker detected the position of the object, Position Adjustment calculates the misalignment between the object and the base position. To detect an object, select from the following six types.

Binary Edge / Gray Edge / Feature Extraction / Matching / Smart Edge (Circle) / Smart Edge (Line)

Position Rotation Adjustment (Horizontal/vertical position and angle shift amount)

Position/Rotation Adjustment detects position (coordinates) and angle of an object using checkers and calculates the misalignment from the base position and rotating angle from the base angle.

To detect an object, select from the following five types.

Feature Extraction (Principal axis angle) / Matching (360-dgree) / Feature Extraction (2 checkers) / Matching (2 checkers) / Smart Edge (Line)

Rotation Adjustment (rotated amount), Position Adjustment (horizontal/vertical shift amount)

Rotation Adjustment detects the angle of an object using checkers and calculates the rotating angle from the base angle.

To detect an object, select from the following six types.

Binary Edge (Horizontal) / Binary Edge (Vertical) / Gray Edge (Horizontal) / Gray Edge (Vertical) / Smart Edge (Line) (Horizontal) / Smart Edge (Line) (Vertical)

4.8.2 Position Adjustment Type

Position Adjustment

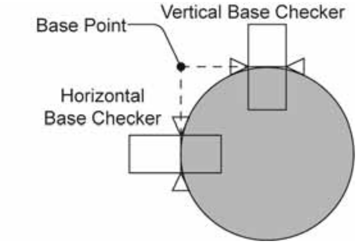
Binary Edge and Gray Edge

These checkers detect in the same method of Binary Edge checker and Gray Edge checker. The X/Y coordinates of the detected edge is considered as a base position.

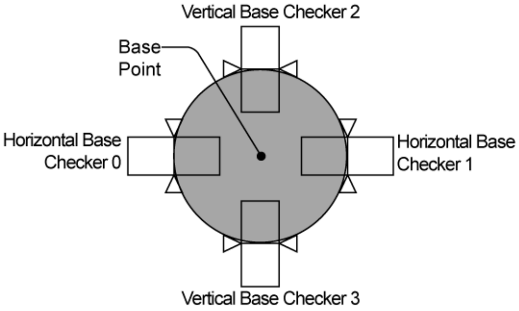
They also have the Center detection function which decides a base position by calculating the middle of the detected two points both in horizontal and vertical directions.

▶ Note

Only one direction either horizontal or vertical can be set.



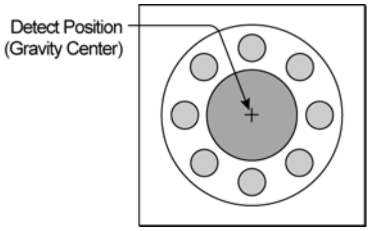
Center Detection



Feature Extraction

This checker detects the gravity center of an object in the same method of Feature Extraction checker.

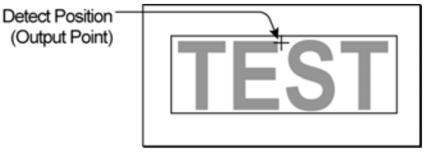
It considers the detected coordinates of the gravity center as a base position.



Matching

This checker detects an object in the same method of Smart Matching checker.

The output point of the detected object will be considered as the base position.

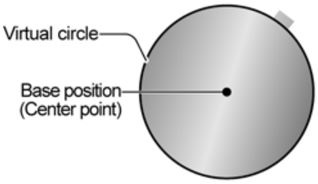


Smart Edge (Circle)

This checker detects a virtual circle in the same method of "Detect Mode: Radius" for Smart Edge (Circle).

The coordinate of the center of the detected virtual circle will be considered as the base position.

If a whole circumference cannot be captured, or for a rounded angle, the position detection is possible.

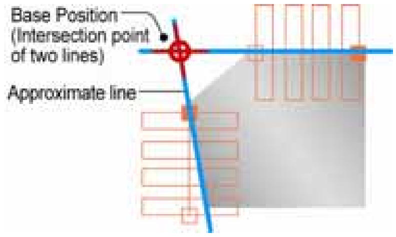


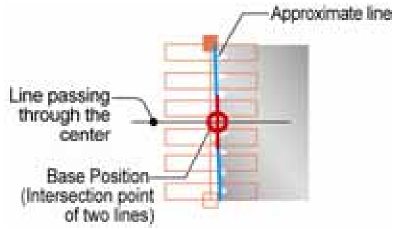
Smart Edge (Line)

This checker detects an object in the same method of Smart Edge (Line)

When the horizontal base checker and vertical base checker are both set, the intersection point of two approximate lines will be considered as the base position.

When only the horizontal base checker or vertical base checker is set, the intersection point of the approximate line and the line passes through the center of the inspection area will be considered as the base position.

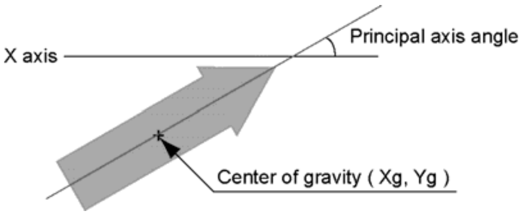



Approximate line
Line passing through the center
Base Position (Intersection point of two lines)

Position/Rotation Adjustment

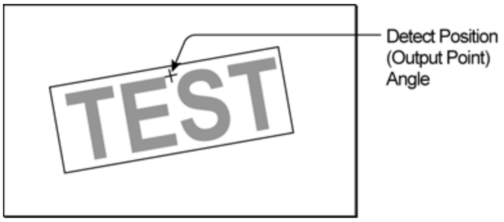
Feature Extraction (Principal Axis Angle)

This checker detects the gravity center and the principal axis angle of an object in the same method of Feature Extraction checker. It considers the detected coordinates of the gravity center and the angle as a base position and base angle respectively. The range of a detected angle is +/- 90 degrees.



Matching 360-degree

This checker detects the position of an object (output point coordinates) and the rotation angle in the same method of Smart Matching. It considers the detected coordinates and the angle as a base position and base angle respectively.

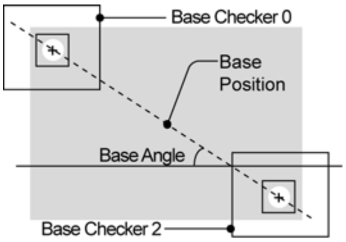


▶ Note

Subtraction function of Matching checker is not available.

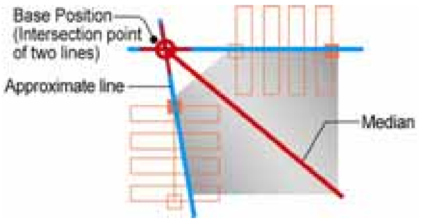
Feature Extraction (2 checkers) and Matching (2 checkers)

It considers an angle which are formed by X axis and a line between two gravity centers detected by two Feature Extractions or between two output points detected by two Smart Matchings as a base angle. And also it considers the middle point of the line as a base position.



Smart Edge (Line)

This checker detects an object in the same method of Smart Edge (Line) The intersection point of two approximate lines detected with two base checkers is considered as the base position, and the angle of the median on two approximate lines is considered as the base angle.



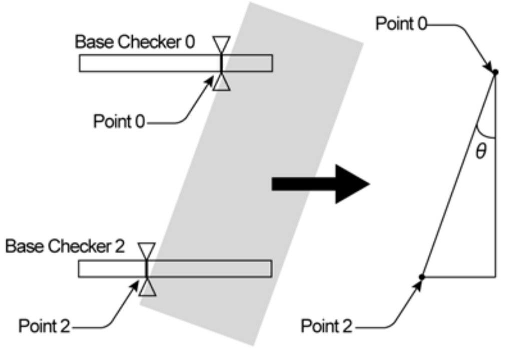
Rotation Adjustment

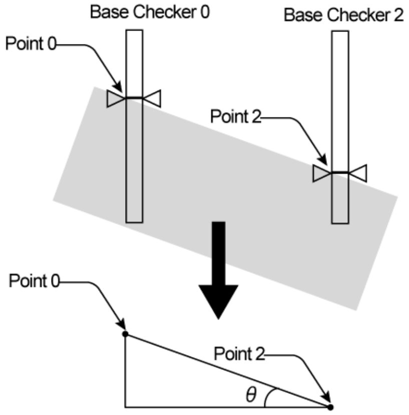
Binary Edge (Horizontal) / Binary Edge (Vertical), Gray Edge (Horizontal) / Gray Edge (Vertical)

These checkers detect two points in the same method of Binary Edge checker or Gray Edge checker, and calculates an object gradient.

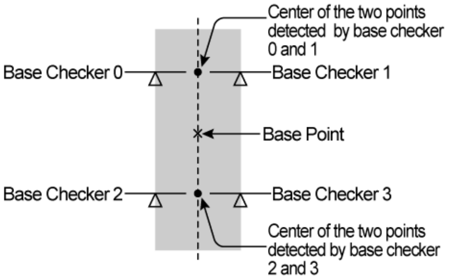
Binary Edge (Horizontal) and Gray Edge (Horizontal) scan horizontally to detect edges. Binary Edge (Vertical) and Gray Edge (Vertical) scan vertically to detect edges.

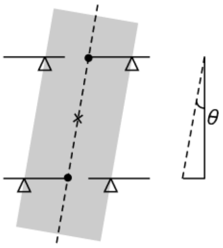
These checkers can obtain a middle point of two points (center detection) other than edges of an object as a base position.





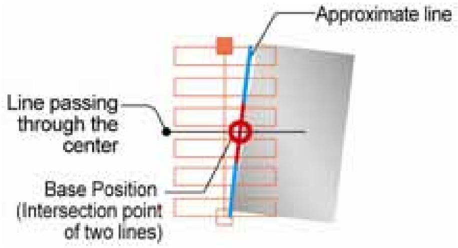
Center Detection

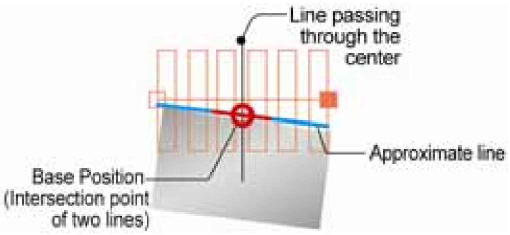

Center of the two points detected by base checker 0 and 1
Base Checker 0
Base Checker 1
Base Point
Base Checker 2
Base Checker 3
Center of the two points detected by base checker 2 and 3



Smart Edge (Line) (Horizontal), Smart Edge (Line) (Vertical)

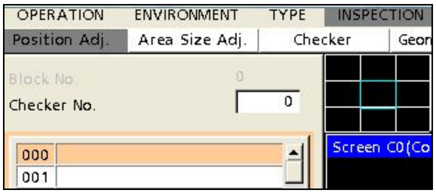
The angle of the approximate line detected in the same method of Smart Edge (Line) is considered as the base angle. The base coordinate is the intersection point of the line passing through the center of the inspection area and the approximate line.


Approximate line
Line passing through the center
Base Position (Intersection point of two lines)


Line passing through the center
Approximate line
Base Position (Intersection point of two lines)

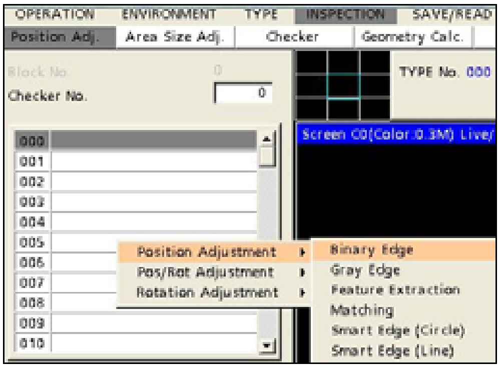
4.8.3 Setting a Position Adjustment

Selecting a number and a type of Position Adjustment



1. **Select “INSPECTION” > "Position Adj.".**

2. **Select the checker No. list and specify a Position Adjustment checker number to set.**



3. **Move the cursor onto a type of Position Adjustment to create.**

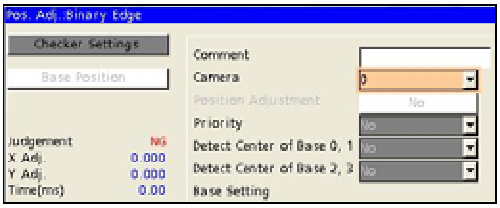
The list of detection methods available in the selected Position Adjustment is displayed.

4. **Tilt the ENTER key right and then up/down to select a detection method.**

The setting window of selected Position Adjustment is displayed.

Selecting a Camera

Select a camera image to set Position Adjustment.



Judgement NG
X Adj. 0.000
Y Adj. 0.000
Time(ms) 0.00
Camera 0
Position Adjustment No
Priority No
Detect Center of Base 0, 1 No
Detect Center of Base 2, 3 No

1. **Select “Checker Settings" in “Pos. Adj.” setting window.**

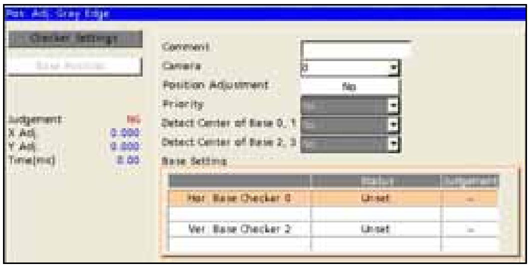
2. **Select a camera No. in “Camera”.**

The image of the selected camera is displayed.

▶ Note

Select a displayed image type (Live/Memory and Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Creating a Base Checker



Pos. Adj.:Gray Edge

Comment
Camera 0
Position Adjustment No
Priority
Detect Center of Base 0, 1
Detect Center of Base 2, 3
Base Setting

	Status	Judgement
Hor. Base Checker 0	Unset	–
Ver. Base Checker 2	Unset	–

Judgement NG
X Adj. 0.000
Y Adj. 0.000
Time(ms) 0.00

1. **Select "Base Setting" in "Checker Settings" setting window.**

   Now, it is ready for base checker setting.

2. **Select a base checker to set.**

   The setting window of selected base checker is displayed.

3. **Set necessary items.**

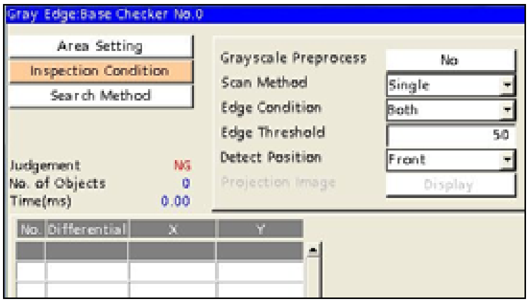
   The setting procedure is the same as the other checkers. For more details, refer to the chapter of description of each checker.

   ▶ Note

   Some items displayed in checkers are not displayed in Position Adjustment. Nondisplayed items cannot be set in Position Adjustment.

4. **Press the TRIG key to execute a test.**

   Only the currently setting base checker can be tested. Confirm a test result in the same way of normal checkers.



Gray Edge:Base Checker No.0

Grayscale Preprocess No
Scan Method Single
Edge Condition Both
Edge Threshold 50
Detect Position Front
Projection Image

Judgement NG
No. of Objects 0
Time(ms) 0.00

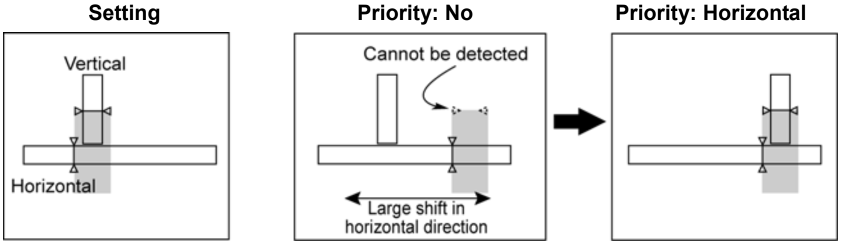
No.	Differential	X	Y

About Priority

The Priority function is effective if an object moves largely either vertically or horizontally. When the object moves largely in the horizontal direction, set to "Horizontal". When it moves largely in the vertical direction, set to "Vertical".

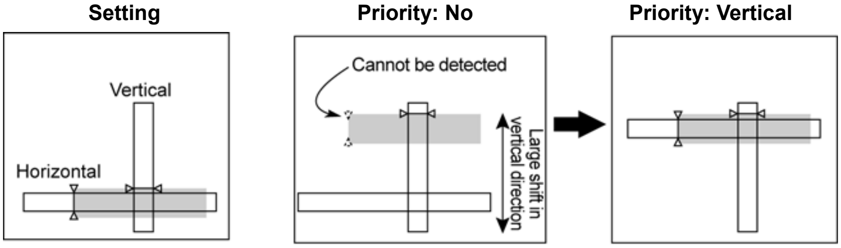
Example) When setting to "Horizontal", this checker calculates a horizontal shift amount first using the horizontal base checker. And then, when executing the vertical base checker, it moves the area horizontally by the shift amount calculated with the horizontal base checker and calculates a vertical shift amount at this position. (When setting to "Vertical", the procedure is the other way round.)

Horizontal Case



Setting Priority: No Priority: Horizontal

Vertical Case

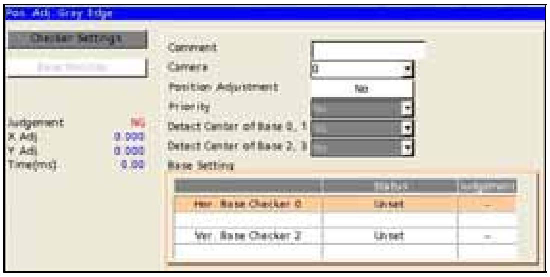


Setting Priority: No Priority: Vertical

When adjusting position by detecting the center

1. **Select "Base Setting" in “Checker Settings” setting window.**

   Now, it is ready for base checker setting.
   At this moment, “Detect Center” cannot be selected.



Comment
Camera 0
Position Adjustment No
Priority No
Detect Center of Base 0, 1 No
Detect Center of Base 2, 3 No
Base Setting

Judgement NG
X Adj 0.000
Y Adj 0.000
Time(ms) 0.00

	Status	Judgement
Hor. Base Checker 0	Unset	--
Ver. Base Checker 2	Unset	--

2. **Select base checkers to detect the center (Horizontal base checker 0 and Vertical base checker 2).**

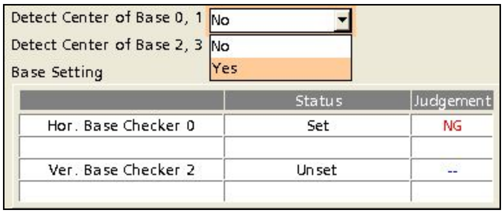
   The setting window of the selected base checker is displayed.

3. **Set an area and a condition for the base checker.**

4. **Press the CANCEL key to go back to the condition setting window.**

   Now, “Detect Center” of the set base checker can be selected.

   Example: When setting horizontal base checker No.0, “Detect Center of Base0, 1” will be activated.

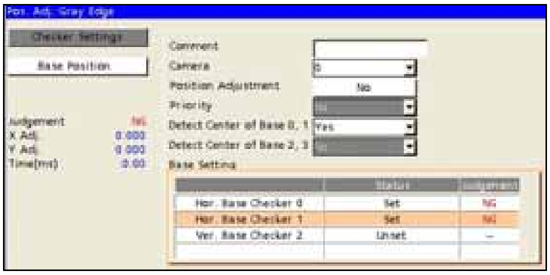


Detect Center of Base 0, 1 No
Detect Center of Base 2, 3
Base Setting

	Status	Judgement
Hor. Base Checker 0	Set	NG
Ver. Base Checker 2	Unset	--

5. **Select “Yes” for “Detect Center of Base 0, 1”.**

   In the Base Setting field, Checker1 (or Checker3) is created.
   The created base checker has the same area and conditions of the base checker set in the step 3.



Comment
Camera 0
Position Adjustment No
Priority No
Detect Center of Base 0, 1 Yes
Detect Center of Base 2, 3 No
Base Setting

Judgement NG
X Adj 0.000
Y Adj 0.000
Time(ms) 0.00

	Status	Judgement
Hor. Base Checker 0	Set	NG
Hor. Base Checker 1	Set	NG
Ver. Base Checker 2	Unset	--

6. **Select the created base checker.**

7. **Move the area of the base checker and change the conditions as necessary.**

8. **After setting is completed, press the CANCEL key.**

   The procedure after this is the same as when detecting no center.

Deleting a Base Checker

With Position Adjustment - Binary Edge/ Gray Edge/ Smart Edge (Line), adjusting only either of horizontally or vertically can be performed. To delete (restore to be unset) the horizontal base checker or vertical base checker that has been "Set", operate from the pop-up menu.

1. **Move the cursor onto the set base checker to delete.**

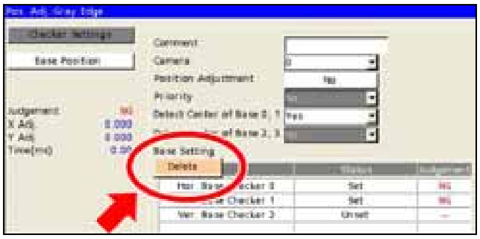
2. **Press the FUNC key.**

The pop-up menu appears.

3. **Select "Delete".**

When the dialog message appears, select “Yes”.

The selected base checker is deleted and “Status” field changes to “Unset”.



Registering Base Position

Register the current object position as a base position.

Note

- When the displayed image is a live image, Position Adjustment scans a newly captured image and the detected position and angle are registered as a base. When displaying a memory image, it scans the currently displayed image and the detected position and angle are registered as a base.
- Displaying a message other than “Register a Base Position,” in the message display area indicates that the checker could not detect an object in a base checker test. Change the setting of a base checker with NG display in the judgement field.

Position Adjustment - Binary Edge, Gray Edge, Smart Edge (Circle), Smart Edge (Line), Position Rotation Adjustment - Smart Edge (Line) and Rotation Adjustment

1. **Select "Base Position".**

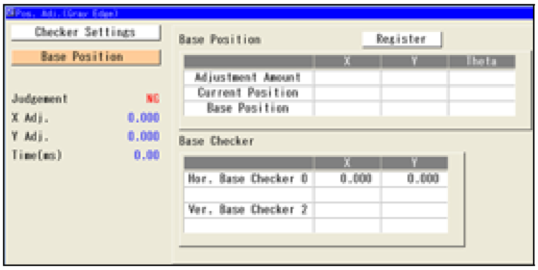
2. **Select "Register".**

3. **When the dialog message appears, select “Yes”.**

Correctly registering a base position displays values in the list of Adjustment Amount, Current Position, Base Position, and Base Checker.

Note

If a base position cannot be registered, return to the Condition setting window and reconsider the settings of the base checker judged as NG.



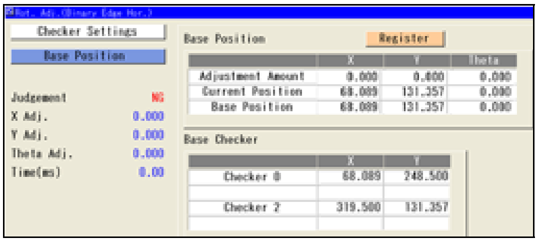
Judgement NG
X Adj. 0.000
Y Adj. 0.000
Time(ms) 0.00

Base Position

	X	Y	Theta
Adjustment Amount			
Current Position			
Base Position			

Base Checker

	X	Y
Hor. Base Checker 0	0.000	0.000
Ver. Base Checker 2		



Judgement NG
X Adj. 0.000
Y Adj. 0.000
Theta Adj. 0.000
Time(ms) 0.00

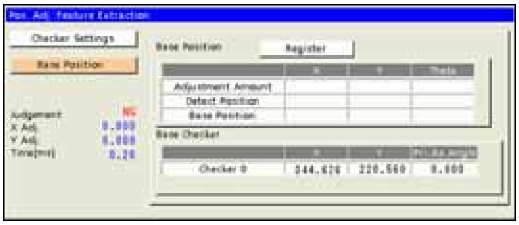
Base Position

	X	Y	Theta
Adjustment Amount	0.000	0.000	0.000
Current Position	68.089	131.357	0.000
Base Position	68.089	131.357	0.000

Base Checker

	X	Y
Checker 0	68.089	248.500
Checker 2	319.500	131.357

Position Adjustment - Feature Extraction, Matching and Pos/Rot Adjustment (Except Position Rotation Adjustment - Smart Edge (Line))



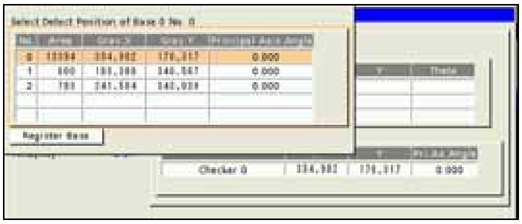
1. **Select "Base Position".**

2. **Select "Register".**

The window to select an object to use in Position Adjustment from the detected objects appears. Even if only one result is detected, this window is displayed.

▶ Note

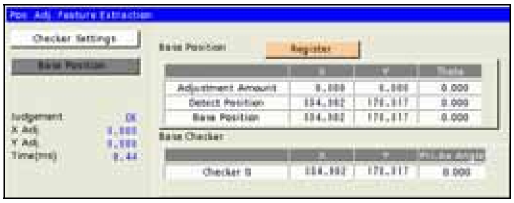
If nothing in the list, no object can be detected. Adjust the conditions.



3. **Select the list.**

4. **Select a number of detect position to use Position Adjustment.**

Adjust the inspection condition and sorting order in the base checker menu so that the selected detection object always be the same number.
The selected detection object is displayed in pink on the screen window.



5. **Press the Cancel key.**

6. **Select "Base Position".**

7. **When the dialog message appears, select "Yes".**

Correctly registering a base position displays values in the list of Adjustment Amount, Current Position, Base Position, and Base Checker.

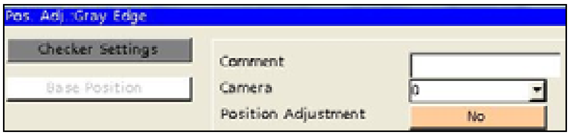
4.8.4 Applying Position Adjustment to Checkers

Which Position Adjustment is applied to checkers must be determined because multiple Position Adjustments can be registered for a Type. To do so, select a Position Adjustment in Area Setting window of each checker.

The procedure is an example of the case when using Position Adjustment checker for the source (of which adjustment amount is referred) and target (which refers to the adjustment mount) both. The procedure is the same when target checkers are other than Position Adjustment (Checkers, Area Size Adjustment).

1. **Select a target checker.**

(In this example, Position Adjustment (Gray Edge))



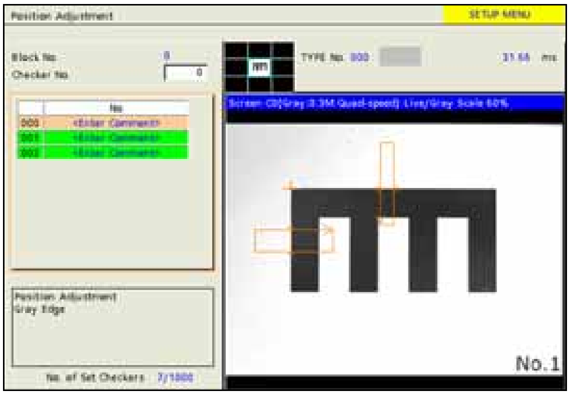
Comment
Camera 0
Position Adjustment No

2. **Select "Checker Settings".**

When target checker is other than position adjustment, select “Set” of “Area Setting”.

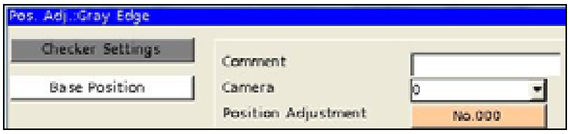
3. **Select "Position Adjustment".**

The list of Position Adjustments that have been set is displayed.
As selecting a number with the cursor, the Position Adjustment area of the number is displayed in orange on the screen window. Observe it to select.



4. **Select a Position Adjustment No. to refer the adjustment amount.**

The selected type No. is displayed in the “Position Adjustment” field.
To cancel applying a position adjustment, select “No” in the top of the list.



Comment
Camera 0
Position Adjustment No.000

▶ Note

* About selectable position adjustment

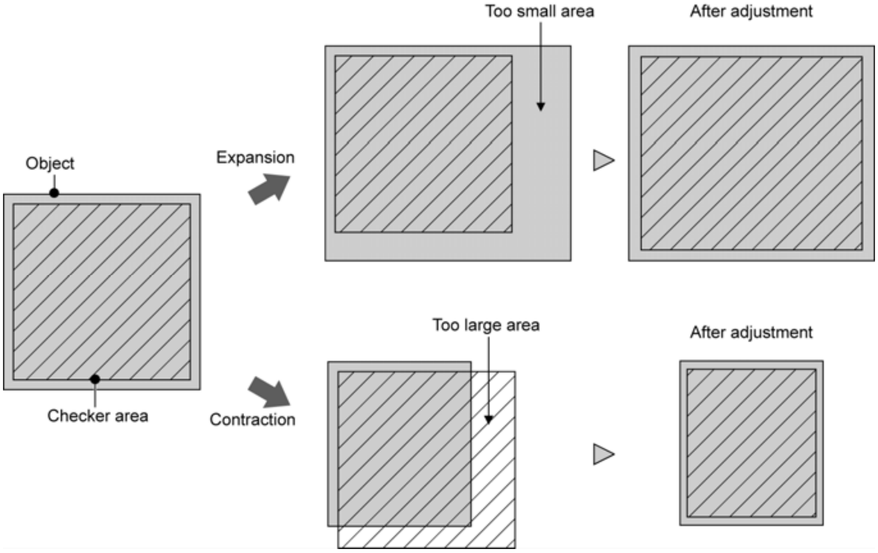
When target checker is Position Adjustment

The number of Position Adjustment checkers must be lower than the number of the currently setting Position Adjustment.

If the currently setting Position Adjustment is No.9 with camera No.0, only the set Position Adjustment checkers of No.0 to 8 are displayed.

4.9 Adjusting Area Size (Area Size Adjustment)

This function expands or contracts the inspection area or mask area to fit a variable-sized object. The function detects the part which signifies an object size, such as edges of the object or register marks, and expands or contracts a checker area based on the coordinates of the part.



▶ Note

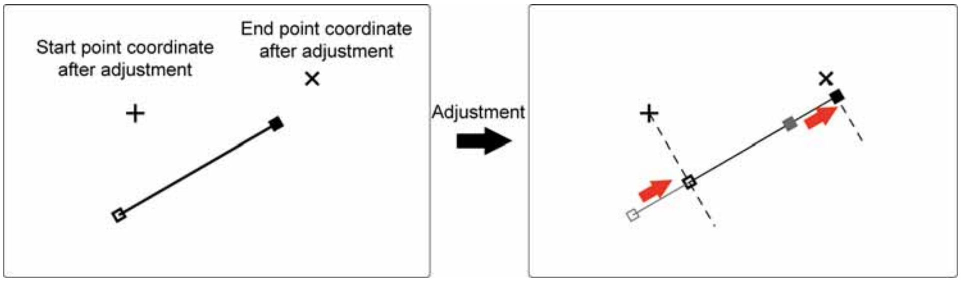
Area Size Adjustment is not available for some checkers. In the checkers which can use Area Size Adjustment, “Area Size Adj.” is displayed in the setting window of each checker.

Available:	Line, Binary Window, Gray Window, Binary Edge, Gray Edge, Feature Extraction, Flaw Detection, Connector (Binary Window), Connector (Gray Window), Smart Edge (Circle), Smart Edge (Line), Color Window
Not available:	Smart Matching, Connector (Gray Edge), Position Adjustment, Area Size Adjustment

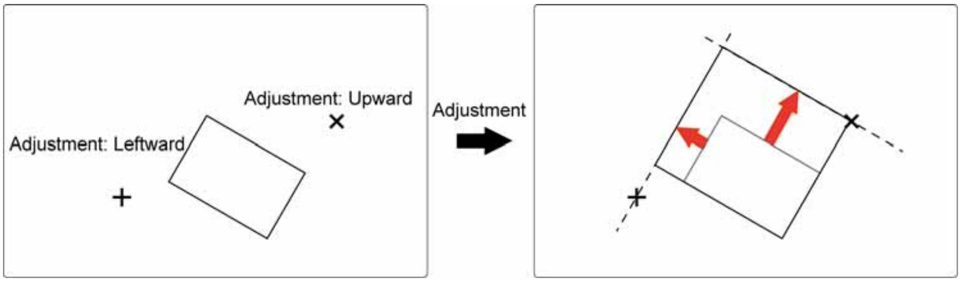
In the Case of Diagonal Inspection Area

When applying Area Size Adjustment on a diagonal inspection area, the function expands or contracts the area without changing the angle.

Example 1:
Line


Start point coordinate after adjustment
End point coordinate after adjustment
Adjustment

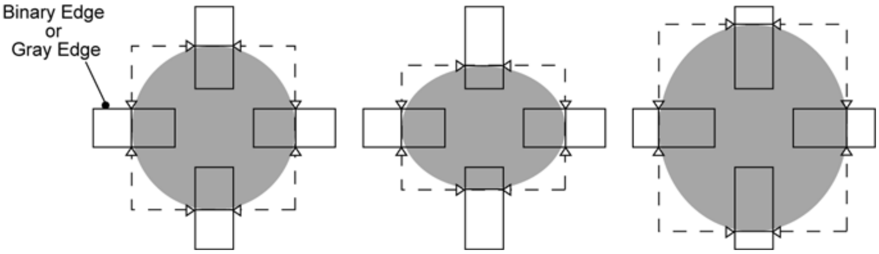
Example 2:
Rectangle, circle, or polygon



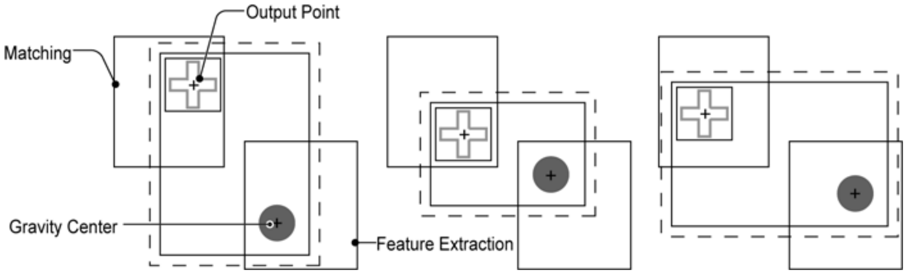
Detecting a Object Size

Binary Edge, Gray Edge, Feature Extraction, Smart Matching and Smart Edge (Line) can be set to detect an object size in Area Size Adjustment.

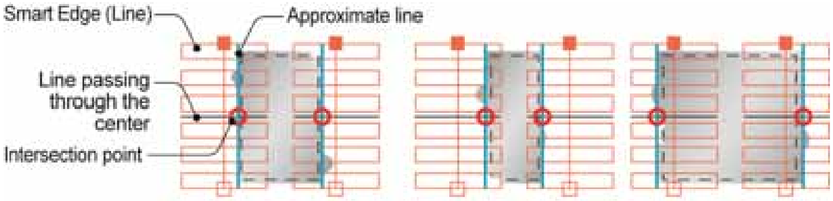
Example 1:



Example 2:



Example 3:



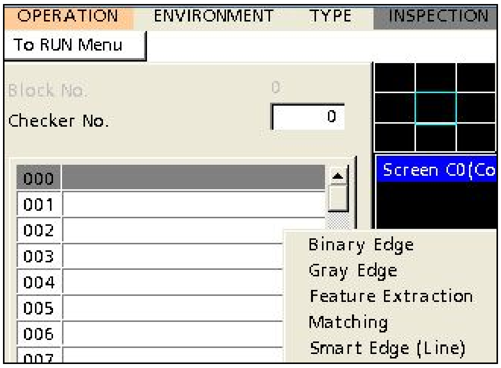
▶ Note

If Area Size Adjustment detects multiple parts, the coordinates of result No.0 is used to adjust the area.

When there is a possible to detect multiple parts, sort them so that the desired part is always No.0.

Creating a Area Size Adjustment Checker

Although Area Size Adjustment provides No.0 to 999 per type (if the number of used block is 10), the setting limit is 1000 checkers combined with Position Adjustment.



Block No. 0

Checker No. 0

1. **Select “INSPECTION” > "Area Size Adj.".**
2. **Select the checker No. list and specify a checker (Area Size Adjustment) number to set.**
3. **Select a type of Area Size Adjustment to create.**

   The setting window of the selected Area Size Adjustment is displayed.

▼Refer to▼

The procedure after here is the same as the checker of the type that you select to create an Area Size Adjustment. Refer to the following page for details.

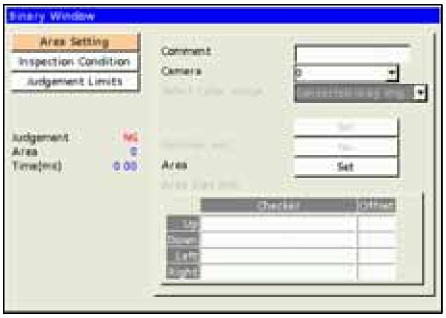
- Binary Edge: page113
- Gray Edge: page 117
- Feature Extraction: page 122.
- Matching: page 128.
- Smart Edge (Line): page 188

Using Area Size Adjustment for Checkers

Multiple Area Size Adjustment checkers can be set. For performing auto adjustment of the area size of each checker, select an Area Size Adjustment checker to use its coordinates for the adjustment.

▶ Note

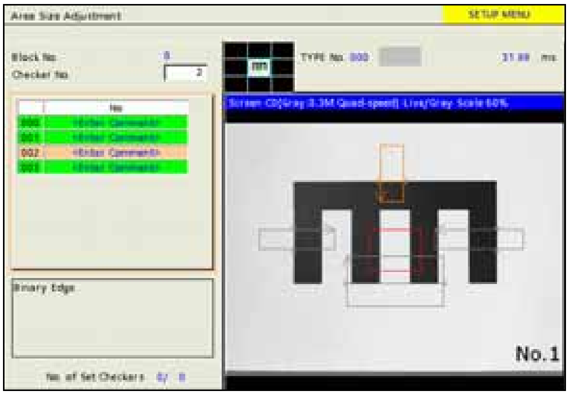
After using Area Size Adjustment, the area frame (checker pattern) is displayed in the adjusted size. However, the positions of the start point (ST) and end point (ED) that are displayed by selecting "Area Setting" > "Change" are on the coordinates before the area size adjustment is made.



1. **Select a checker to adjust the size.**

2. **Select "Area Setting".**

3. **Select the table of "Area Size Adjustment".**



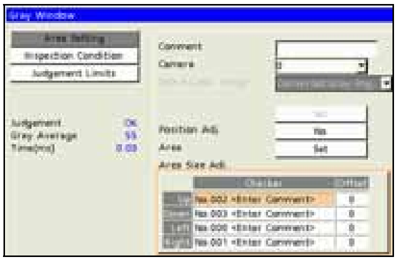
4. **Select a point which you want to adjust, start point, end point, up, down, left or right.**

   The list of Area Size Adjustments that have been set is displayed.
   As selecting a number with the cursor, the Area Size Adjustment area of the number is displayed in orange on the screen window. Observe it to select.

5. **Select an Area Size Adjustment checker.**

   The screen returns to Area Setting of the checker and the selected number of Area Size Adjustment is displayed.

   Repeat the procedure and select Area Size Adjustment checkers as necessary. (You can also set just a single part such as only start point.)

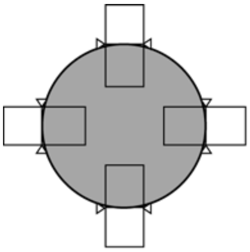


6. **Specify the offset value as necessary.**

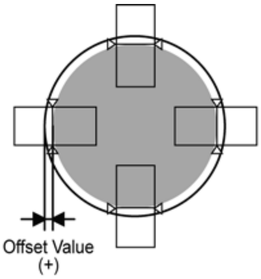
About Offset Value

Offset Value is to create an area outside (side of larger area) or inside (side of smaller area) of the coordinates of an edge, a gravity center, or an output point detected by Area Size Adjustment checker. You can specify different values for each of up, down, left and right.

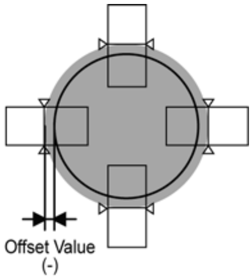
Offset = 0



Offset = +1 to 128



Offset = -1 to -128

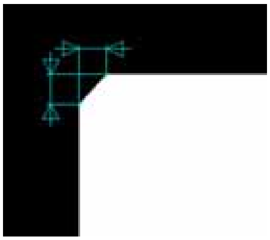


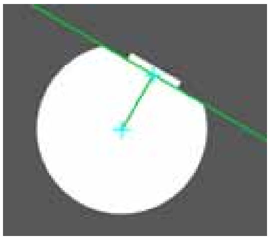
4.10 Geometry Calculation of Detected Data

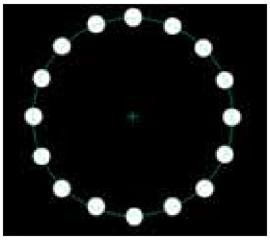
4.10.1 What is Geometry Calculation?

Geometry Calculation is a function that calculates the distance between two points, intersection point of two lines and median using the data detected with each checker. With this function, only specifying the result detected by a checker enables to execute calculation without setting any operation expression.

Inspection examples


Measurement of C-cut size

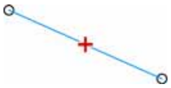
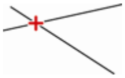
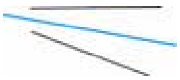
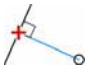
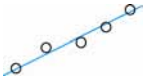
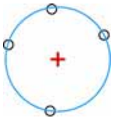
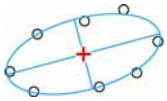

Measurement of distance between D-cut point and center


Measurement of approximate circle with multiple points

▶ Note The figures drawn in the image examples in this chapter includes the images drawn with the "Character/Figure Drawing" function.

Types of Geometry Calculation

The following seven types of geometry calculations are available.

Type of calculation			Output Data
Distance Point-Point		Detects the distance between two points , the line connecting two points and its median.	• Distance between two points • Coordinate X and Y of median • Line angle • Line element (a, b, c)
Intersecting Point		Detects the intersecting point and the angle of two lines	• Coordinate X and Y of Intersecting point • Intersecting angle of two lines
Median		Detects the intersecting angle of two lines and the median (bisector) of the angle.	• Intersecting angle of two lines • Median angle • Median element (a, b, c)
Distance Point-Line		Detects the intersecting point of a perpendicular to a line through a point, and the length of the perpendicular.	• Pedal X and Y • Length of perpendicular (Distance between point and line) • Perpendicular angle • Perpendicular element (a, b, c)
Approximate Line		Detects the approximate line from multiple coordinate values.	• Approximate line angle • Approximate line element (a, b, c) • Standard deviation
Approximate Circle		Detects the approximate circle from multiple coordinate values.	• Center X and Y of approximate circle • Radius of approximate circle • Standard deviation
Approximate Ellipse		Detects the approximate ellipse from multiple coordinate values.	• Center X and Y of approximate ellipse • Major and minor axes of approximate circle • Angle of approximate circle (Major axis gradient) • Standard deviation

4.10.2 Setting a Geometry Calculation

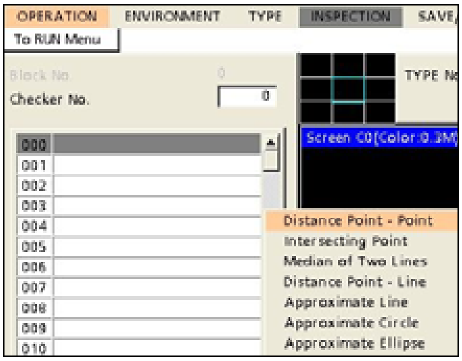
Selecting a Checker No. and a Type of Detect Mode

1. **Select “INSPECTION” > "Geometry Calc.".**

2. **Select the checker No. list and specify a checker number to set.**

3. **Move the cursor onto a type of Geometry Calculation to create.**

The setting window of the selected type is displayed.



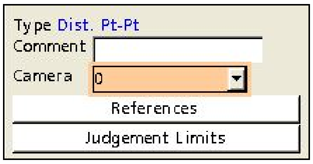
Checker No. 0

Selecting a Camera

Select a camera image to set “Geometry Calculation”.

1. **Select a camera No. in “Camera” in the setting window of "Geometry Calculation".**

The image of the selected camera is displayed.



Type Dist. Pt-Pt

Camera 0

▶ Note

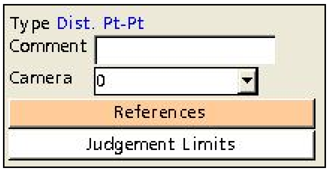
Select a displayed image type (Live/Memory and Gray/Color/Binary) or magnification in “Image Menu” opened by pressing the F1 key.

Setting a Reference

Specify the created checker to detect "Point" or "Line" which are necessary for Geometry Calculation.

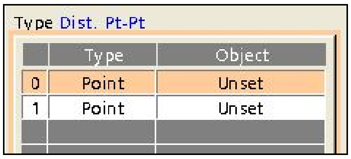
1. **Select "Reference".**

The items such as points or lines which are required for the selected type of Geometry Calculation are listed.
Items to be specified vary depending on geometry calculations.
Refer to the next page for how to set an area.



Type Dist. Pt-Pt

Camera 0



Type Dist. Pt-Pt

	Type	Object
0	Point	Unset
1	Point	Unset

Detect mode	Input item	
Distance Point-Point	Point 0, Point 1	
Intersecting Point	Line 0, Line 1	
Median of Two Lines		
Distance Point-Line	Point 0, Line 1	
Approximate Line	Point 0 to Point 9 or All points	2 points or more
Approximate Circle		3 points or more
Approximate Ellipse		6 points or more

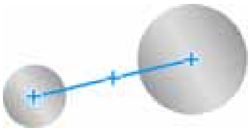
▶ Note

- Only the checkers set with the same camera can be referred.
- The procedure for setting "Distance Point-Line" is the same as those for setting "Point" in "Distance Point-Point" and "Line" in "Intersecting Point".

For Distance Point - Point

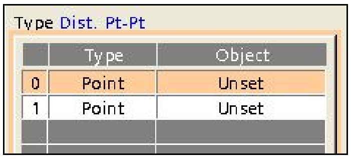
In this section, for the object detected in Feature Extraction No.0, enter the detected zeroth coordinate in Point 0, and enter the detected first coordinate in Point 1.

In Feature Extraction, it has been set to sort the objects in descending order of area and detect the circle of the largest area zerothly.



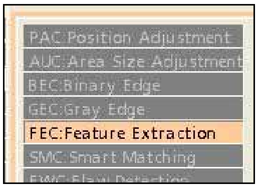
1. **Select No.0: Point from the list.**

   The list of checkers which can be input is displayed.
   Unset checkers are shown in gray and cannot be selected.
   For details of selectable checkers, see page 223.



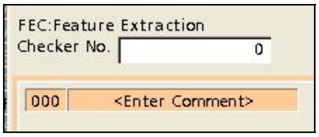
Type Dist. Pt-Pt

	Type	Object
0	Point	Unset
1	Point	Unset



2. **Select “FEC: Feature Extraction” from the list.**

   The list of Feature Extraction checkers is displayed.

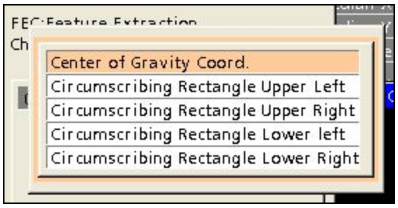


FEC:Feature Extraction
Checker No. 0

000	<Enter Comment>

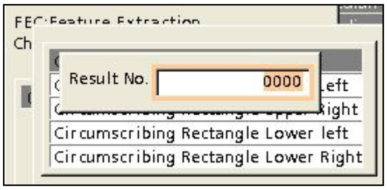
3. **Select Checker No. 000.**

   The list of result types is displayed.


FEC:Feature Extraction
Center of Gravity Coord.
Circumscribing Rectangle Upper Left
Circumscribing Rectangle Upper Right
Circumscribing Rectangle Lower left
Circumscribing Rectangle Lower Right

4. **Select "Center of Gravity Coord." and specify Result No. 0000.**

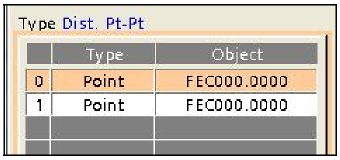
   The selected data is displayed in a symbol for No.0: Point in the list.



Result No. 0000

FEC:Feature Extraction
Circumscribing Rectangle Lower left
Circumscribing Rectangle Lower Right

5. **Set the second point (No.1: Point) in the same steps.**



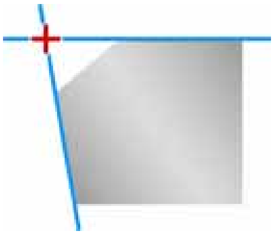
Type Dist. Pt-Pt

	Type	Object
0	Point	FEC000.0000
1	Point	FEC000.0000

For Intersecting Point

"Intersecting Point" is used to calculate the intersecting point using the lines detected by Smart Edge (Line) and Geometry Calculation.

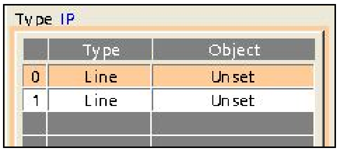
When using the lines detected by Geometry Calculation, only smaller numbers than the number of the currently setting Geometry Calculation can be specified.



▶ Note

The procedure for setting "Reference" of Median of Two Lines is the same as the one for Intersecting Point.

The following is an example when setting Smart Edge (Line) to No. 0 and Geometry Calculation to No. 1.

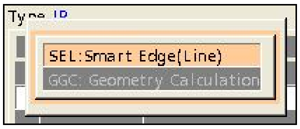


Type IP

	Type	Object
0	Line	Unset
1	Line	Unset

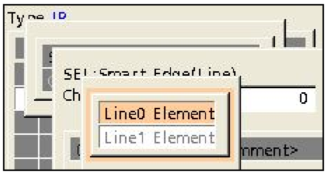
1. **Select No.0: Line from the list.**

The list of checkers which can be input is displayed.
If there is no checker that can be specified, checkers are shown in gray and cannot be selected.
For details of selectable checkers, see page 223.



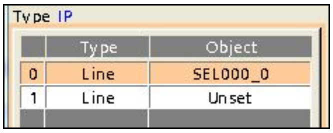
2. **Select “SEL: Smart Edge (Line)” from the list.**

The list of result types is displayed.



3. **Select "Line0 Element" or "Line1 Element".**

The selected data is displayed in a symbol for No.0: Line in the list.



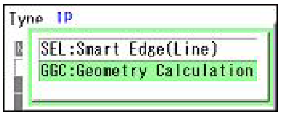
Type IP

	Type	Object
0	Line	SEL000_0
1	Line	Unset

4. **Select No.1: LIne.**

5. **Select “GGC: Geometry Calculation” from the list.**

The list of the geometry calculations set to the numbers smaller than the number of the currently setting checker is displayed.

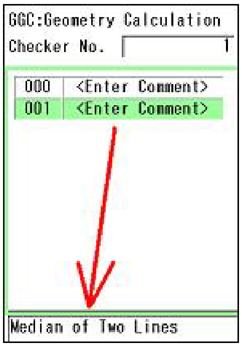


6. **Select the geometry calculation you want to use.**

Geometry calculations to calculate lines are the following 4 types.

- Distance Point - Point
- Median of Two Lines
- Distance Point-Line
- Approximate Line

When selecting a geometry calculation other than the above, the intersecting point of two lines cannot be calculated.
When selecting Geometry Calculation No., the type is displayed in the message field below the list. Check it.



GGC:Geometry Calculation
Checker No. 1

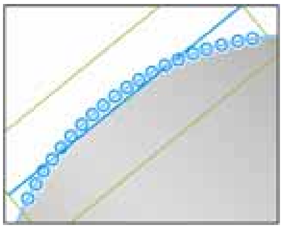
000	<Enter Comment>
001	<Enter Comment>

Median of Two Lines

For Approximate Circle

Selecting "All Points" enables to set multiple points detected by one checker in block.

In this section, enter all the coordinate positions of the object detected by Smart Edge (Line) in the point 0.



▶ Note

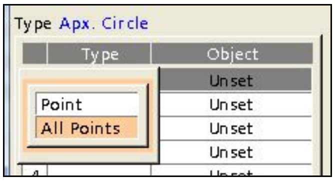
The procedures for setting "Reference" of Approximate Line and Approximate Ellipse are the same as that of Approximate Circle.

1. **Select No.0: Point from the list, and select "All Points".**

   The list of checkers which can be input is displayed. For details of selectable checkers, see page 223. Unset checkers are shown in gray and cannot be selected.

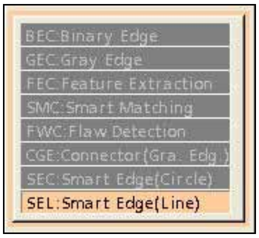
   ▶ Note

   The procedure for setting "Reference" when selecting "Point" is the same as that of Distance Point - Point.



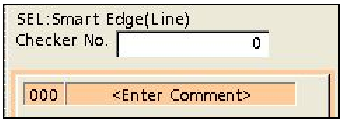
2. **Select “SEL: Smart Edge (Line)” from the list.**

   The list of Smart Edge (Line) checker is displayed.



3. **Select Checker No. 000.**

   The list of result types is displayed.

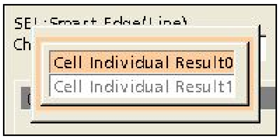


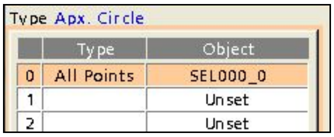
SEL:Smart Edge(Line)
Checker No. 0
000 <Enter Comment>

4. **Select "Cell Individual Result0".**

   The selected data is displayed in a symbol for No.0 in the list.

   Set as necessary after No.1.
   "All Points" and "Point" can be mixed (e.g. set No.0 to "All Points" and set No.1 to "Point").





Type Apx. Circle

	Type	Object
0	All Points	SEL000_0
1		Unset
2		Unset

▶ Note

When points which cannot be detected by the specified "Target" checker for some reason as below exist, the approximate circle, approximate ellipse and approximate line will be calculated with the coordinate values of the detected points only.

- When the specified checker did not detect edges or objects
- When the cell individual result of the specified Smart Edge (Circle) or Smart Edge (Line) was excluded by the denoising function.

However, the calculation cannot be executed when the number of detected points is less than each minimum number of points for Approximate Circle, Approximate Ellipse and Approximate Line.

List of Settable Items for Each Object

	Point	All Points	Line
PAC: Position Adjustment	○ Base Position Coord. Detect Position Coord. Base Coord. (Detect Coord. of Base Checker)	×	×
AUC: Area Size Adjustment	○	×	×
BEC: Binary Edge	○	○	×
GEC: Gray Edge	○	○	×
FEC: Feature Extraction	○ Center of Gravity Coord. Circumscribing Rectangle Coord. (Upper left, Upper right, Lower left, Lower right)	○ (Center of Gravity Coord.)	×
SMC: Smart Matching	○	○	×
FWC: Flaw Detection	○	○	×
CGE: Connector (Gray Edge)	○ Area 0 Area 1 (*a	○	×
SEC: Smart Edge (Circle)	○ Center Coord. 0 Center Coord. 1 (*b Cell Individual Result 0 Cell Individual Result 1 (*c	○ Cell Individual Result 0 Cell Individual Result 1 (*c	×
SEL: Smart Edge (Line)	○ Max. Measurement Coord. Min. Measurement Coord. Line0 Start Coord. Line0 End Coord. Line1 Start Coord. (*b Line1 End Coord. (*b Cell Individual Result 0 Cell Individual Result 1 (*b	○ Cell Individual Result 0 Cell Individual Result 1 (*b	○ Line0 Element Line1 Element (*b
GGC: Geometry Calculation	○ **(*d**	×	○ **(*d (*e**

*a) When selecting "Gap", "Float" or "Width Measurement" in Execution Mode
*b) When selecting "Measure Width" in Detect Mode
*c) When selecting "Measure Width" or "Measure Diameter" in Detect Mode
*d) Available only for the geometry calculations of the smaller numbers than the currently setting geometry calculation
*e) Normally operation can be performed only with the following types which calculate line elements (abc): Distance Point - Point / Median of Tow Lines / Distance Point - Line / Approximate Line

▶ Note

The checker with a camera number different from that selected for the setting geometry calculation cannot be specified.

Setting Measurement Condition

Measurement conditions vary depending on the type of geometry calculation.

Detect mode	Measurement condition	
Distance Point-Point	Line Display:	Segment / Half line0 / Half line1 / Wall-to-wall
	Angle Range:	0<->360 / -180<->180
	Direction:	ST -> ED / ED -> ST / Down / Left / Up / Right
Intersecting Point	Intersecting Angle:	Acute Angle / CW / CCW
Median of Two Lines	Angle Range:	0<->360 / -180<-> 180
	Direction:	Vector Sum / Down / Left / Up / Right
	Intersecting Angle:	Acute Angle / CW / CCW
Distance Point-Line	Line Display:	Segment / Half line0 / Half line1 / Wall-to-wall
	Angle Range:	0<->360 / -180<-> 180
	Direction:	OT0 -> IP / IP -> PT0 / Down / Left / Up / Right
Approximate Line	Angle Range:	0<->360 / -180<-> 180
	Direction:	Down / Left / Up / Right
Approximate Circle	None	
Approximate Ellipse	Angle Range:	0<->360 / -180<-> 180
	Direction:	Down / Left / Up / Right

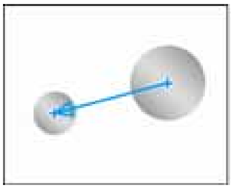
About Measurement Conditions

Line Display

Select the display method of the detected line.
The following figures show the examples of "Distance Point-Point". The large circle is the start point (Reference No. 0) and the small circle is the end point (Reference No. 1).

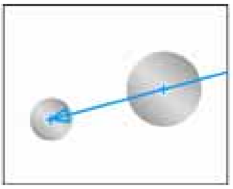
Segment

Draw between No.0 and No.1



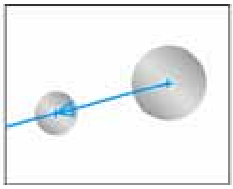
Half line 0

Draw between No.0 and the edge of the screen



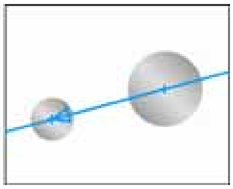
Half line 1

Draw between No.1 and the edge of the screen



Wall-to-wall

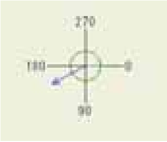
Draw between the both edges of the screen



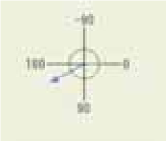
Angle Range

Specify 0 to 360 degree or -180 to 180 degree to output the angle data to be detected.
The position at three o'clock is 0 degree.

0 <-> 360



-180 <-> 180



Note

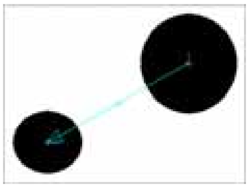
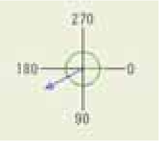
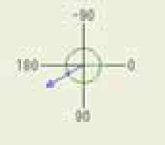
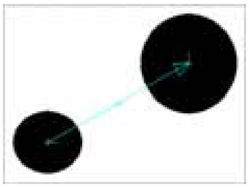
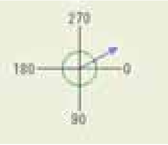
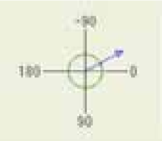
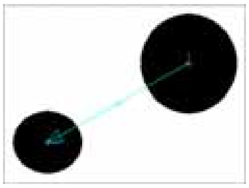
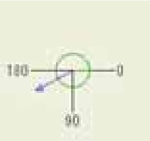
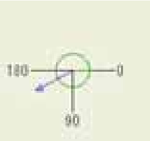
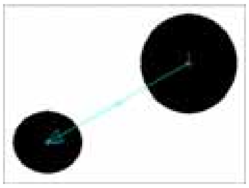
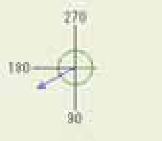
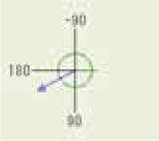
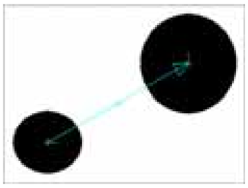
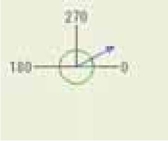
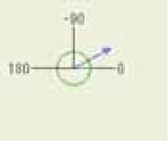
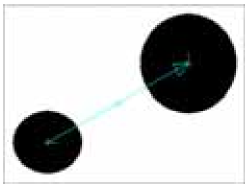
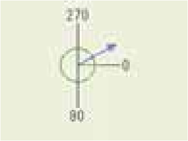
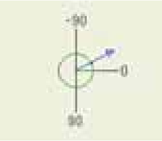
The above figures show the examples when Calibration Scale is not used or when Calibration Scale is used and "Rightward - Downward" is selected for Coordinate Axis (positive direction).

Changing the setting of Coordinate Axis may change the position of 0 degree or the value of the detected angle.

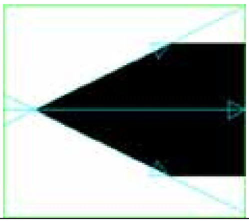
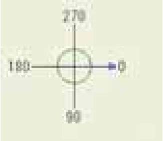
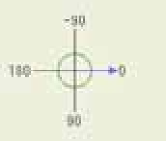
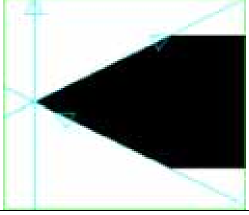
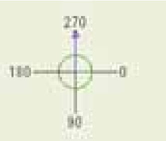
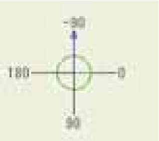
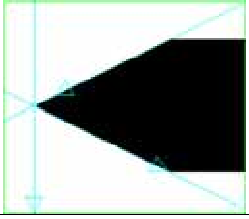
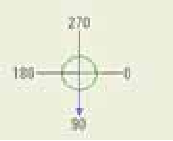
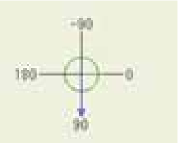
Direction

Detected angles vary depending on the specified direction and the setting value of "Angle Range".

Example) For Distance Point - Point

Direction	Appearance of Direction	Angle Range and Detect Angle	
		Angle Range: 0<->360	Angle Range: -180<->180
ST -> ED		Range: 0 - 359.999 Result: 160 	Range: -179.999 - 180 Result: 160 
ED -> ST		Range: 0 - 359.999 Result: 340 	Range: -179.999 - 180 Result: -20 
Down		Range: 0 - 179.999 Result: 160 	Range: 0 - 179.999 Result: 160 
Left		Range: 90 - 269.999 Result: 160 	Range: 90 - 180, -90.001 - -179.999 Result: 160 
Up		Range: 180 - 359.999 Result: 340 	Range: 0 - -179.999 Result: -20 
Right		Range: 0 - 89.999, 270 - 359.999 Result: 340 	Range: 0 - 89.999 and -0.001 - -90 Result: -20 

Example) When Median of Two Lines - Direction = Vector Sum

	Angle Range	
	Angle Range: 0<->360	Angle Range: -180<->180
Two lines are headed in the same direction. 		
Two lines are headed in different directions. Example 1 		
Two lines are headed in different directions. Example 2 		

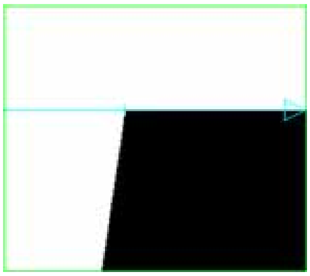
▶ Note

- In case of Median of Two Lines, the direction of measure median varies depending on the direction of two lines.
- The concepts of Down, Left, Up and Right for Median of Two Lines are the same as those for Distance Point - Point.
- About Direction of Lines
  The direction of the line detected by Smart Edge (Line) is that of the Start point (ST) -> End point (ED) of the area setting.
  The direction of the line detected by Approximate Line of Geometry Calculation is as set in "Direction".

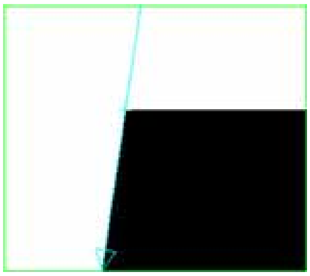
Intersecting Angle

Specify one of the three methods to detect the angle between two intersecting lines.

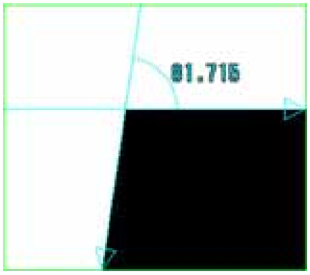
Line specified in Reference No.0



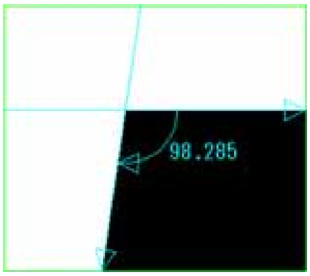
Line specified in Reference No.1



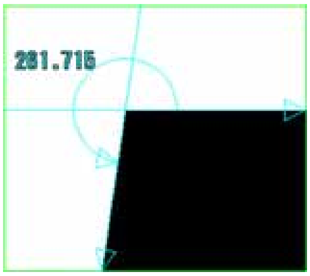
Acute Angle



CW



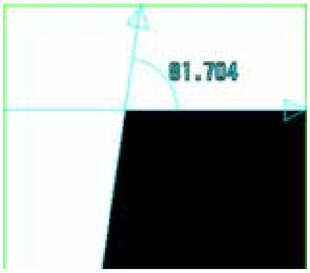
CCW



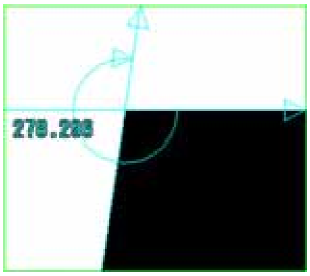
In case of CW or CCW, the start position is the line specified in Reference No.0.

When the direction of a line changes, the detected angular positions differ between CW and CCW.
The following is the case that the direction of line in Reference No.1 is reversed.

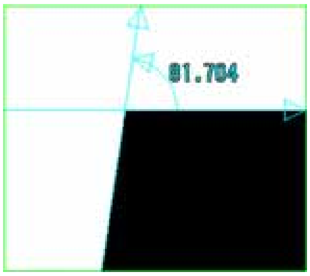
Acute Angle



CW

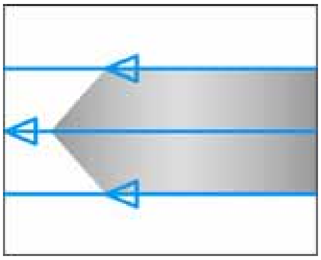
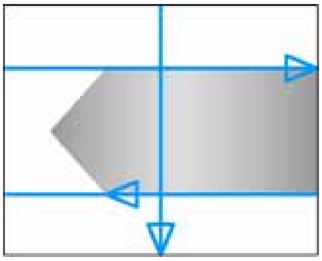


CCW



▶ Note

The intersecting angle and median is output as below when two lines are not intersected.

	When two lines are headed in the same direction	When two lines are headed in different directions
Intersecting Angle	Error(E0072)	Error(E0072)
Median	It is calculated with the same direction and angle as the two lines. 	A line passing through the center of the image is calculated, which is the angle of Line No.0 + 90 degrees. 

Setting Judgement Condition

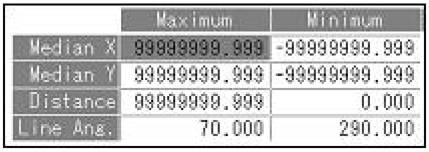
Measurement conditions vary depending on the type of geometry calculation.

Detect mode	Judgement limits	Input range
Distance Point-Point	Median X, Median Y	-99999999.999 to 99999999.999
	Distance	0 to 99999999.999
	Line Angle	0 to 359.999(When Angle Range is 0<->360) -179.999 to 180.000 (When Angle Range is -180<->180)
Intersecting Point	IP X, IP Y	-99999999.999 to 99999999.999
	Angle	0 to 359.999
Median of Two Lines	Angle	0 to 359.999
	Line Angle	0 to 359.999 (When Angle Range is 0<->360) -179.999 to 180.000 (When Angle Range is -180<->180)
Distance Point-Line	Pedal X, Pedal Y	-99999999.999 to 99999999.999
	Distance	0 to 99999999.999
	Pedal Angle	0 to 359.999 (When Angle Range is 0<->360) -179.999 to 180.000 (When Angle Range is -180<->180)
Approximate Line	Line Angle	0 to 359.999 (When Angle Range is 0<->360) -179.999 to 180.000 (When Angle Range is -180<->180)
	Standard Deviation	0 to 99999999.999
Approximate Circle	Center X, Center Y	-99999999.999 to 99999999.999
	Radius	0 to 99999999.999
	Standard Deviation	0 to 99999999.999
Approximate Ellipse	Center X, Center Y	-99999999.999 to 99999999.999
	Major Axis	0 to 99999999.999
	Minor Axis	0 to 99999999.999
	Major Axis Gradient	0 to 359.999 (When Angle Range is 0<->360) -179.999 to 180.000 (When Angle Range is -180<->180)
	Standard Deviation	0 to 99999999.999

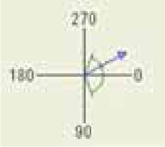
Maximum and Minimum Values of Line Angle

As for Line Angle, the maximum value can be set to a smaller value than the minimum value (Max. value < Min. value). Set the values checking the guide display.

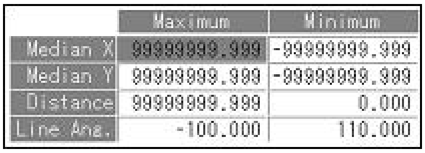
In the example on the right, it will be judged as OK if the detected angle is in the range of "290 to 70 degrees".



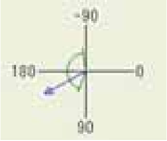
	Maximum	Minimum
Median X	99999999.999	-99999999.999
Median Y	99999999.999	-99999999.999
Distance	99999999.999	0.000
Line Ang.	70.000	290.000



In the example on the right, it will be judged as OK if the detected angle is in the range of "110 to -110 degrees".



	Maximum	Minimum
Median X	99999999.999	-99999999.999
Median Y	99999999.999	-99999999.999
Distance	99999999.999	0.000
Line Ang.	-100.000	110.000



Error Messages when performing Geometry Calculation

If Geometry Calculation is not performed properly, error numbers and messages are displayed in the checker list.

Error No.	Message	Cause
E0070	Unset item found.	When a checker to be used is not specified.
E0071	No ref. checker result.	When the specified checker did not detect edges, objects or lines.

Error No.	Message	Type	Cause
E0072	Could not normally calculate.	Distance Point-Point	When two points are in the same position
		Intersecting Point	• When two lines are parallel and not intersected • When the intersection point is out of the range of +/-9999(*)
		Approximate Line	• When the input point is less than 2 • When all the input points are in the same position
		Approximate Circle	• When the input point is less than 3 • When the input points are located on a line • When the center of the approximate circle is out of the range of +/-9999(*)
		Approximate Ellipse	• When the input point is less than 6 • When the input points are located on a line • When the center of the approximate ellipse is out of the range of +/-9999(*) • When the ellipse cannot be calculated (due to the positions of the input points)

*) Values in pixels before calibration.

4.11 Calculation of Detected Data (Numerical Calculation)

This function calculates using the data detected by checkers and outputs the data to the external devices. Up to 1000 expressions (when 10 blocks are used) can be set for each product type.

▶ Note

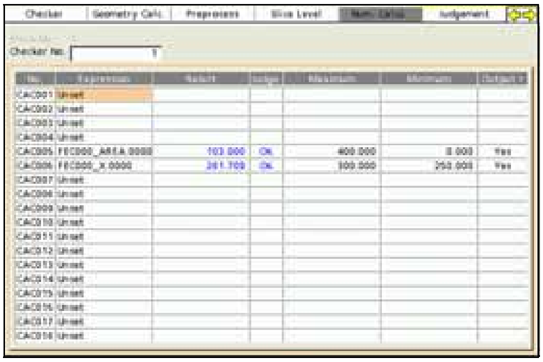
- PV200 can handle the values from -2147483648.000 to + 2147483647.000, which are -(2^{31}) to (2^{31}-1), during calculation. When a calculating value exceeds the range, it is considered as an error (ER) and an error signal (ERROR0) is output. In that case, the calculation result is output as “0”.
- The setting limit is the maximum of 1000 expressions per product type combined with expressions of Numerical Calculation. (After creating 1000 expressions of Numerical Calculation, you cannot create a judgement expression any more.)
- In Connector (Binary Window), Connector (Gray Window), and Connector (Gray Edge), you can register some types of data into a Data R/W sheet from the setting windows. Refer to the description of each checker for details.
- When the judgement of the numerical calculation registered in a numerical expression is error (ER), it is referred as “0” in the calculated result.

Example) When CA000 is error

No.		Expression	Result
CA001	=	CA000	0
CA002	=	CA000 + 500	500

4.11.1 Setting a Calculation

Creating a Calculation



1. **Select "INSPECTION” > “Num. Calcu.” from the menu bar.**

   “Numerical Calculation” list is displayed.
   Next to the calculation number, the beginning part of an expression is displayed.
   Tilting the ENTER key right in the list to display the next page shows 63 characters of expression and comment.

2. **Select a numerical calculation list and a number to set.**

   The screen of numerical calculation setting is displayed.

3. **Select the numerical calculation input field and press the ENTER key again.**

The list of items that can be registered in a calculation is displayed.

Checker:	Select this to enter the inspection data or the statistics data of checkers including position adjustment and area size adjustment.
Geometry Calculation:	Select this to enter the result of geometry calculation or the statistics data of them.
Numerical Calculation:	Select this to enter the result of numerical calculation or the statistics data of them.
Judgement:	Select this to enter the result of judgement or the statistics data of them.
Constant:	Select this to enter a fixed value. Values that can be input are +/-9999999.999.
System Register:	Select this to enter the System Registers No.0 to 7 specified in the environment setting.
Scan Count:	Select this to enter the scan count after startup or type switching.
Operators and Functions:	Select this to enter an operator or a function. Refer to the section of Operators and Functions, page 243 for details.

▶ Note

Scan Count is reset to “0” by turning on the power, switching type, and resetting statistics data.

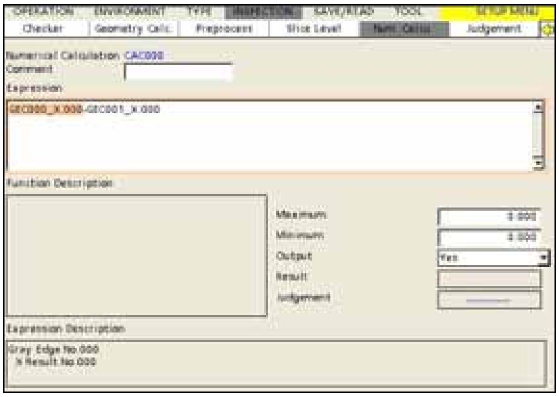
4. **Enter an operation expression.**

Up to 16 items and 560* characters can be set.

If you selected a wrong item, delete it with the F2 key and reregister the expression.

▶ Note

Moving the cursor onto an item displays the information of the item in the expression explanation field.



Numerical Calculation CAC000

Comment

Expression

GEC000_X.000-GEC001_X.000

Maximum 0.000

Minimum 0.000

Output Yes

Expression Description

Gray Edge No.000
X Result No.000

5. **Enter a comment with the software keyboard as necessary.**

6. **Press the CANCEL key again.**

When the dialog message appears, select “Yes”.

“Yes”:	Registers the expression.
"No":	Returns to the status before inputting the expression.
"Cancel":	Cancels registering the expression and come back to status to edit.

▶ Note

If the expression is incorrect such as wrong grammar or unspecified data which is necessary for the function, selecting “Yes” cannot execute the registration and a message is displayed in the bottom field. The cursor is moved to the wrong item. Correct it.

7. **Press the TRIG key to run a test and confirm the result as necessary.**

Input Example: Entering a Result of a Checker

For this example, enter the object area detected thirdly by Feature Extraction No.0. Depending on the type of checker, selectable data varies.

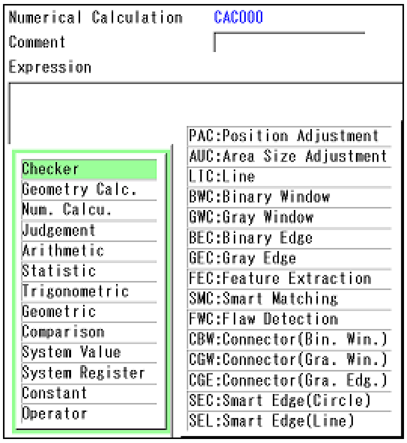
1. **In the list of items that can be entered in expression, select “Checker” > "FEC(Feature Extraction)".**

   The list of Feature Extraction checkers is displayed.

2. **Select checker No. 000.**

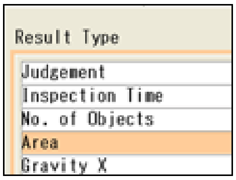
   The list of result types is displayed.

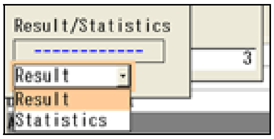
   ▶ Note
   For some checkers, the list of result types is displayed on multiple pages. Tilt the ENTER key left or light to change the page.


Numerical Calculation CAC000
Comment
Expression

3. **Select "Area", the data to enter.**

   The window to set a result No. is displayed. Among multiple detected objects, use the object No. numbered with Feature Extraction checker to specify.





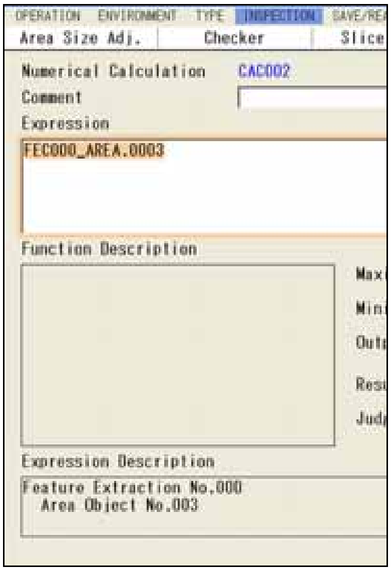
4. **Select “0003”.**

   ▶ Note
   If specifying the number exceeding the number of detected objects, the input value will be “0”.

5. **Select "Result".**

   The code indicating “the object area detected thirdly by Feature Extraction No.0” is displayed in the expression field.

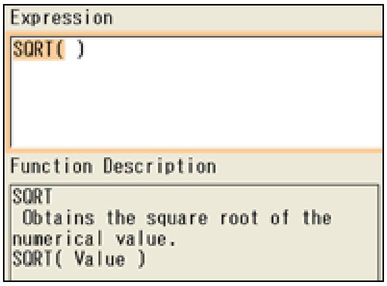
   Highlighting a code displays the meaning of it in the Expression Description field in the bottom of the screen.



Numerical Calculation CAC002
Comment
Expression
FEC000_AREA.0003
Expression Description
Feature Extraction No.000
Area Object No.003

Inputting Functions

After selecting a type of function, highlighting a code shows the description of the function in the field under the expression field. Refer to it to enter an expression.


Expression
SQRT( )
Function Description
SQRT
Obtains the square root of the numerical value.
SQRT(Value)

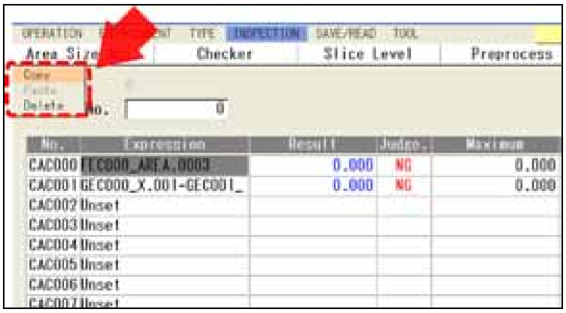
Copying an Set Expression

1. **Select "INSPECTION” > “Num. Calcu.” from the menu bar.**

“Numerical Calculation” window is displayed.

2. **Select a numerical calculation list in the setting window and move the cursor onto the expression No. to copy.**

3. **Press the FUNC key and select “Copy” from the displayed menu.**



No.	Expression	Result	Judge.	Maximum
CAC000	FEC000_AREA.0003	0.000	NG	0.000
CAC001	GEC000_X.001-GEC001_	0.000	NG	0.000
CAC002	Unset			
CAC003	Unset			
CAC004	Unset			
CAC005	Unset			
CAC006	Unset			
CAC007	Unset			

4. **Move the cursor onto the destination expression No.**

5. **Press the FUNC key and select “Paste” from the displayed menu.**

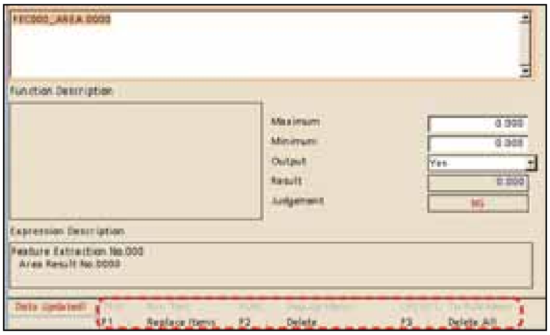
Copying is executed.

▶ Note

If an expression already exists in the destination, the message of overwrite confirmation appears.

Replacing an Item

This function replaces a part of an expression with another item to use.



Maximum 0.000
Minimum 0.000
Output Yes
Result 0.000
Judgement NG

Feature Extraction No.000
Area Result No.0000

1. **Move the cursor onto the item to replace.**

The descriptions of the F1, F2 and F3 keys are displayed in the key guide.

2. **Press the F1 key: Replace Items.**

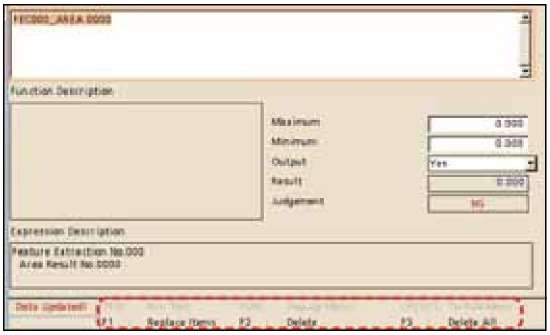
In a similar way to creating an expression, an item select window is displayed.

3. **Select an item.**

It is replaced with the selected item.

Deleting an Item

A part of or an entire operation expression can be deleted.



Maximum 0.000
Minimum 0.000
Output Yes
Result 0.000
Judgement NG

Feature Extraction No.000
Area Result No.0000

1. **Select an expression in the numerical calculation setting window.**

2. **To delete just an item, move the cursor onto the item and press the F2: Delete key.**

The item is deleted.

3. **To delete an entire expression, press the F3: Delete All key.**

As the confirming message appears, selecting “Yes” deletes all items registered in the expression.

Setting Judgement Limits

Set a tolerance (maximum and minimum values) of the calculated result. If the value is within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG". If any judgement is not necessary, there is no need to set.

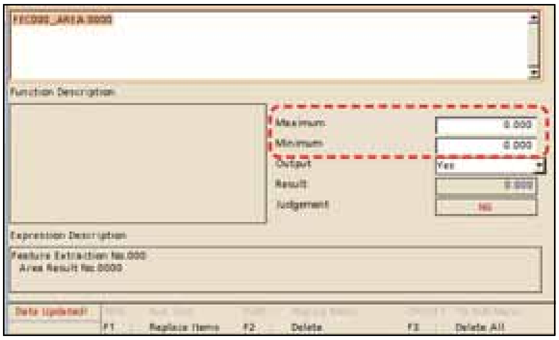
1. **In numerical expression setting window, select “Maximum” and enter a value.**

2. **In numerical expression setting window, select “Minimum” and enter a value.**

3. **Press the TRIG key to execute a test and confirm the judgement.**

▶ Note

Maximum/Minimum values can be input in the previous window, in the list of numerical calculations.



FEC000_AREA.0000

Maximum 0.000

Minimum 0.000

Output Yes

Result 0.000

Judgement NG

Feature Extraction No.000
Area Result No.0000

Data Updated!

Setting an Output Condition

Select whether or not to output calculation results to the external devices for each expression. Default setting is set to output.

▶ Note

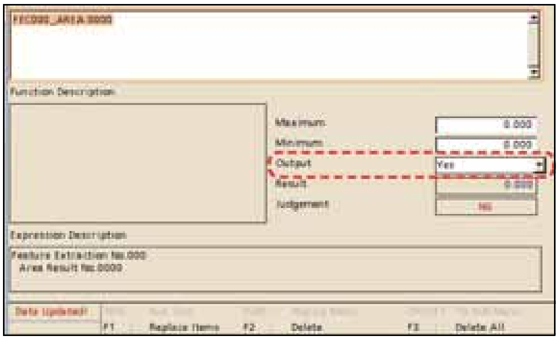
In addition to the setting for each expression, setting from “ENVIRONMENT” > “Input/Output” outputs numerical calculation results to the external devices.

1. **Select "Output” in the numerical calculation setting window.**

2. **To output it, select “Yes”. Select “No” not to output.**

▶ Note

Output conditions can be input in the previous window, in the list of numerical calculations.



FEC000_AREA.0000

Maximum 0.000

Minimum 0.000

Output Yes

Result 0.000

Judgement NG

Feature Extraction No.000
Area Result No.0000

Data Updated!

4.11.2 Data That Can Be Used in Numerical Calculation

The data described below is that can be used in numerical calculation. The symbols in parentheses are displayed in operation expressions.

Inspection data that can be registered in Numerical Calculation

▶ Note

Depending on type of result data, selectable statistics data varies when selecting “Statistics”.

Statistics: Type 1

Scan Count	(@COUNT)	OK count	(@OKCOUNT)	NG count	(@NGCOUNT)

Statistics: Type 2

Minimum value	(@MIN)	Min. OK Judge.	(@OKMIN)	Min. NG Judge.	(@NGMIN)
Maximum value	(@MAX)	Max. OK Judge.	(@OKMAX)	Max. NG Judge.	(@NGMAX)
Average	(@AV)	OK average	(@OKAV)	NG average	(@NGAV)
Range	(@RG)	OK range	(@OKRG)	NG range	(@NGRG)
Variance	(@DV)	OK Variance	(@OKDV)	NG Variance	(@NGDV)

Checker

Item	Result No.	Result Type		Statistics type	Output Value, etc	
Position Adjustment (PAC) No.0-999	---	Judgement (JUDGE)		1	OK=1, NG=0	
		Inspection Time (TIME)		2		
		Base Position X (BPOSX)		2		
		Base Position Y (BPOSY)		2		
		Base Position Theta (BANG)		2		
		X Adjustment Amount (AJX)		2		
		Y Adjustment Amount (AJY)		2		
		Theta Adjustment Amount (AJANG)		2		
		Detect Position X (X)		2		
		Detect Position Y (Y)		2		
		Theta(ANG)		2		
		Judgement of Base Checker (BJUDGE)	No.0-3	1	OK=1, NG=0	Base=Base checker
		Base Inspection Time (BTIME)	No.0-3	2		
		Base X-Coordinate (BX)	No.0-3	2		
		Base Y-Coordinate (Y)	No.0-3	2		
		Base Projection X (BPX)	No.0-3	2		
		Base Projection Y (BPX)	No.0-3	2		
Area Size Adjustment (AUC) No.0-999	---	Judgement (JUDGE)		1	OK=1, NG=0	
		Inspection Time (TIME)		2		
		X coordinate (X)		2		
		Y coordinate (Y)		2		
		Projection distance of X (PX)		2		
		Projection distance of Y (PY)		2		
Line (LIC) No.0-999	---	Judgement (JUDGE)		1	OK=1, NG=0	
		Inspection Time (TIME)		2		
		Pixel judgement (DJUDGE)		1	OK=1, NG=0	
		Objects judgement (LJUDGE)		1	OK=1, NG=0	
		No. of Pixels (DCOUNT)		2	0 - 125938	
		No. of Objects (LCOUNT)		2	0 - 41979	
Binary Window(BWC) No.0-999	---	Judgement (JUDGE)		1	OK=1, NG=0	
		Inspection Time (TIME)		2		
		Area (AREA)		2	0 - 1920000	

Item	Result No.	Result Type	Statistics type	Output Value, etc
Gray Window(GWC) No.0-999	---	Judgement (JUDGE)	1	OK=1, NG=0
		Inspection Time (TIME)	2	
		Gray Average (AVE)	2	0 - 255
Binary Edge(BEC) No.0-999	---	Judgement (JUDGE)	1	OK=1, NG=0
		Inspection Time (TIME)	2	
		No. of Objects (COUNT)	2	0 - 256
	0-255	X coordinate (X)	2	
		Y coordinate (Y)	2	
		Detected color (COLOR)	2	"White > Black"=0, "Black > White"=1
		Projection distance of X (PX)	2	
		Projection distance of Y (PY)	2	
Gray Edge(GEC) No.0-999	---	Judgement (JUDGE)	1	OK=1, NG=0
		Inspection Time (TIME)	2	
		No. of Objects (COUNT)	2	0 - 256
	0-255	X coordinate (X)	2	
		Y coordinate (Y)	2	
		Differential Value (DIF)	2	0 - 255
		Projection distance of X (PX)	2	
		Projection distance of Y (PY)	2	
Feature Extraction (FEC) No.0-999	---	Judgement (JUDGE)	1	OK=1, NG=0
		Inspection Time (TIME)	2	
Common Result:		No. of Objects (COUNT)	2	0 - 10000
Individual Result1 1/2 page	0-9999	Area (AREA)	2	0 - 1920000
		X coordinate of gravity center (X)	2	
		Y coordinate of gravity center (Y)	2	
		Projection width (PW)	2	
		Projection height (PH)	2	
		Perimeter (LEN)	2	
		Principal axis angle (ANG)	2	-89.9 - +90.0, -180.0
		Projection distance of X (PX)	2	
		Projection distance of Y (PY)	2	
Individual Result2: 2/2 page		X coordinate of the upper left point of circumscribing rectangle (LUX)	2	
		Y coordinate of the upper left point of circumscribing rectangle (LUY)	2	
		X coordinate of the upper right point of circumscribing rectangle (RUX)	2	
		Y coordinate of the upper right point of circumscribing rectangle (RUY)	2	
		X coordinate of the lower left point of circumscribing rectangle (LDX)	2	
		Y coordinate of the lower left point of circumscribing rectangle (LDY)	2	
		X coordinate of the lower right point of circumscribing rectangle (RDX)	2	
		Y coordinate of the lower right point of circumscribing rectangle (RDY)	2	

Item	Result No.	Result Type	Statistics type	Output Value, etc
Smart Matching(SMC) No.0-999	---	Judgement (JUDGE)	1	OK=1, NG=0
		Inspection Time (TIME)	2	
		No. of Objects (COUNT)	2	0 - 255
	0-255	Detect Template No. (TEMP)	2	
		Correlation (COR)	2	
		X coordinate (X)	2	
		Y coordinate (Y)	2	
		Angle (CANG)	2	-179.999 -180.000
		Pixels of Max. Subtracted Object (AREA)	2	
		No. of Subtracted Objects (LCNT)	2	0 -128
		Projection distance of X (PX)	2	
		Projection distance of Y (PY)	2	
	0-5	No. of objects (interim) (CNT)	2	0 -256
		Correlation value (interim) (CLL)	2	0.001 -1.000
Flaw Detection(FWC) No.0-999	---	Judgement (JUDGE)	1	OK=1, NG=0
		Inspection Time (TIME)	2	
		No. of objects (COUNT)	2	0 -512
	0-511	Flaw size (SIZE)	2	1 - 3600
		First Cell of Flaw. (CNO)	2	
		X coordinate (X)	2	
		Y coordinate (Y)	2	
		Projection distance of X (PX)	2	
		Projection distance of Y (PY)	2	
Connector - Binary Window(CBW) No.0-999	---	Judgement (JUDGE)	1	OK=1, NG=0
		Inspection Time (TIME)	2	
		No. of Cells(CELL)	2	3 - 100
	0-99	Area (AREA)	2	
		Individual judgement (PJUDGE)	1	OK=1, NG=0
Connector Gray Window (CGW) No.0-999	---	Judgement (JUDGE)	1	OK=1, NG=0
		Inspection Time (TIME)	2	
		No. of Cells(CELL)	2	3 - 100
	0-99	Gray Average (AVE)	2	0 -255
		Individual judgement (PJUDGE)	1	OK=1, NG=0
Connector Gray Edge (CGE) No.0-999 Common Result: 1/2 page	---	Judgement (JUDGE)	1	OK=1, NG=0
		Pitch total judgement (PTJUDG)	1	OK=1, NG=0
		Distance difference total judgement (UPJUDG)	1	OK=1, NG=0
		Inspection time (TIME)	2	
		No. of Cells(CELL)	2	3 - 100
		Max. Pitch (PMAX)	2	
		Min. Pitch (PMIN)	2	
		Average Pitch (PAVE)	2	

Item	Result No.	Result Type	Statistics type	Output Value, etc
Individual Result: 2/2 page	0-99	Pitch Individual Judgement (PJUDGE)	1	OK=1, NG=0
		Distance difference individual judgement (UJUDGE)	1	OK=1, NG=0
		Pitch (PT)	2	
		Distance difference (UPT)	2	
		Edge X coordinate 0 of area 0 (X0)	2	
		Edge Y coordinate 0 of area 0 (Y0)	2	
		Edge differential 0 of area 0 (D0)	2	0 -255
		Edge X coordinate 1 of area 1 (X1)	2	
		Edge Y coordinate 1 of area 1 (Y1)	2	
		Edge differential 1 of area 1 (D1)	2	0 -255
Smart Edge (Circle) (SEC) No.0-999 Detected Result: 1/3 page	---	Max. value (LMAX)	2	Measurement value = Radius, Diameter or Width
		Min. value (LMIN)	2	
		Average value (LAVE)	2	
		Standard Deviation (STD)	2	
		Max. Angle (AMAX)	2	
		Min. Angle (AMIN)	2	
		Center X 0 (CX0)	2	
		Center Y 0 (CY0)	2	
		Radius 0 (R0)	2	
		Circularity 0 (CIR0)	2	
		Center X 1 (CX1)	2	Each data of outer detected circle when selecting Detect Mode: Width
		Center Y 1 (CY1)	2	
		Radius 1 (R1)	2	
		Circularity 1 (CIR1)	2	
Common Result: 2/3 page		Judgement (JUDGE)	1	OK=1, NG=0
		Measurement Judgement (LJUDGE)	1	
		Standard Devation Judgement (SJUDGE)	1	
		Circularity Judgement (CJUDGE)	1	
		Unused Edge Count Judgement (NJUDGE)	1	
		Inspection Time (TIME)	2	
		Used Edge Count (FCNT)	2	
		Unused Edge Count (NCNT)	2	
		No. of Cells (CELL)	2	0-3599
Individual Result: 3/3 page	0-3599	Individual Judgement (IJUDGE)	1	OK=1, NG=0
		Measurement value (LEN)	2	
		Deviation (DEV)	2	
		X 0 (X0)	2	
		Y 0 (Y0)	2	
		Differential 0 (D0)	2	0 -255

Item	Result No.	Result Type	Statistics type	Output Value, etc
		X 1 (X1) *1)	2	
		Y 1 (Y1) *1)	2	
		Differential 1 (D1) *1)	2	
		Judgement Code (STAT)	2	0-4 *2)
Smart Edge (Line) (SEL) No.0-999 Common Result: 1/3 page	---	Max. value (LMAX)	2	
		Min. value (LMIN)	2	
		Average value (LAVE)	2	
		Standard Deviation (STD)	2	
		Max. X (XMAX)	2	
		Max. Y (YMAX)	2	
		Min. X (XMIN)	2	
		Min. Y (YMIN)	2	
		Judgement (JUDGE)	1	OK=1, NG=0
		Measurement Judgement (LJUDGE)	1	
		Standard Devation Judgement (SJUDGE)	1	
		Linearity Judgement (JUDGE)	1	
		Unused Edge Count Judgement (NJUDGE)	1	
		Inspection Time (TIME)	2	
		Used Edge Count (FCNT)	2	
		Unused Edge Count (NCNT)	2	
		No. of Cells (CELL)	2	
Detected Result: 2/3 page		Line 0 Start Coordinate X (SX0)	2	
		Line 0 Start Coordinate Y (SY0)	2	
		Line 0 End Coordinate X (EX0)	2	
		Line 0 End Coordinate Y (EY0)	2	
		Line 0 Element a (EA0)	2	
		Line 0 Element b (EB0)	2	
		Line 0 Element c (EC0)	2	
		Line 0 Angle (ANG0)	2	
		Linearity 0 (LI0)	2	
		Line 1 Start Coordinate X (SX1)	2	Approximate line data that is detected based on the edges detected with the condition 1 when selecting Width for Detect Mode
		Line 1 Start Coordinate Y (SY1)	2	
		Line 1 End Coordinate X (EX1)	2	
		Line 1 End Coordinate Y (EY1)	2	
		Line 1 Element a (EA1)	2	
		Line 1 Element b (EB1)	2	
		Line 1 Element c (EC1)	2	
		Line 1 Angle (ANG1)	2	
		Linearity 1 (LI1)	2	

*1)
When Execution Mode = Width: Outer edge data
When Execution Mode = Diameter: Edge data of the opposite cell to Result No. cell.

*2) 0: Cell that detected edges and Individual Judgement NG cell
1: Cell that detected edges and Individual Judgement OK cell
2: Cell that detected edges and denoising
3: Cell that detected no edge
4: Masked cell

Item	Result No.	Result Type	Statistics type	Output Value, etc
Individual Result: 3/3 page	0-2999	Individual Judgement (IJUDGE)	1	OK=1, NG=0
		Measurement value (LEN)	2	
		X 0 (X0)	2	
		Y 0 (Y0)	2	
		Differential 0 (D0)	2	0 -255
		X 1 (X1)	2	Data of the edges detected with the condition 1 when selecting Width for Detect Mode
		Y 1 (Y1)	2	
		Differential 1 (D1)	2	
		Judgement Code (STAT)	2	0-4 *1)
Color Window (CWC) No.0-999 Result: 1/2 page	---	Judgement (JUDGE)	1	OK=1, NG=0
		Inspection Time (TIME)	2	
		R Judgement (RJUDG)	1	OK=1, NG=0
		R Average Judgement (RAJUDG)	1	OK=1, NG=0
		R Standard Deviation Judgement (RSJUDG)	1	OK=1, NG=0
		G Judgement (GJUDG)	1	OK=1, NG=0
		G Average Judgement (GAJUDG)	1	OK=1, NG=0
		G Standard Deviation Judgement (GSJUDG)	1	OK=1, NG=0
		B Judgement (BJUDG)	1	OK=1, NG=0
		B Average Judgement (BAJUDG)	1	OK=1, NG=0
		B Standard Deviation Judgement (BSJUDG)	1	OK=1, NG=0
Result: 2/2 page		R Maximum (RMAX)	2	
		R Minimum (RMIN)	2	
		R Average (RAV)	2	
		R Standard Deviation (RSD)	2	
		G Maximum (GMAX)	2	
		G Minimum (GMIN)	2	
		G Average (GAV)	2	
		G Standard Deviation (GSD)	2	
		B Maximum (BMAX)	2	
		B Minimum (BMIN)	2	
		B Average (BAV)	2	
		B Standard Deviation (BSD)	2	

*1)

0: Cell that detected edges and Individual Judgement NG cell
1: Cell that detected edges and Individual Judgement OK cell
2: Cell that detected edges and denoising
3: Cell that detected no edge
4: Masked cell

Geometry Calculation

Detected result data varies depending on the type of geometry calculation. Refer to Geometry Calculation: page 218 for details.

Item	Result No.	Result Type	Statistics type	Output Value, etc
Geometry Calculation (GGC) No.0-999 Result: 1/2 page	---	X coordinate (X)	2	
		Y coordinate (Y)	2	
		Standard Deviation (STD)	2	
		Angle (ANG)	2	
		Line Parameter A (LINEA)	2	
		Line Parameter B (LINEB)	2	
		Line Parameter C (LINEC)	2	
		Distance (DIST)	2	
		Intersecting Angle (CANG)	2	0 - 360
		Radius (R)	2	
		Major Axis (LA)	2	
		Minor Axis (SA)	2	
		Inspection Time (TIME)	2	
Judgement: 2/2 page		Judgement (JUDGE)	1	OK=1, NG=0
		X Judgement (XJUDGE)	1	
		Y Judgement (YJUDGE)	1	
		Standard Deviation Judgement (SJUDGE)	1	
		Angle Judgement (AJUDGE)	1	
		Distance Judgement (DJUDGE)	1	
		Intersecting Angle Judgement (CAJUDGE)	1	
		Radius Judgement (RJUDGE)	1	
		Major Axis Judgement (LAJUDGE)	1	
		Minor Axis Judgement (SAJUDGE)	1	

Numerical calculation

Item		**No.**	**Result Type**	**Statistics type**	**Output Value, etc**
Numerical Calculation	CAC Numerical Calculation	0-999 *1)	Judgement (JUDGE)	1	OK=1, NG=01
			Result (VALUE)	2	
	OCA Numerical Calculation (Previous Result)	0-999	Judgement (JUDGE)	1	OK=1, NG=0
			Result (VALUE)	2	

*1) Only smaller No. than the currently setting numerical calculation No. is settable.

Judgement

Item		**No.**	**Result Type**	**Statistics type**	**Output Value, etc**
Judgement	JRC Judgement (Internal)	0-999	Judgement (JUDGE)	1	Only statistics
	JDC Judgement (External)				

Constant/ System Register/Scan Count

Item	Result	Statistics type	Output Value, etc
System Value (SYS)	Number of Scans (COUNT)	No	0 - 2147483647
System Register	SYS:REG0 to SYS:REG7	No	-9999999.999 - 9999999.999
Constant	Input value: -9999999.999 to 9999999.999	No	

4.11.3 Operators and Functions

Operators

+	Addition	
-	Subtraction	
*****	Multiplication	
/	Division	If denominator becomes "0", the calculation will be terminated and an error signal (ERROR1) will be output.
(,)	Parenthesis	Up to three parentheses can be used successionally. You cannot use four or more of them successionally. Correct: (((A+B)-C+D)+E), Wrong: ((((A+B)-C+D)+E)+F)

Arithmetical Function

MOD (S0, S1)	Remainder when S0 is divided by S1	e.g.) MOD (9,4) = 1
POW (S0, S1)	Value of S0 multiplied by S1.	e.g.) POW (3, 2) = 9
LOG10 (S)	Common logarithm of S	e.g.) LOG10 (100) = 2
SQRT (S)	Square root of S	e.g.) SQRT (144) = 12
ABS (S)	Absolute value of S	e.g.) ABS (-255) = 255
PI ( )	Pi (fixed value)	PI ( ) = 3.142
INT (S)	Integer portion of S	e.g.) INT (-1.8) = -1
ROUND (S)	Round S to a whole number	e.g.) ROUND (1.485) = 1
FLOOR (S)	Round S down to a whole number	e.g.) FLOOR (1.485) = 1
CEIL (S)	Round S up to a whole number	e.g.) CEIL (-1.3) = -1

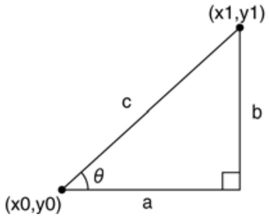
Difference among INT, ROUND, FLOOR and CEIL

S	INT (S)	ROUND (S)	FLOOR (S)	CEIL (S)
1.5	1	2	1	2
1.4	1	1	1	2
-1.4	-1	-1	-2	-1
-1.5	-1	-2	-2	-1

Statistical Function

MAX(C,S)	Maximum value from S-number of results of numerical calculation No.C	Example) In the case of CA000=10 CA001=5.8 CA002=3 MAX(0, 3) = 10 MIN(0, 3) = 3 AVE(0, 3) = 6.267 SUM (0, 3) = 18.8 SORT(0, 3, 1, 0)=3 The 0-th (smallest) value of the ascendingly sorted results of numerical calculation No.0 to 2.
MIN(C,S)	Minimum value from S-number of results of numerical calculation No.C	
AVE(C,S)	Average of S-number of results of numerical calculation No.C	
SUM(C,S)	Sum of S-number of results of numerical calculation No.C	
SORT(C,S0,S1,S2)	S2th value when sorting S-number of numerical calculation No.C in order of S1 condition (0=descending, 1=ascending).	

Trigonometrical Function



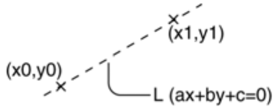
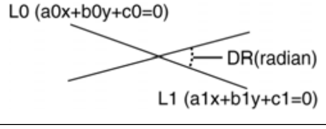
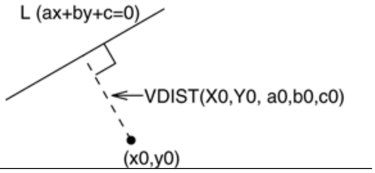
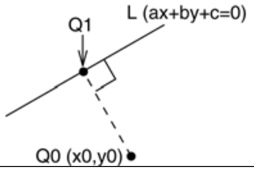
(θ = degree)

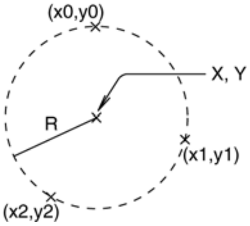
- $\mathrm{SIND}(\theta)=\frac{\mathrm{b}}{\mathrm{c}}$
- $\mathrm{COSD}(\theta)=\frac{\mathrm{a}}{\mathrm{c}}$
- $TAND(\theta)=\frac{b}{a}$

SIN(Radian)	Sine of angle DR (radian)	e.g.) b = SIN (Radian) * c
COS(Radian)	Cosine of angle DR (radian)	e.g.) a = COS (Radian) * c
TAN(Radian)	Tangent of angle DR (radian)	e.g.) a / b = TAN (Radian)
ASIN(S)	Arcsine of angle DR (radian)	e.g.) Radian = ASIN (b / c)
ACOS(S)	Arccosine of angle DR (radian)	e.g.) Radian = ACOS (a / c)
ATAN(S)	Arctangent of angle DR (radian)	e.g.) Radian = ATAN (b / a)
SIND(Degree)	Sine of angle D	e.g.) b = SIND (Degree) * c
COSD(Degree)	Cosine of angle D	e.g.) a = COSD(Degree) * c
TAND(Degree)	Tangent of angle D	e.g.) a/b = TAND(Degree)
ASIND(S)	Arcsine of angle D	e.g.) Degree = ASIND(b / c)
ACOSD(S)	Arccosine of S	e.g.) Degree = ACOSD (a / c)
ATAND(S)	Arctangent of S	e.g.) Degree = ATAND (b / a)
RAD(Degree)	Radian of angle D	e.g.) RAD(45) = 45 / 360 x 2π= 0.785
DEG(Radian)	Angle of radian R	e.g.) DEG(0.785) = 45

Geometric Function

MIDDLEX(X0,Y0,X1,Y1)
MIDDLEY(X0,Y0,X1,Y1)
	Coordinate X and Y of the middle point of two points Q0 (X0, Y0) and Q1 (X1, Y1)

CPOINTX (a0,b0,c0,a1,b1,c1) **CPOINTY (a0,b0,c0,a1,b1,c1)**	Coordinate X and Y of the intersection of two lines L0 (a0x+b0y+c0=0) and L1 (a1x+b1y+c1=0) If two lines are parallel, the judgement will be “ERR”.
ELINEPA (x0,y0,x1,y1) **ELINEPB (x0,y0,x1,y1)** **ELINEPC (x0,y0,x1,y1)**	Element a, b and c of a line L (ax+by+c=0) which connects two points (x0,y0) and (x1,y1). 
CANGLE (a0,b0,c0,a1,b1,c1)	Narrow intersecting angle DR (radian) of two lines L0 (a0x+b0y+c0=0) and L1 (a1x+b1y+c1=0) If two lines are parallel, the judgement will be “ERR”. 
DIST (X0,Y0,X1,Y1)	Distance between two points Q0 (X0,Y0) and Q1(X1,Y1) in pixels
VDIST (X0,Y0, a0,b0,c0)	Length of a perpendicular to line L (a0x+b0y+c0=0) through point Q (X0,Y0) in pixels 
VPOINTX (X0,Y0, a,b,c) **VPOINTY (X0,Y0, a,b,c)**	Coordinate X and Y of Q1 which is a intersection of line L (ax+by+c=0) and a perpendicular to line L through point Q0 (X0,Y0) 

CIRCLEX (x0,y0,x1,y1,x2,y2) **CIRCLEY (x0,y0,x1,y1,x2,y2)** **CIRCLER (x0,y0,x1,y1,x2,y2)**	Coordinate X and Y of the center and radius (in pixels) of a circle through three points, (x0,y0), (x1,y1) and (x2,y2)	 If it cannot be calculated, the judgement will be “Error”.

LINELSA (C0,C1,S)
LINELSB (C0,C1,S)
LINELSC (C0,C1,S)
	Regression line expression in least squares
	Element a, b and c of a regression line (ax+by+c) when regarding numerical calculation No.C0 as the top of X, calculation No.C1 as the top of Y, and S-number of calculation data as continuous data. Element a, b, and c are calculated by LINELSA, LINELSB, and LINELSC respectively.
	If it cannot be calculated, the judgement will be “Error”.
	
	Example) Regression line of five points (X0 , Y0) to (X4, Y4)
	CAC000 = X0
	CAC001 = X1
	CAC002 = X2
	CAC003 = X3
	CAC004 = X4
	CAC005 = Y0
	CAC006 = Y1
	CAC007 = Y2
	CAC008 = Y3
	CAC009 = Y4
	CAC010 = LINELSA(0, 5, 5)
	CAC011 = LINELSB(0, 5, 5)
	CAC012 = LINELSC(0, 5, 5)
		Register the points in a calculation so that their coordinates X and Y are continuous.
		To obtain element a.
		To obtain element b.
		To obtain element c.

Comparison Function

EQ (S0, S1)	Returns "1" when S0 = S1, otherwise "0".	e.g.) EQ (85, 85) = 1
NEQ (S0, S1)	Returns "1" when S0 ≠ S1, otherwise "0".	e.g.) NEQ (85, 85) = 0
LT (S0, S1)	Returns "1" when S0 < S1, otherwise "0".	e.g.) LT (85, 85) = 0
LEQ (S0, S1)	Returns "1" when S0 ≤ S1, otherwise "0".	e.g.) LEQ (85, 85) = 1
GT (S0, S1)	Returns "1" when S0 > S1, otherwise "0".	e.g.) GT (215, 85) = 1
GEQ (S0, S1)	Returns "1" when S0 ≥ S1, otherwise "0".	e.g.) GEQ (215, 85) = 1

4.12 Totally Judging Results of Checkers (Judgement)

PV has a function that totally judges on the judgements of checkers and numerical calculations. Although 1000 Judgements are provided, No.0 to 999 (when 10 blocks are used), you can set maximum of 1000 expressions per type combining with numerical calculations.

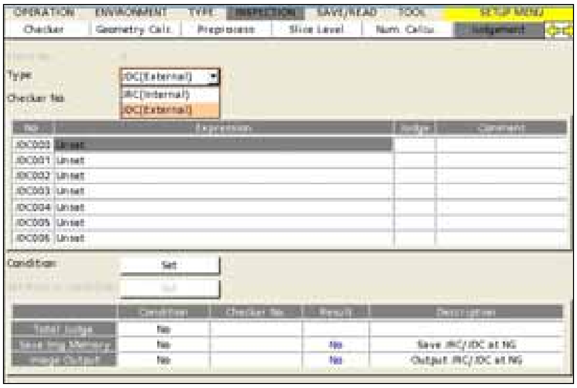
Judgement can be displayed on the screen and output to the external devices. In addition, images can be saved according to the judgement and the images can be output to the external devices.

▶ Note

When the execution mode is set to “Automatic Switch”, the judgement is a branch condition. Refer to Chapter 4.4.3 (page 75) about the setting procedure of branch conditions.

4.12.1 Setting Judgement Conditions

Creating a Calculation



No.	Expression	Judge	Comment
JDC000	Unset		
JDC001	Unset		
JDC002	Unset		
JDC003	Unset		
JDC004	Unset		
JDC005	Unset		
JDC006	Unset		

	Condition	Checker No.	Result	Description
Total Judge	No			
Save Img. Memory	No		No	Save JRC/JDC at NG
Image Output	No		No	Output JRC/JDC at NG

1. **Select "INSPECTION” > “Judgement” from the menu bar.**

   “Judgement” window is displayed.

   ▶ Note

   If [Judgement] is not displayed after selecting [INSPECTION], tilt the ENTER key to the right to show the hidden menus. Yellow arrows shown in the submenu row indicates that the menu is hidden.

2. **Select a type of Judgement to set by [Type].**

   The list of the judgements that you selected is displayed.
   Judgement has two types as below. Select them in accordance with your purpose.

JDC (External):	The judgement result can be output to the external device.
JRC (Internal):	The judgement results cannot be output to the external device. The other conditions are the same as that of JDC (External). Use JRC when computing a judgement which is not necessary to be output to the external device. Example: As a precalculation of JDC (External) As a condition to save images or to output images.

3. **Select a calculation list and a judgement number to set.**

   The screen of numerical calculation setting is displayed.

4. **Select the numerical calculation input field and press the ENTER key again.**

   The list of items that can be registered in a calculation is displayed.

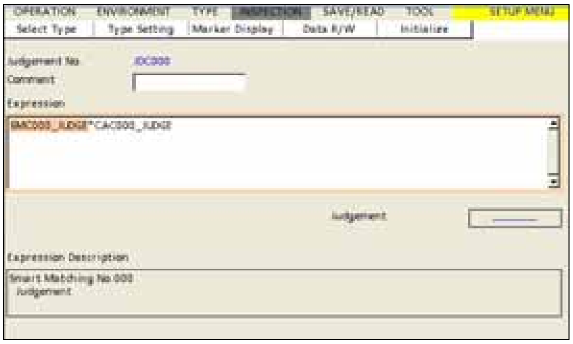
Checker:	Select this to input judgements of checkers including Position Adjustment and Area Size Adjustment.
Operator:	Select this to input operators such as “AND” and “OR” to judge results totally.
Numerical Calculation:	Select this to input a judgement of a numerical calculation.
Judgement JRC:	Select this to input a judgement of JRC (Internal). (When you have set a judgement of JRC, you can select only JRC with smaller number than currently setting JRC.)
Judgement JDC:	Select this to input judgement of JDC (External) with smaller number than currently setting judgement number. (When you have set a judgement of JRC, you cannot select JDC.)

5. **Enter an operation expression.**

Up to 16 items and 560 characters* can be set.
If you selected a wrong item, delete it with the F2 key and reregister the expression.

▶ Note

Moving the cursor onto an item displays the information of the item in the expression explanation field.
*) The products before ver.1.1 limit the number of characters to 256.



Judgement No. JDC000
Comment
Expression
SMC000_JUDGE*CAC000_JUDGE
Expression Description
Smart Matching No.000
Judgement

6. **Enter a comment with the software keyboard as necessary.**

7. **After inputting is completed, press the CANCEL key.**

8. **Press the Cancel key again.**

When the dialog message appears, select “Yes”.
“Yes”: Registers the expression.
"No": Returns to the status before inputting the expression.
"Cancel": Cancels registering the expression and come back to status to edit.

▶ Note

When an expression is incorrect such as a grammatical error, even if you select [Yes], a message appears and registration cannot be executed. Correct the expression in the case.

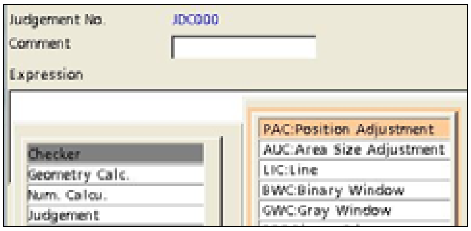
9. **Press the TRIG key to run a test and confirm the updated judgement as necessary.**

Input Example: Entering a Judgement of a Checker

For this example, we enter the judgement of Position Adjustment No.0. Depending on the type of checker, selectable data varies.

1. **In the list of items that can be entered in an expression, select “Checker” > "PAC(Position Adjustment)".**

The list of position adjustment is displayed.



Judgement No. JDC000
Comment
Expression

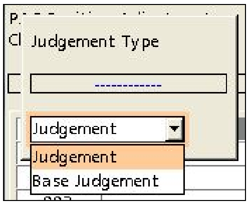
2. **Select checker No. 000.**

The list of result types is displayed.

3. **Select "Judgement".**

The code indicating the judgement of Position Adjustment No.0 is displayed in the expression field.

Highlighting a code displays the meaning of it in the bottom field of the screen.



Copying Expression

1. **Select "INSPECTION” > “Judgement” from the menu bar.**

   “Judgement” window is displayed.

2. **Specify a type of judgement in the Judgement window.**

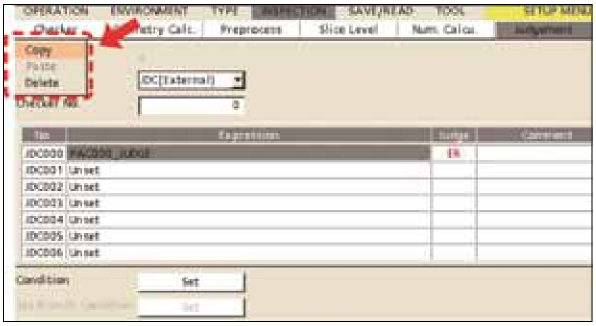
3. **Select a calculation list and a judgement number to copy.**

4. **Press the FUNC key and select “Copy” from the displayed menu.**

5. **Move the cursor onto the destination judgement No.**

6. **Press the FUNC key and select “Paste” from the displayed menu.**

   Copying is executed.



No	Expression	Judge	Comment
JDC000	FAC000_JUDG2	ER	
JDC001	Un set		
JDC002	Un set		
JDC003	Un set		
JDC004	Un set		
JDC005	Un set		
JDC006	Un set		

▶ Note

If an expression already exists in the destination, the message of overwrite confirmation appears.

Replacing a Item

This function replaces a part of an expression with another item to use.

1. **Move the cursor onto the item to replace.**

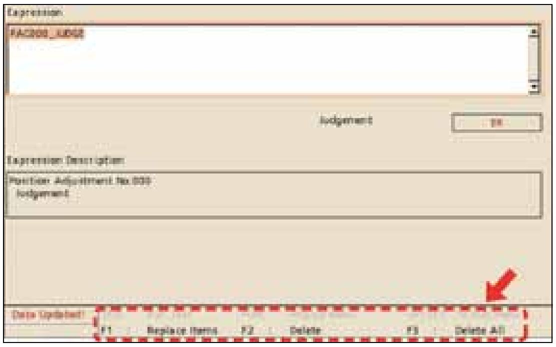
   The descriptions of the F1, F2 and F3 keys are displayed in the key guide.

2. **Press the F1 key: Replace Items.**

   In a similar way to creating an expression, an item select window is displayed.

3. **Select an item.**

   It is replaced with the selected item.



Position Adjustment No.000
Judgement

Deleting Operation Expressions and Items

A part of or an entire operation expression can be deleted.

1. **Move the cursor onto the deleting item.**

2. **To delete just an item, move the cursor onto the item and press the F2: Delete key.**

   The item is deleted.

3. **To delete an entire expression, press the F3: Delete All key.**

   As the confirming message appears, selecting “Yes” deletes all items registered in the expression.

Data That Can Be Used in Judgement

The data described below is that can be used in judgement expression. The symbols in parentheses are displayed in operation expressions.

Checker - Position Adjustment (PAC) No.0-999

<table>
<tr><th colspan="5">Item</th><th>Condition for OK judgement</th></tr>
<tr><td colspan="5">Judgement
(JUDGE)</td><td>The specified object or edge is detected.</td></tr>
<tr><td colspan="2">Base Judgement
(BJUDGE)</td><td>Position Adjustment:
• Binary Edge
• Gray Edge</td><td>Position Adjustment:
• Feature Extraction
• Matching
• Smart Edge (Circle)
Position Rotation Adjustment:
• Feature Extraction (Principal Axis Angle)
• 360-degree Matching</td><td>Position Rotation Adjustment
• Feature Extraction (2 checkers)
• Matching (2 checkers)
Rotation Adjustment all</td><td></td></tr>
<tr><td rowspan="4"></td><td>No.0 (0)</td><td>Horizontal Base Checker 0</td><td>Base Checker 0</td><td>Base Checker 0</td><td rowspan="4">The base checkers can detect the specified object or edge.</td></tr>
<tr><td>No.1 (1)</td><td>Horizontal Base Checker 1 (Center Detection)</td><td></td><td>Base Checker 1 (Center Detection)</td></tr>
<tr><td>No.2 (2)</td><td>Vertical Base Checker 2</td><td></td><td>Base Checker 2</td></tr>
<tr><td>No.3 (3)</td><td>Vertical Base Checker 3 (Center Detection)</td><td></td><td>Base Checker 3 (Center Detection)</td></tr>
</table>

Others

Item		Condition for OK judgement
Checker - Area Size Adjustment (AUC) No.0-999	Judgement (JUDGE)	The specified object or edge is detected.
Checker - Line (LIC) No.0-999	Judgement (JUDGE)	Pixel judgement and Object judgement are both OK.
	Pixel judgement (DJUDGE)	The number of pixels is within the Judgement limits.
	Object judgement (LJUDGE)	The number of objects is within the Judgement limits.
Checker - Binary Window(BWC) No.0-999	Judgement (JUDGE)	Area value is within the OK Judgement limits.
Checker- Gray Window(GWC) No.0-999	Judgement (JUDGE)	Gray Average is within the OK Judgement limits.
Checker - Binary Edge(BEC) No.0-999	Judgement (JUDGE)	The number of detected edges is within the OK Judgement limits.
Checker - Gray Edge(GEC) No.0-999	Judgement (JUDGE)	
Checker- Feature Extraction (FEC) No.0-999	Judgement (JUDGE)	The number of detected objects is within the OK Judgement limits.
Checker - Smart Matching(SMC) No.0-999	Judgement (JUDGE)	The number of detected objects at the last phase is equal to the maximum limitation of the number of detected objects that was set at the last phase of the sequence.
Checker - Flaw Detection(FWC) No.0-999	Judgement (JUDGE)	The number of detected flaws is within the OK Judgement limits.
Checker - Connector - Binary Window(CBW) No.0-999	Judgement (JUDGE)	
	Individual Judgement(PJUDGE) No.0-99	

Item		Condition for OK judgement
Checker - Connector Gray Window (CGW) No.0-999	Judgement (JUDGE)	
	Individual Judgement(PJUDGE) No.0-99	
Checker - Connector Gray Edge (CGE) No.0-999	Judgement (JUDGE)	Pitch Total Judgement and Distance Difference Total Judgement are both OK.
	Pitch total judgement (PTJUDG)	Pitch Judgements are all OK.
	Distance Difference Total Judgement (UPJUDG)	Distance Difference Judgements are all OK.
	Pitch Judgement(PJUDGE) No.0-99 (Judgement of each pitch)	The detected pitches are within the Judgement limits of pitches.
	Distance Difference Judgement(UJUDGE) No.0-99 (Judgement of each distance difference)	The detected distance difference is within the Judgement limits of distance difference.
Smart Edge (Circle) (SEC) No.0-999	Judgement (JUDGE)	The judgements of Measurement Value, Standard Deviation, Circularity and Unused Edge Count are all OK.
	Measurement Judgement (LJUDGE)	Measurement Value*1) is within the range of the maximum/minimum limitations.
	Standard Devation Judgement (SJUDGE)	Standard Deviation is within the range of the maximum/minimum limitations.
	Circularity Judgement (CJUDGE)	Circularity is within the range of the maximum/minimum limitations.
	Unused Edge Count Judgement (FJUDGE)	Unused Edge Count is within the range of the maximum/minimum limitations.
	Individual Judgement (IJUDGE) No.0-3599	The result of the cell with the specified No. is OK. (Undetected, excluded and NG cells are NG.)
Smart Edge (Line) (SEL) No.0-999	Judgement (JUDGE)	The judgements of Measurement Value, Standard Deviation, Linearity and Unused Edge Count are all OK.
	Measurement Judgement (LJUDGE)	Measurement Value*2) is within the range of the maximum/minimum limitations.
	Standard Devation Judgement (SJUDGE)	Standard Deviation is within the range of the maximum/minimum limitations.
	Linearity Judgement (JUDGE)	Linearity is within the range of the maximum/minimum limitations.
	Unused Edge Count Judgement (FJUDGE)	Unused Edge Count is within the range of the maximum/minimum limitations.
	Individual Judgement (IJUDGE) No.0-3599	The result of the cell with the specified No. is OK. (Undetected, excluded and NG cells are NG.)

Item		Condition for OK judgement
Color Window (CWC) No.0-999	Judgement (JUDGE)	The judgements of the gray value, average and standard deviation of red, green and blue elements are all OK.
	R Judgement (RJUDGE)	The gray value of red element is within the range of the maximum/minimum limitations.
	R Average Judgement (RAJUDGE)	The gray average of red element is within the range of the maximum/minimum limitations.
	R Standard Deviation Judgement (RSJUDGE)	The standard deviation of gray value of red element is within the range of the maximum/minimum limitations.
	G Judgement (GJUDGE)	The gray value of green element is within the range of the maximum/minimum limitations.
	G Average Judgement (GAJUDGE)	The gray average of green element is within the range of the maximum/minimum limitations.
	G Standard Deviation Judgement (GSJUDGE)	The standard deviation of gray value of green element is within the range of the maximum/minimum limitations.
	B Judgement (BJUDGE)	The gray value of blue element is within the range of the maximum/minimum limitations.
	B Average Judgement (BAJUDGE)	The gray average of blue element is within the range of the maximum/minimum limitations.
	B Standard Deviation Judgement (BSJUDGE)	The standard deviation of gray value of blue element is within the range of the maximum/minimum limitations.
Geometry Calculation (GGC) No.0-999	Judgement (JUDGE)	All the judgements for the items set in Judgement Limits are OK.
	X Judgement (XJUDGE)	IP X or Center X is within the range of the maximum/minimum limitations.
	Y Judgement (YJUDGE)	IP Y or Center Y is within the range of the maximum/minimum limitations.
	Standard Deviation Judgement (SJUDGE)	Standard Deviation is within the range of the maximum/minimum limitations.
	Angle Judgement (AJUDGE)	Line Angle is within the range of the maximum/minimum limitations.
	Distance Judgement (DJUDGE)	Distance is within the range of the maximum/minimum limitations.
	Intersecting Angle Judgement (CAJUDGE)	Intersecting Angle is within the range of the maximum/minimum limitations.
	Radius Judgement (RJUDGE)	Radius is within the range of the maximum/minimum limitations.
	Major Axis Judgement (LAJUDGE)	Major Axis of Ellipse is within the range of the maximum/minimum limitations.
	Minor Axis Judgement (SAJUDGE)	Minor Axis of Ellipse is within the range of the maximum/minimum limitations.
Numerical Calculation (CAC/OCA)	CAC Numerical Calculation (JUDGE) No.0-999	Calculation result is within the Judgement limits.
	OCA Numerical Calculation Previous Result (JUDGE) No.0-999	
Judgement (JRC/JDC)	JUC Judgement (JUDGE) No.0-999	Judgement formula returns true.
	JDC Judgement (JUDGE) No.0-999	

*1) Measurement Value = Radius, Diameter or Width (decided according to the setting value of Detect Mode)
*2) Measurement Value = Deviation, Distance or Width (decided according to the setting value of Detect Mode)

About Operators

Use operators to judge results of multiple checkers or numerical calculations.

+: Logical sum

Returns "OK (1)", if the result of either A or B is OK (1).

Example: JDC001=A+B

A	B	JDC001
OK (1)	**OK (1)**	**OK (1)**
OK (1)	NG (0)	**OK (1)**
NG (0)	**OK (1)**	**OK (1)**
NG (0)	NG (0)	NG (0)

*: Logical product

Returns "OK (1)", if the results of both A and B are OK (1).

Example: JDC001=A*B

A	B	JDC001
OK (1)	**OK (1)**	**OK (1)**
OK (1)	NG (0)	NG (0)
NG (0)	**OK (1)**	NG (0)
NG (0)	NG (0)	NG (0)

#: Exclusive OR

Returns "OK (1)", if the results differ between A and B.

Example: JDC001 = A # B

A	B	JDC001
OK (1)	**OK (1)**	NG (0)
OK (1)	NG (0)	**OK (1)**
NG (0)	**OK (1)**	**OK (1)**
NG (0)	NG (0)	NG (0)

/: Negation

Reverses a judgement.

Do not put a symbol "/" before the multiple contents in parentheses.

Example: JDC001=/A

A	/	JDC001
OK (1)	Reversed	NG (0)
NG (0)	Reversed	**OK (1)**

JDC001 = / (A + B) ← Wrong: Because A and B is in parentheses.
JDC001 = / A * / B ← This means the same as the above formula. (Boolean algebra, De Morgan's laws)
Or store the formula of A+B in JRC (Internal) once, and then negate the JRC.

JDC002 = / (A * B) ← Wrong: Because A and B is in parentheses.
JDC002 = / A + / B ← This means the same as the above formula. (Boolean algebra, De Morgan's laws)
Or store the formula of A*B in JRC (Internal) once, and then negate the JRC.

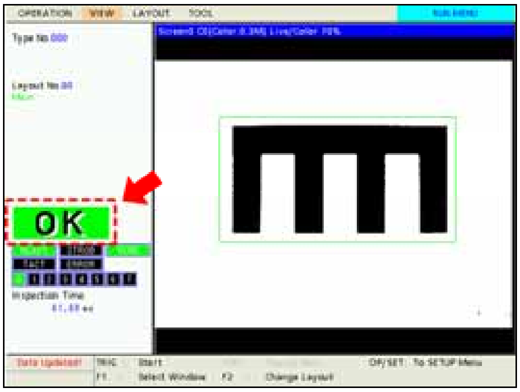
(: Left parenthesis
): Right parenthesis

Judges the contents in parentheses by priority.

4.12.2 Total Judgement

Total Judgement is a judgement displayed in the status display area in RUN menu or SETUP menu. It can be output to the external devices solely. One of judgements per type can be registered as a Total Judgement *1). In User-Defined mode or Automatic Switch mode, a judgement can be registered as a Total Judgement for each block.

*1) When Execution Mode is "Execute All". When Execution Mode is "Automatic Switch" or "User-Defined", only the specified number of blocks can be registered.

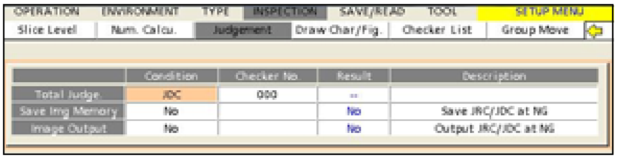


Selecting Total Judgement Expression

For “Execute All” execution mode

1. **Select "Condition" in judgement output setting window.**

“Condition” setting window is displayed.



	Condition	Checker No.	Result	Description
Total Judge.	JDC	000	--	
Save Img Memory	No		No	Save JRC/JDC at NG
Image Output	No		No	Output JRC/JDC at NG

2. **Select “Condition” column of Total Judge.**

Select a judgement type to register as a Total Judgement.
[NO]: No Total Judgement
[JRC]: Use a JRC(Internal) as a Total Judgement
[JDC]: Use a JDC(External) as a Total Judgement

3. **Select “Checker No.” column and set a judgement number.**

The result of the Total Judgement is displayed in the "Result” column.

4. **After setting is completed, press the CANCEL key.**

Now you completed registering.

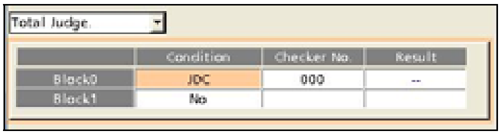
For “Automatic Switch” or “User-Defined” execution mode

1. **Select "Condition" in judgement output setting window.**

“Condition” setting window is displayed.

2. **Select “Total Judge.” in the item selecting field on the upper left.**

The list of the Total Judgement by blocks is displayed.



Total Judge.

	Condition	Checker No.	Result
Block0	JDC	000	--
Block1	No		

3. **Select “Condition” column of the block No. to set in the list and select a judgement type.**

For details, refer to the procedure of “Execute All” execution mode.

4. **Select “Checker No.” column and set a judgement number.**

5. **After setting is completed, press the CANCEL key.**

4.12.3 Selecting an Image Output Condition

Inspected images can be saved in the image memory of PV200 and output to the external devices when the judgement of the judging checker is “NG” during an inspection. Select a judging checker to be a condition to output images.

▶ Note

This setting is available only when the condition of “Image Output” (or “Save Image Memory”) is set to “NG judgement”. These conditions can be set from “Input/Output” of “ENVIRONMENT”.

Selecting a Condition Expression of Inspection Image Output/ Save in the Image Memory

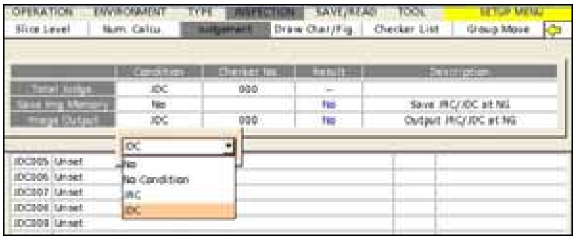
For “Execute All” execution mode

1. **Select "Condition" in judgement output setting window.**

“Condition” setting window is displayed.

2. **Select “Condition” column of Save Img. Memory or Image Output.**

Select a judgement type to register.



	Condition	Checker No.	Result	Description
Total Judge	JDC	000	–	
Save Img Memory	No		No	Save JRC/JDC at NG
Image Output	JDC	000	No	Output JRC/JDC at NG

JDC005	Unset
JDC006	Unset
JDC007	Unset
JDC008	Unset
JDC009	Unset

[No]: Images are not output or saved
[No Condition]: Not selecting a condition and output or save all images*
[JRC]: Use a JRC(Internal) as a condition to image output/save
[JDC]: Use a JDC(External) as a condition to image output/save

▶ Note

*Select ”No Condition” to temporarily output/save all images regardless of a judgement condition when the image output condition is set to “NG Judgement” which is in the window of “Input/Output” of “ENVIRONMENT”.

When the other conditions are selected than “NG Judgement”, the setting of Judgement window is invalid.

3. **Select “Checker No.” column and enter a judgement number.**

The status of Image Output (or Save Image Memory) is displayed in the "Result” column.
"No" indicates that image output/save is not executed because the condition is not fulfilled.

4. **After setting is completed, press the CANCEL key.**

Now you completed registering.

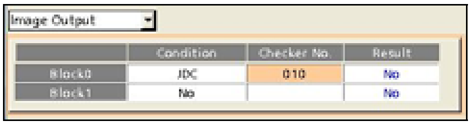
For “Automatic Switch” or “User-Defined” execution mode

1. **Select "Condition" in judgement output setting window.**

   “Condition” setting window is displayed.

2. **Select “Image Output” (or “Save Image Memory”) in the item selecting field on the upper left.**

   The list of the Save Image Memory or Image Output by blocks is displayed.



	Condition	Checker No.	Result
Block0	JDC	010	No
Block1	No		No

3. **Select “Condition” column of the block No. to set in the list and select a judgement type.**

   For details, refer to the procedure of “Execute All” execution mode.

4. **Select “Checker No.” column and set a judgement number.**

5. **After setting is completed, press the CANCEL key.**

   Now you completed registering.

▶ Note

In case of automatic switch, as for the inspection image output and image memory save, only the setting for the block finally executed is enabled.

For example, if executing the operation in the order of block No. 0 → block No.1 when the conditions for the inspection image output have been set for the block No. 0 only, the inspection image is not output as the conditions for the inspection image output have not been set for the block No. 1 finally executed.

4.13 Character/Figure Drawing

4.13.1 What is Character/Figure Drawing?

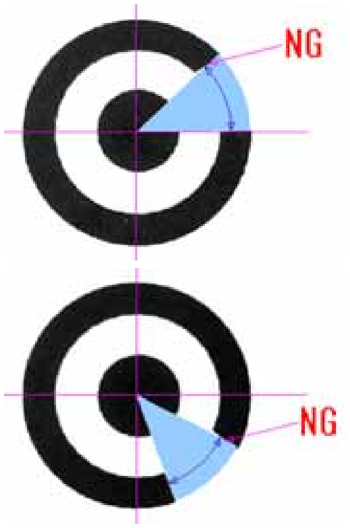
Character/Figure Drawing is the function to draw figures or characters, and display them on the screen window.

The drawable figures are Line, Cross, Rectangle, Slanted rectangle, Ellipse and Character. For some shapes, an arrowhead can be added or figure can be filled.

As the function(*1) that refers the values detected by each checker is provided, not only drawing a figure of a fixed size at a fixed position but also changing the size or position depending on the inspection result is possible. The values of the data detected by each checker or judgement result (OK/NG) can be also displayed as well as a fixed text.

The color is selectable from eight colors. There is the function to switch the display color according to the judgement results of each checker.

Up to ten figures can be registered for one character/figure drawing.

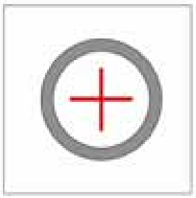


Note

- *1) Only the checkers set with the same camera can be referred.
- If the execution mode is "User-defined" or "Automatic Switch" when running a test in RUN Menu, the figure in the block that is not executed is not displayed. (Using the Marker function (page 421) displays a figure on the screen window of the specified camera regardless of the execution block.)
- Five kinds of figures and characters are collectively called "Figure" in this manual.

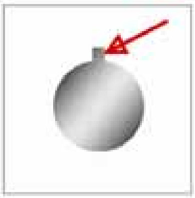
Examples of Figures

Cross



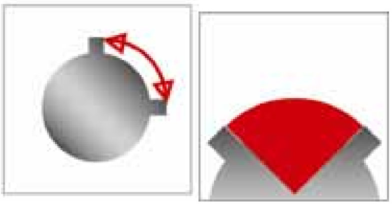
Set the intersection of a cross. The line length can be specified.

Line
(Straight line)



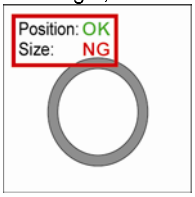
Set a start point and an end point. A half line can be displayed.

Ellipse



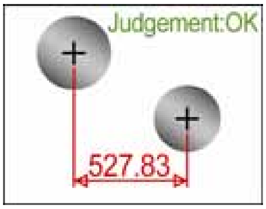
Set the center, width and height. Specifying the start and end angles enables to draw an arc or sector.

Rectangle, Slanted rectangle



Set a start point and an end point.
The figure can be filled.
Specify the center, width and height for "Slanted rectangle".

Character



Display judgement results, detected data or fixed text characters.
Specify the display position, character size and number of digits.

List of Menu Options

Character/Figure Drawing No.000 to 999*

- Comment
- Camera
- Color by Judgement
- Color (OK Color)
- NG Color
- No.0 - 9
  - Line
    - Start XY, End XY
    - Line Display — Segment / Half line 0 / Half line 1 / Wall-to-wall
    - Arrowhead — None / Start / End / Both
  - Cross
    - IP XY
    - Cross Display — Normal / Wall-to-wall
    - Length — 3 - 999
  - Rectangle
    - Start XY, End XY
    - Solid
  - Slanted rectangle
    - Center XY, Width, Height, Angle
    - Solid
  - Ellipse
    - Center XY, Width, Height, Start Angle, End Angle, Angle
    - Solid
    - Arrowhead — None / Start / End / Both
  - Character
    - Display Character
    - Coordinate XY
    - Character Size — 14 - 280
    - Display Base — Top Left / Top Center / Top Right / Left Center / Center / Right Center / Bottom Left / Bottom Center / Bottom Right
    - Offset Unit — Characters / Pixel
    - Offset X
    - Offset Y
    - Judgement Display — 1 0 E / OK NG ER
    - Digit Count — 1 - 15
    - Decimal Digit — 0 - 3
    - Alignment — Left / Center / Right

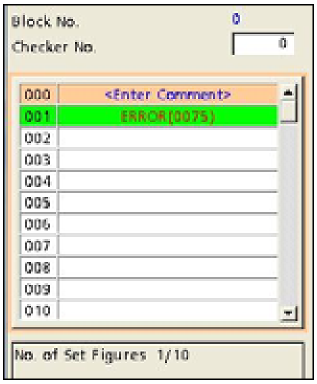
* When the number of blocks is 10.

4.13.2 Creating Character/Figure Drawing

Creating Character/Figure Drawing

1. **Select "Inspection" > "Draw Char/Fig." from the menu bar.**

   The list of Character/Figure Drawing checker is displayed.
   The number of figures that have been set in the highlighted checker number is displayed in the message field beneath the list.
   Example) No. of Set Figures 1/10



Block No. 0
Checker No. 0

000	<Enter Comment>
001	ERROR(0075)
002	
003	
004	
005	
006	
007	
008	
009	
010	

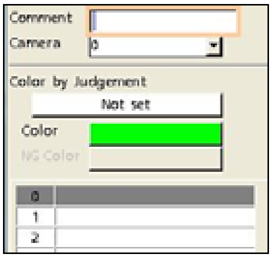
No. of Set Figures 1/10

2. **Select the checker number to be set and press the ENTER key.**

   The setting window for Character/Figure Drawing is displayed.
   If more than one figure is created, the figure with the larger number is displayed in the front.
   For example, rectangles of the same size are created in the same position, No.0 is in red and No.1 is in blue. In this case, only the blue rectangle of No.1 is displayed on the screen window.

3. **Select a camera No. in "Camera".**

   The image of the selected camera is displayed.



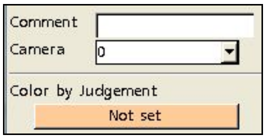
Camera 0

Setting Color

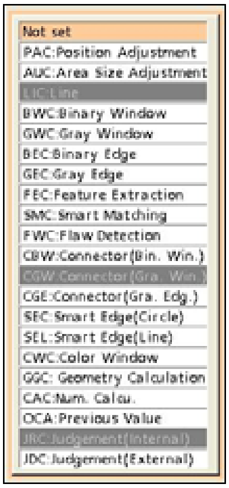
Set the color of figures. The display color can be switched or hidden depending on the judgement results (OK / NG) of the checkers with the same camera number.

4. **If you want to change the display color depending on the judgement results of each checker, select "Color by Judgement".**

   (When you do not use the function to change the color depending on the judgement results, proceed to Step 6.)
   The list of settable checkers is displayed. Unset checkers are shown in gray and cannot be selected.



Camera 0



5. **Select the checker and checker number to be set.**

   The selected checker and checker number is displayed in a symbol in the "Color by Judgement" field.

   ▶ Note

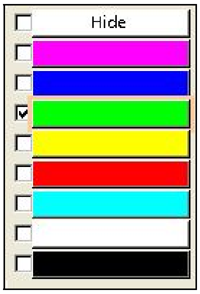
   When the checker which outputs more than one judgement results has been selected, specify which judgement result is used.
   Example: When selecting "Smart Edge (Circle)"
   Judgement, Measurement Judgement, Standard Deviation Judgement, Circularity Judgement, Unused Edge Count Judgement, Individual Judgement (Judgement of each cell)

6. **When "Color" (Color by Judgement) has been set, select "OK Color" or "NG Color".**

   "Hide" and eight preset colors are available.

7. **Select a desired color and press the ENTER key.**

   The box of the selected color is checked.



Selecting Figure

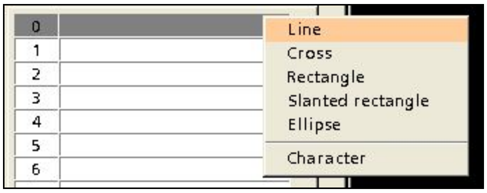
Up to ten figures with the same camera and color settings can be set.

8. **Select the list of figure.**

   Now you can select No.0 to 9.

9. **Select the figure number to set.**

   The available six figures are displayed.



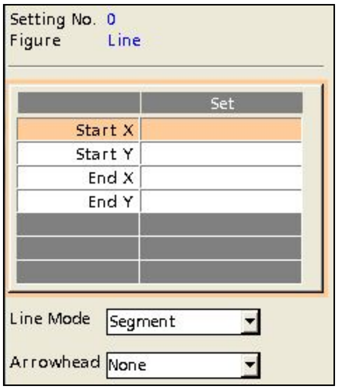
10. **Select the figure number to create.**

    The setting window of the selected figure is displayed. The items to specify the size of the figure and the display position are in the upper table, and the optional items to set appearance such as Arrowhead or Solid are beneath the table.

    Refer to the next page for how to set each figure.

    Note

    After the selection of a figure, it cannot be changed to another figure.
    To change the figure, delete the current figure and recreate a new figure.



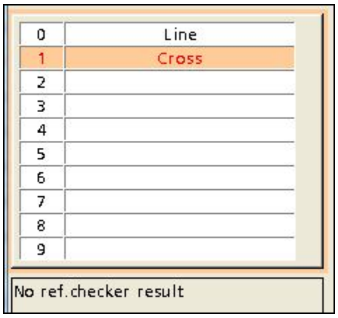
Setting No. 0
Figure Line

	Set
Start X	
Start Y	
End X	
End Y	

Line Mode Segment
Arrowhead None

Note

The set figure name is displayed in the list.
When the figure name is displayed in red, it shows that the figure cannot be drawn correctly. Moving the cursor onto the figure number displays the reason why it cannot be drawn in the message field. Change the setting to draw the figure correctly.

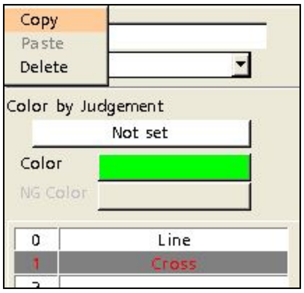


0	Line
1	Cross
2	
3	
4	
5	
6	
7	
8	
9	

No ref.checker result

Copying and Deleting Figure

Figures can be deleted or copied from the pop-up menu to be displayed by pressing the FUNC key.



Color by Judgement: Not set

NG Color

0	Line
1	Cross

1. **Highlight the figure number you want to delete or copy and press the FUNC key.**

2. **Select "Delete" or "Copy".**

When selecting "Delete", the dialog message appears. Select “Yes”.

3. **When selecting "Copy", move the cursor onto the destination figure number, press the FUNC key, and select “Paste”.**

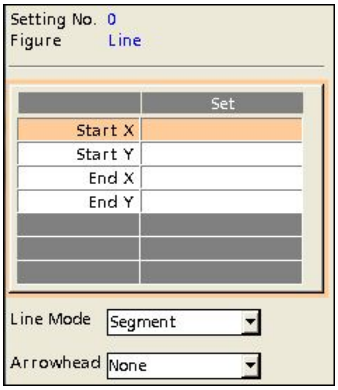
The copied figure is pasted.
If a figure already exists in the destination, the message of overwrite confirmation appears. Select “Yes” to overwrite it.

4.13.3 Setting the Drawing Position and Size of a Drawing

Line (Straight Line)

Specify the X and Y coordinates of the start and end points to display a line. The start and end points can be specified with the cursor, values and the coordinates detected by each checker. For details of selectable items, see page 269.

Specifying Start Point and End Point



Setting No. 0
Figure Line

	Set
Start X	
Start Y	
End X	
End Y	

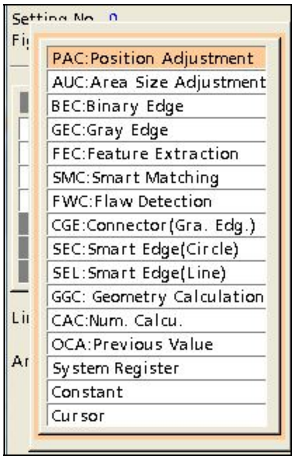
Line Mode: Segment
Arrowhead: None

1. **Select the table to set the start point XY and end point XY on the setting window of Line, and move the cursor onto "Start X" and press the ENTER key.**

A list of available items is displayed. (The checkers displayed in gray indicates that they are not unset.)

2. **Select the item to input in Start X from the list of the selectable items.**

When selecting "Cursor", move the cross mark displayed on the screen window and press the ENTER key.



▶ Note

About the items that X and Y-coordinates are input together
When selecting items other than Numerical Calculation, System Register and Constant, X and Y-coordinates are input together.
For example, when selecting "GEC: Gray Edge" for setting Start X, the XY-coordinate of the detected edge is input for Start X and Start Y.
If Start Y has been already input, it is overwritten.

If you want to set the item that the X and Y-coordinates are input together to X-(or Y-)coordinate and the item that a single coordinate is input such as Numerical Calculation, System Register or Constant to Y-(or X-)coordinate, specify the item that the coordinates are input together first and then specify the item that a single coordinate is input.

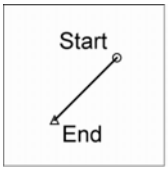
3. **In the same way, set Start Y, End X and End Y.**

Optional Settings

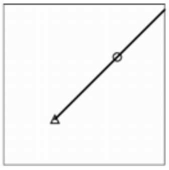
1. **Select "Line Display".**

Select the type of the line from the following four types.

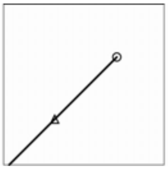
Segment
Display a line between the start and end points.



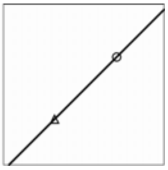
Half line 0
Display a line between the end point and the edge of the screen in the start point side.



Half line 1
Display a line between the start point and the edge of the screen in the end point side.

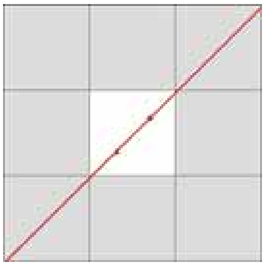


Wall-to-wall
Display a line between the both edges of the screen in the start and end point sides (*).



Note

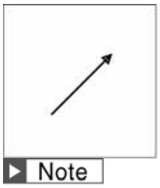
(*)Draw a line up to the ends of the eight screens surrounding the image captured with 4-Mega Camera (X-Coordinate: -2048 to 4095, Y-coordinate: -2048 to 4095) regardless of the type of the camera used. The right figure shows the example when using 4-Mega Camera.



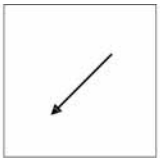
2. **Select "Arrowhead".**

Set this when adding arrowhead to the line.

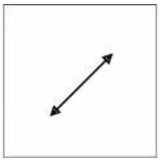
Start
Add an arrowhead to the start point.

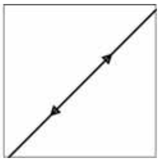


End
Add an arrowhead to the end point.



Both
Add arrowheads to the both start and end points.
The right figure shows the example when "Line Display" is "Wall-to-wall".





Note

When "Line Display" is set to "Half line 0", "Half line 1" or "Wall-to-wall", the arrowheads are displayed at the start and end points.

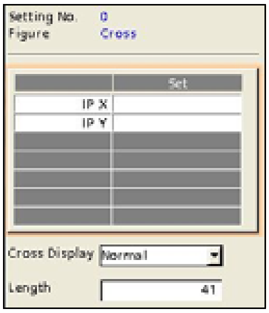
Cross

Specify the X and Y coordinates of the intersection point of a cross to display a cross. The intersection point can be specified with the cursor, values and the coordinates detected by each checker. For details of selectable items, see page 269.

Specifying Intersection Point

1. **Select the table to set the intersection point X and Y on the setting window of Cross, and move the cursor onto "IP X" and press the ENTER key.**

A list of available items is displayed. (The checkers displayed in gray indicates that they are not unset.)



Setting No. 0
Figure Cross

	Set
IP X	
IP Y	

Cross Display: Normal
Length: 41

2. **Select the item to input in IP X from the list of the selectable items.**

When selecting "Cursor", move the cross mark displayed on the screen window and press the ENTER key.
▼Refer to▼
About the items that X and Y-coordinates are input together (page 260)

3. **In the same way, set IP Y.**

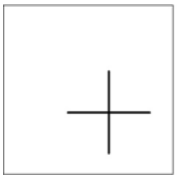
Optional Settings

Set the length of a cross.

1. **Select "Cross Display".**

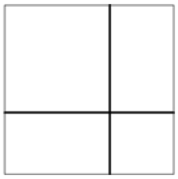
Normal (Default)

Display the cross of the length specified in the next step.



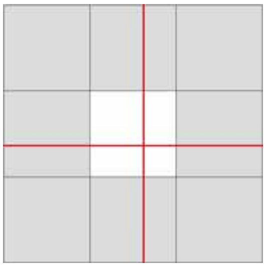
Wall-to-wall

Display the cross of the length up to the ends of the screen. (*)



▶ Note

(*)Draw a line up to the ends of the eight screens surrounding the image captured with 4-Mega Camera (X-Coordinate: -2048 to 4095, Y-coordinate: -2048 to 4095) regardless of the type of the camera used.
The right figure shows the example when using 4-Mega Camera.



2. **When selecting "Normal" in "Cross Display", set the length of the cross in "Length".**

The length to be set is the total length of the vertical line and horizontal line of the cross. The available value is an odd value in the range of 3 to 999 (pixels).

Rectangle

Specify the X and Y coordinates of the start and end points to display a rectangle. The start and end points can be specified with the cursor, values and the coordinates detected by each checker. For details of selectable items, see page 269.

Specifying Start Point and End Point

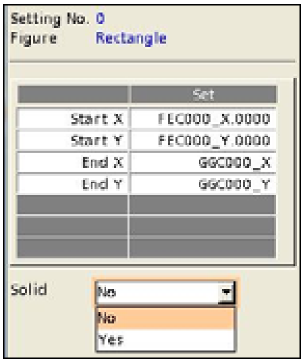
Refer to the procedure of "Specifying Start Point and End Point" for Figure: Line (page 260).

Optional Setting

Rectangle can be filled.

1. **Select "Solid".**

No (Default): Displays only the frame border of rectangle.
Yes: Fills the inside of rectangle with the same color of the frame boarder.



Setting No. 0
Figure Rectangle

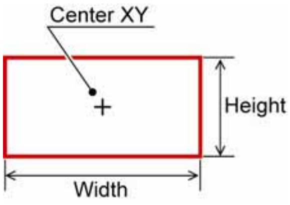
	Set
Start X	FEC000_X.0000
Start Y	FEC000_Y.0000
End X	GGC000_X
End Y	GGC000_Y

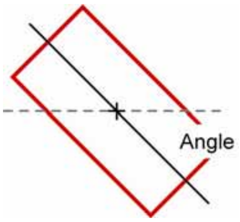
Solid No

Slanted Rectangle

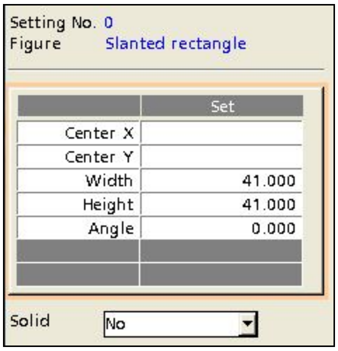
Specify the center coordinate, width, height and rotation angle to draw a slanted rectangle. For details of selectable items, see page 269.

Setting Size of Rectangle, Rotation Angle and Display Position





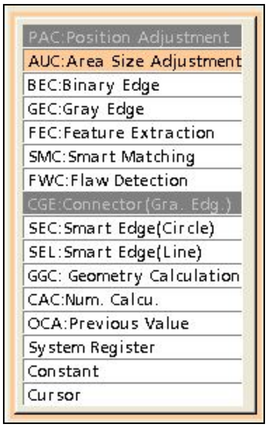
Specifying Center Coordinate



Setting No. 0
Figure Slanted rectangle

	Set
Center X	
Center Y	
Width	41.000
Height	41.000
Angle	0.000

Solid No



1. **Select the table on the setting window of Slanted rectangle, and move the cursor onto "Center X" and press the ENTER key.**

A list of available items is displayed. (The checkers displayed in gray indicates that they are not unset.)

2. **Select the item to input in Center X from the list of the selectable items.**

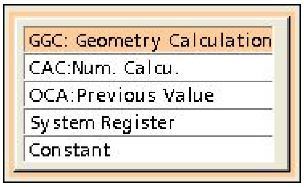
When selecting "Cursor", move the cross mark displayed on the screen window and press the ENTER key.

Refer to

About the items that X and Y-coordinates are input together (page 260)

3. **In the same way, set Center Y.**

Specifying Width and Height



4. **Move the cursor onto "Width" and press the ENTER key.**

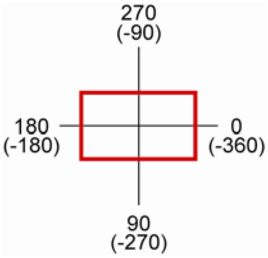
A list of available items is displayed.

5. **Select the item to input in Width from the list of the selectable items.**

6. **In the same way, set Height.**

Specifying (Rotation) Angle

Set the rotation angle of the rectangle.
Specify the angle in a range of -360 to 360 regarding the position at three o'clock as 0 degree.
Clockwise is positive angle (0 to 360) and counterclockwise is negative angle (0 to -360).



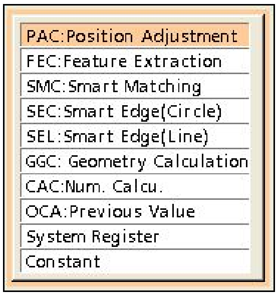
▶ Note

When specifying a value of Numerical Calculation or System Register for the reference of the angle, the value may exceed +/-360. In that case, the angle of the remainder is automatically calculated by dividing the input value by 360.

Example) When the value of System Register is 750
750 divided by 360 is 2, and the remainder is 30. = 30 degrees

7. **Move the cursor onto "Angle" and press the ENTER key.**

A list of available items is displayed.



PAC:Position Adjustment
FEC:Feature Extraction
SMC:Smart Matching
SEC:Smart Edge(Circle)
SEL:Smart Edge(Line)
GGC: Geometry Calculation
CAC:Num. Calcu.
OCA:Previous Value
System Register
Constant

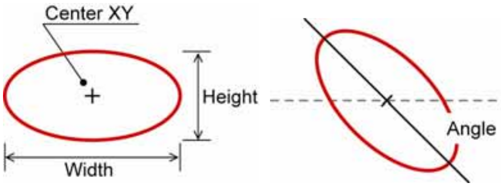
8. **Select the item to input in Angle from the list of the selectable items.**

Ellipse

Specify the center coordinate, width, height and (rotation) angle to draw an ellipse.
An arc can be also drawn by specifying the angle range.

For details of selectable items, see page 269.

Setting Size of Ellipse, Position and Angle

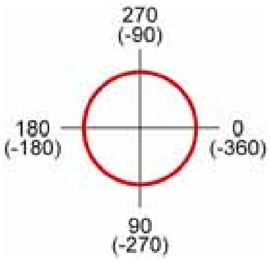


▼Refer to▼

The setting procedures of Center, Width and Angle are the same as that of "Slanted rectangle". Refer to page 263.

Setting Start Angle and End Angle Drawing Elliptic Arc)

To draw an elliptic arc, set the start and end points of the arc by specifying the angles. The start point is called Start Angle and the end point is called End Angle. In the same way of (Rotation) "Angle", set them in a range of -360 to +360.



▶ Note

When specifying a value of Numerical Calculation or System Register for the reference of each angle, the value may exceed +/-360. In that case, the angle of the remainder is automatically calculated by dividing the input value by 360.

Example) When the value of System Register is 750

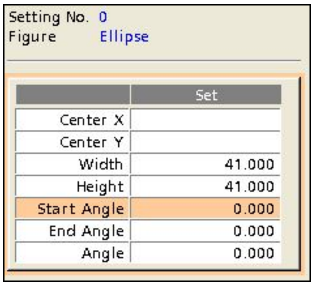
750 divided by 360 is 2, and the remainder is 30. = 30 degrees

1. **Move the cursor onto "Start Angle" and press the ENTER key.**

   A list of available items is displayed. (The checkers displayed in gray indicates that they are not unset.)

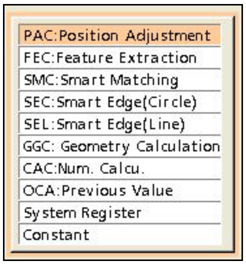
2. **Select the item to input in Start Angle from the list of the selectable items.**

3. **In the same way, set End Angle.**



Setting No. 0
Figure Ellipse

	Set
Center X	
Center Y	
Width	41.000
Height	41.000
Start Angle	0.000
End Angle	0.000
Angle	0.000



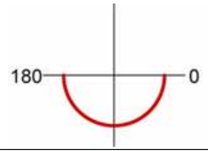
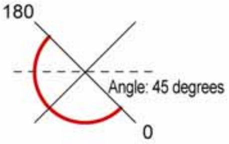
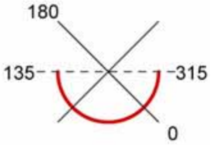
- PAC:Position Adjustment
- FEC:Feature Extraction
- SMC:Smart Matching
- SEC:Smart Edge(Circle)
- SEL:Smart Edge(Line)
- GGC: Geometry Calculation
- CAC:Num. Calcu.
- OCA:Previous Value
- System Register
- Constant

About 0-degree Position

The position of "0 degree" for the start and end angles is at three o'clock as mentioned above. However, if the ellipse is rotated (when the angle specified in the previous section is other than 0), the specified angle is at the position of 0 degree.

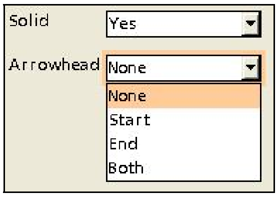
Note that the position of the displayed arc varies when the (rotation) angle of each ellipse differs even if the same values are set to the start and end angles as shown in the example below.

Example)

	Setting 1	Setting 2	Setting 3
Angle	0	45	45
Start angle	0	0	315
End angle	180	180	135
Displayed arc			

Optional Settings

"Solid" and "Arrowhead" is provided for the options of "Ellipse".

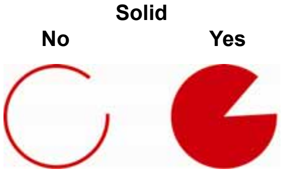


Solid Yes
Arrowhead None

- None
- Start
- End
- Both

1. **Set "Solid".**

   When filling an arc, the area from the start angle to the end angle is filled as shown in the right figure.



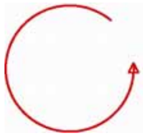
2. **Set "Arrowhead".**

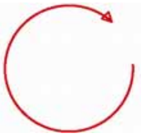
   Select one from the following three types to add the arrowhead.

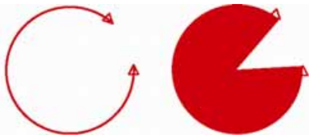
Start
Add an arrowhead to the start angle side.

End
Add an arrowhead to the end angle side.

Both
Add arrowheads to the both start and end angle sides.
The right figure shows the example of the solid figure.







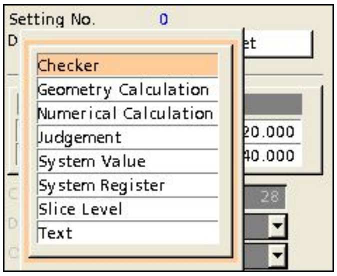
Character

Displays a maximum of 16 one-byte characters such as inspection results of checkers and system values. Set the characters to display, display position, character size, number of digits and alignment.

Specifying Characters to Display

1. **Select “Display Character” in “Character” setting window.**

A list of available items is displayed. (The items displayed in gray indicates that they are not unset.)

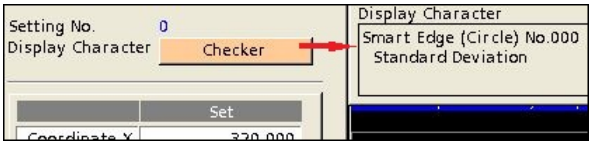


The data that can be set for each item is as follows.

Checker:	Comment of each checker, Inspection result (*Same as the items that can be input in Numerical Calculation)
Geometry Calculation:	Comment, Inspection result
Numerical Calculation:	Comment, Inspection result (Previous value is selectable.)
Judgement:	Comments of JRC(Internal), JDC(External), Judgement
System values:	Inspection time, Inspection frequency, Total judgement, Scan count, Type No.
System Register:	System Register 0 - 7
Slice Level:	Maximum and Minimum values of each slice level group
Text:	Character string up to 16 (one-byte) characters With "PVWIN200", you can input the characters that not on the software keyboard.

2. **Select characters to display from the list.**

After the selecting is completed, the detail of the displayed characters is shown in the upper part of the screen window.



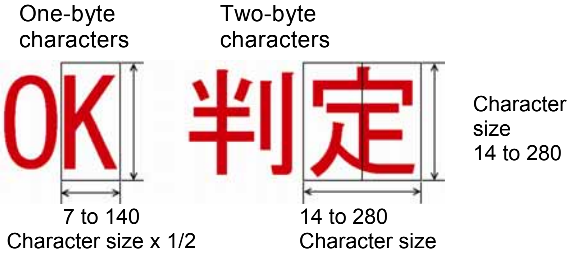
Setting No. 0
Display Character Checker

Display Character
Smart Edge (Circle) No.000
Standard Deviation

Character Size and Display Base

About Character Size

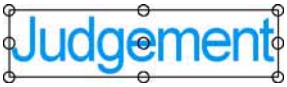
Specify the vertical size of a character in the range of 14 to 280 pixels by 14. This size includes the vertical size of the character, top and bottom margins.
As shown in the right figure, the horizontal and vertical sizes of two-byte characters are the same, however, the horizontal size of one-byte characters is a half of the vertical size.



About Display Position

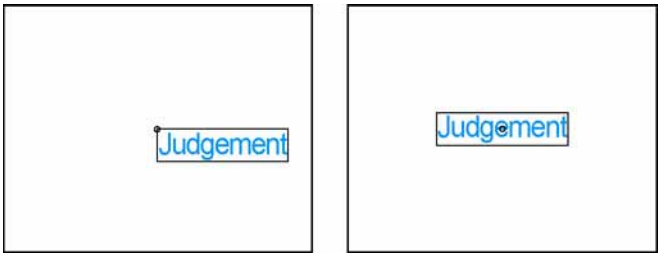
Coordinate X, **Coordinate Y**	Refer the coordinate values detected by each checker, results of numerical calculation or values stored in the system registers, or specify specific positions with values or the cursor. It is also possible to refer the coordinate of the characters that have been set for the currently setting Character/Figure Drawing checker. However, only the character coordinate that has been set to the smaller number than the currently setting number can be referred.

Display Base When displaying a string in a specified position, the top left point of the string is placed on the specified coordinate value. This point is called "Display Base". It is selectable from nine points including Top Left.



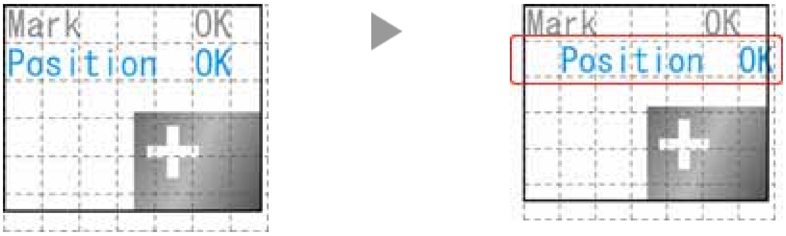
Note Differences in the display positions among display bases

Example) When setting Coordinate X and Y to the center of the screen


Display Base =Top Left
Display Base = Center

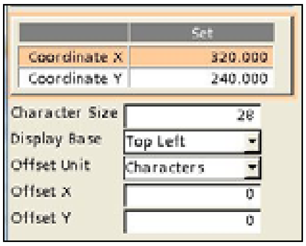
Offset It is used to move strings from Coordinate X and Coordinate Y for a certain amount to display. The amount of moving strings is called "Offset" and the unit is "Offset Unit".

Select either "Characters" or "Pixel" for Offset Unit. When the offset unit is "Characters", a one-byte character of the size specified in "Character Size" is counted as one character.


Offset X: 0
Offset X:2

1. **Select the table to set the coordinate X and Y, and move the cursor onto "Coordinate X" and press the ENTER key.**

   A list of available items is displayed. (The checkers displayed in gray indicates that they are not unset.)
   For details of selectable reference items, see page 269.



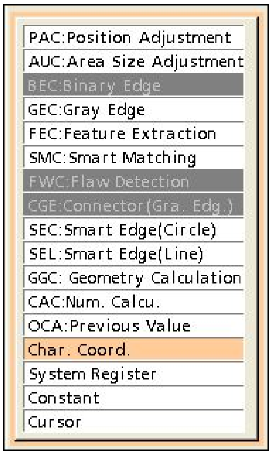
	Set
Coordinate X	320.000
Coordinate Y	240.000

Character Size 28
Display Base Top Left
Offset Unit Characters
Offset X 0
Offset Y 0

2. **Select the item to input in Coordinate X from the list of the selectable items.**

   When "Character" has been already created in the number smaller than the currently setting figure number, the coordinate of that character can be referred.

   Refer to
   About the items that X and Y-coordinates are input together (page 260)



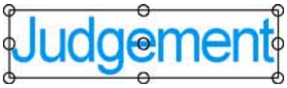
3. **Set "Coordinate Y".**

4. **Set "Character Size".**

   Settable Range: 14 to 280

5. **Set "Display Base".**

Select from nine points (the encircled positions in the right figure), which are eight points on the circumscribing rectangle of the characters (including margins) and the center point.
Top Left (Default) / Top Center / Top Right / Left Center / Center / Right Center / Bottom Left / Bottom Center / Bottom Right



▶ Note
When the displayed characters are numerical values, the size of the circumscribing rectangle of characters depends on the "Digit Count" optionally set.

6. **Set "Offset Unit", "Offset X" and "Offset Y".**

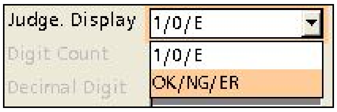
The settable offsets X and Y are as shown in the right table.

Offset Unit	Offset X	Offset Y
Character	±292	±146
Pixel	±2048	±2048

Optional Settings for Display Method

The following options are available depending on created display characters. Set as necessary.

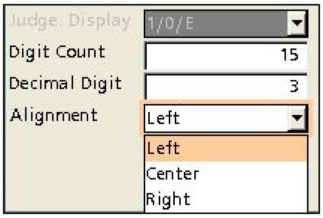
Judge Display: "1/0/E" (Default) / "OK/NG/ER"
When Display Character is Judgement, select either values or characters to display the judgement.



Judge. Display 1/0/E

Digit Count: 1 to 15
Set when Display Character is numerical values.
Specify the digit number that is over the displayed values.
Set the total digit number including the symbol for negative values, decimal point for actual values and the number of decimal places.

▶ Note
When the digit number of the displayed value exceeds the specified digit count, all the digits are displayed as asterisks "*".



Judge. Display 1/0/E
Digit Count 15
Decimal Digit 3
Alignment Left

Decimal Digit: 0 to 3
Set when Display Character is actual values.
When the specified digit number is smaller than the number of decimal places for the displayed value, the value is rounded to the specified digit number.
Example) When Display Character is 100.125 and Decimal Digit is 2, the displayed value is "100.13".

Alignment: Left (Default) / Center / Right
Set when Display Character is numerical values.
Select the alignment of characters when the displayed characters are smaller than the specified digit count.

A list of the Data Can Be Referred to Figure

	Coordinate X, Y	Width, Height	Angle
PAC: Position Adjustment	○ Base Position Coord. Detect Position Coord. Base Coord. (Detect Coord. of Base Checker)	×	○ Base Position Angle Detect Position Angle
AUC: Area Size Adjustment	○	×	×
BEC: Binary Edge	○	×	×
GEC: Gray Edge	○	×	×
FEC: Feature Extraction	○ Center of Gravity Coord. Circumscribing Rectangle Coord. (Upper left, Upper right, Lower left, Lower right)	×	○ (Principal axis angle)
SMC: Smart Matching	○	×	○
FWC: Flaw Detection	○	×	×
CGE: Connector (Gray Edge)	○ Area 0 Area 1 (*a	×	×
SEC: Smart Edge (Circle)	○ Center Coord. 0 Center Coord. 1 (*b Cell Individual Result 0 Cell Individual Result 1 (*c	×	○ Max. Angle Min. Angle
SEL: Smart Edge (Line)	○ Max. Measurement Coord. Min. Measurement Coord. Line0 Start Coord. Line0 End Coord. Line1 Start Coord. (*b Line1 End Coord. (*b Cell Individual Result 0 Cell Individual Result 1 (*b	×	○ Line 0 Angle Line 1 Angle (*b
GGC: Geometry Calculation	○	○ Distance/Radius/Major Axis/Minor Axis	○
CAC: Numerical Calculation	○	○	○
OCA: Numerical Calculation (Previous Result)	○	○	○
Character Coordinate (*d)	○ (Character coord. of Character/Figure Drawing)	×	×
System Register	○	○	○
Constant	○	○	○
Cursor	○	×	×

*a) When selecting "Gap" or “Float" in "Execution Mode"
*b) When selecting "Measure Width" in Detect Mode
*c) When selecting "Measure Width" or "Measure Diameter" in Detect Mode
*d) Only when Figure = Character

▶ Note

The checker with a camera number different from that selected for the setting Character/Figure Drawing checker cannot be referred.

4.14 Checker List

This function shows setting status and execution result of the checkers, position adjustments, area size adjustments, numerical calculations, judgements and character/figure drawing. To change the settings of them, you can jump to the setting window from this window.

In this function, all displayed items in the table are called “checker” including position adjustment, judgement and character/figure drawing as well as the general checkers.

Displaying Checker List

1. **Select "INSPECTION" from the menu bar.**

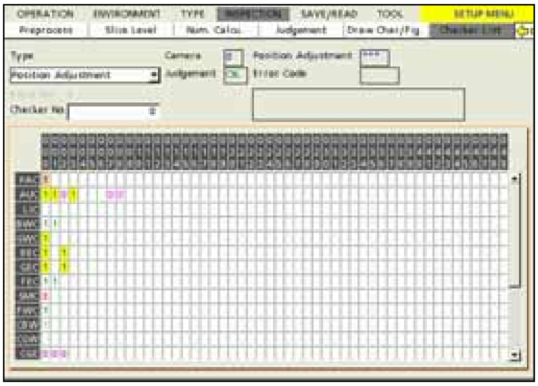
2. **Tilt the ENTER key right and select displayed “Checker List”.**

   The checker list is displayed.

3. **Press the TRIG key.**

   A test is executed and its result appears on the screen.

   When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.



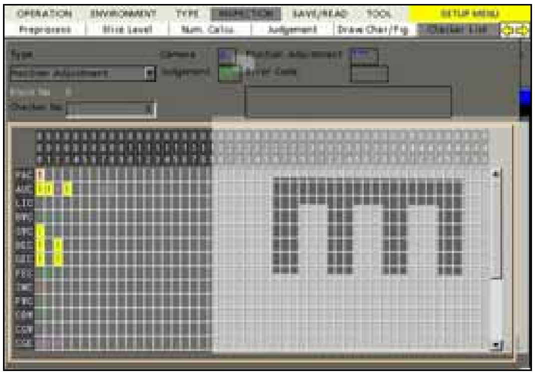
Checker Pattern displayed on Screen Window

High transparency setting of the SETUP menu allows an image or checker patterns on the screen window, which is overlapping with the window of Checker List, to be seen.

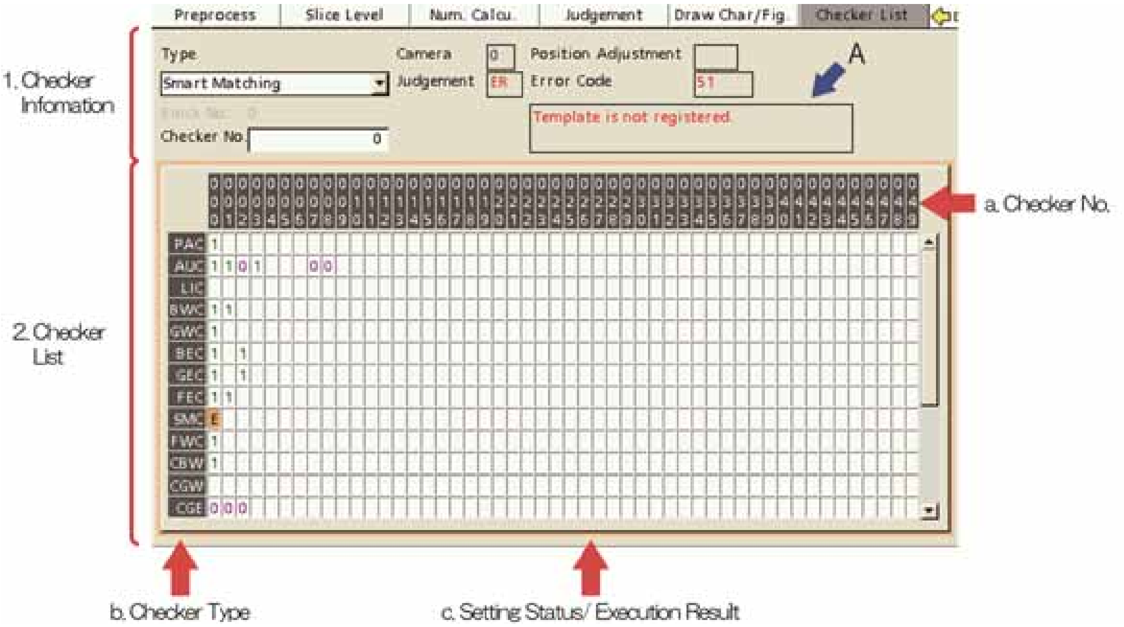
When its camera setting is the same as that of the image currently displayed on the screen window, the checker pattern selected in the checker list is displayed in orange.

The condition to display the checker patterns for checkers other than the selected checker is determined by the setting of "Pattern Display" in the Image Menu.

Refer to page 100 for the details of setting procedure.



Overview of Checker List



Type: Smart Matching

Camera: 0

Judgement: ER

Position Adjustment:

Error Code: 51

Template is not registered.

Checker No: 0

	000	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016	017	018	019	020	021	022	023	024	025	026	027	028	029	030	031	032	033	034	035	036	037	038	039	040	041	042	043	044	045	046	047	048	049
PAC	1																																																	
AUC	1	1	0	1				0	0																																									
LIC																																																		
BWC	1	1																																																
GWC	1																																																	
BEC	1		1																																															
GEC	1		1																																															
FEC	1	1																																																
SMC	E																																																	
FWC	1																																																	
CBW	1																																																	
CGW																																																		
CGE	0	0	0																																															

1. Checker information

It displays the information of the checker selected in Checker List described in 2. Selecting the checker outputting the judgement of which is error ("E") shows detail of the error in the field of A in the figure above.

2. Checker List

a: Checker No.

Fifty checkers are displayed per page. (e.g. No.000 - 049) To display checkers after No.050, tilt the ENTER key left/ right. Tilting the ENTER key and pressing the SHIFT key switches pages.

b: Checker type

The checkers are displayed in symbols. It displays Position adjustment on the top line and Judgement (output) on the bottom line.

Checker type is displayed in the area of 1. Checker information.

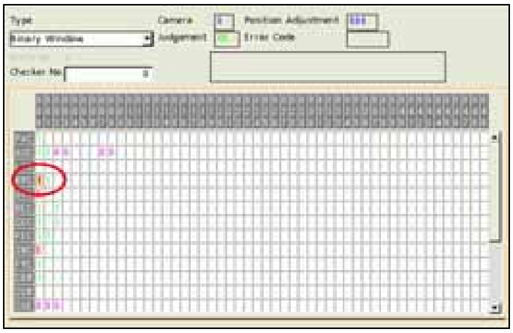
c: Setting status and Execution result

This field shows the setting status and the execution result of the checker type and checker No. of the selected cell in the following symbols and colors(*). You can change the displaying colors.

Blank:	Unset
"1" (Green):	Already set, Judgement: OK
"0" (Pink):	Already set, Judgement: NG
"E" (Red):	Already set, Judgement = Error Error information is displayed in the "A" field of the checker information display area.
Highlight Color (Yellow):	In some cases, selecting the cell of Position Adjustment (PAC) displays some other cells in yellow. This indicates that the PAC that you are selecting is adjusting the checker displayed in yellow.

Changing Checker Settings (Jump to Setting Window)

After running a test by the TRIG key on the Checker list window, you can jump to the setting window from it the Checker List to change or refer to the checker setting.



Type: Binary Window

Checker No: 0

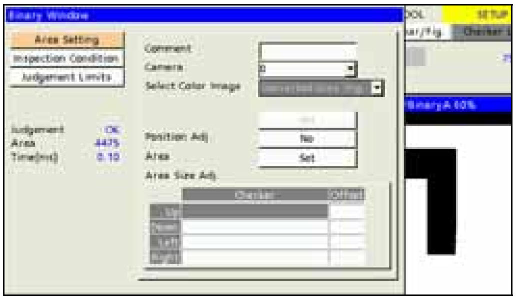
1. **Tilt the ENTER key up/down on the Checker list window to select the checker list.**

2. **Select a cell of the checker type and No. to change the setting.**

The setting window of the selected checker appears.

3. **After setting is completed, press the CANCEL key.**

It returns to the checker list window.



Binary Window

Judgement OK

Area 4475

Time(ms) 0.10

Position Adj: No

Area: Set

4.15 Outputting Inspection Results to the External Device

PV200 has features of outputting judgements of inspections and results of numerical calculations through the I/O terminal block, and the ports, and writing them in an attached SD memory card. In addition, captured images can be saved in a PC through Ethernet port and written in an attached SD memory card.

Multiple data can be output to multiple destinations. For example, a judgment is output to the I/O terminal block, a result of numerical calculation is output to a PLC through the COM port, and an inspection image is output to a PC through Ethernet port at the same time.

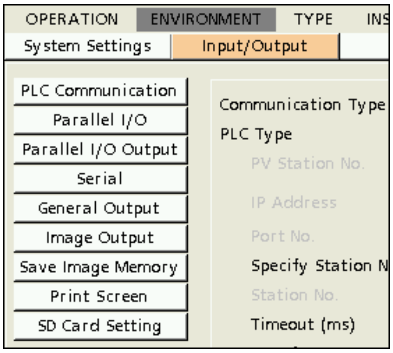
These settings are set in “Input/Output” setting window.

Displaying the Input/Output Setting Window

1. **Select "ENVIRONMENT" from the menu bar.**

2. **Select "Input/Output".**

“Input/Output” setting window is displayed.



4.15.1 Outputting through Parallel I/O

Scan count, Judgement and result of numerical calculations can be output to the parallel I/O terminal block.

Outputting a Result of Judgement Expression

▶ Note

- Judgement that can be output is JDC (External output register). JRC (Internal register) cannot be output.
- When outputting a Judgement result while you inspect in "Automatic Switch" mode, PV outputs the result of only the block executed lastly.

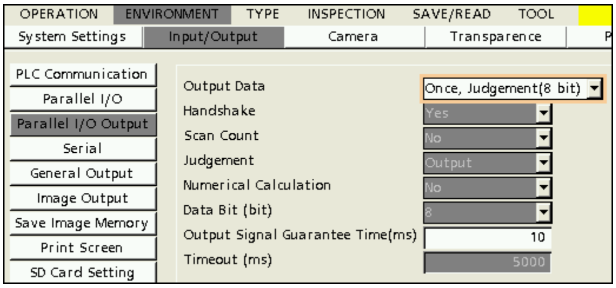
Outputting Judgement No.0-7

When execution mode is "Execute All", Judgement No.0-7 are output to the "OUT0-7" of the I/O terminal block.

When execution mode is “User-Defined” or “Automatic Switch”, 8 points are output to the “OUT0-7” of the I/O terminal block in ascending order from the smallest number of judgment of the executed block or the last executed block respectively.

1. **Select “Parallel I/O Output” in “Input/Output” setting window.**

2. **Select “Once, Judgement(8 bit)” for “Output Data”.**



Output Data: Once, Judgement(8 bit)
Handshake: Yes
Scan Count: No
Judgement: Output
Numerical Calculation: No
Data Bit (bit): 8
Output Signal Guarantee Time(ms): 10
Timeout (ms): 5000

3. **Set “Output Signal Guarantee Time”.**

Settable range is 1 - 1000 ms. (Default: 10 ms)
After outputting OUT signal and TACT signal, PV200 holds to output for the time specified in the item. TACT signal turns off after the specified time passes. (Whether OUT signal is held or reset depends on the setting in “System Settings” > “Operation” > “Parallel I/O Output Reset Condition”.)
For more details, refer to Chapter 8.3 Timing Chart, page 374.

Outputting All Judgement (JDC) That Have Been Set

Results of setting judgement expressions can be output (up to 1000 data).

Using “OUT0-7” of data of the I/O terminal block, the results are output divided in 8-point unit. As a timing signal of data communication, STROBE signal of I/O terminal block, or STROBE signal and ACKNOWLEDGE(ACK) signal are used. (To use ACK signal, it is necessary to assign the function to ASSIGN or EXTRA signal in “ENVIRONMENT” > “Input/Output” > "Parallel I/O".)

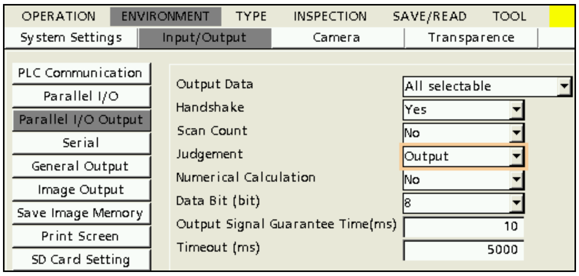
▼Refer to▼

About output timing of signals, refer to Chapter 8.3 (page 374).

1. **Select “Parallel I/O Output” in “Input/Output” setting window.**

2. **Select “All Selectable” for “Output Data”.**

3. **Set “Judgement” to “Output”.**



Output Data: All selectable
Handshake: Yes
Scan Count: No
Judgement: Output
Numerical Calculation: No
Data Bit (bit): 8
Output Signal Guarantee Time(ms): 10
Timeout (ms): 5000

4. **Set “Handshake”.**

Handshake is to output data while communicating completion signals of sending and receiving with external devices.

“Yes”:	As a data output completion signal, STROBE signal is used and as a signal to receive a data receive completion signal of external devices, ACK signal is used.
“No”:	As a data output completion signal, STROBE signal is used. Not using ACK signal, the next data will be output after a certain period of time. In this method, PV200 does not confirm whether the external device has received data or not.

▶ Note

"Data Bit” is a parameter for outputting Numerical Calculation and Scan Count. If you output only Judgement, it is not necessary to set. (The setting value of Data Bit does not influence the output result of Judgement.)

5. **Set “Output Signal Guarantee Time”.**

Settable range is 1 - 1000 ms. (Default: 10 ms)

When Handshaking is not employed:
OUT signal is output in the doubled cycle of the time specified in this item.
When Handshaking is employed:
After handshaking of the first inspection, output of the second inspection is not executed during "Output Signal Guarantee Time".

6. **Set "Timeout (ms)" when you employ handshake.**

Settable range is 4 - 2000 ms. (Default: 5000 ms)
Specify maximum time from data output to ACK signal (data receipt completion signal) input from the external device. If ACK signal is not input within this period, a time error occurs and ERROR signal is output.

Output Example when outputting only Judgement

Output Data Assignment in the case of “8 bit” (1000-data output)

	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
1st	JDC007	JDC006	JDC005	JDC004	JDC003	JDC002	JDC001	JDC000
2nd	JDC015	JDC014	JDC013	JDC012	JDC011	JDC010	JDC009	JDC008
				:				
125th	JDC999	JDC998	JDC997	JDC996	JDC995	JDC994	JDC993	JDC992

▶ **Note**

Until the last number of data which has been set a judgement expression, data will be output. For example, when No.0-5 and No.14 are set, No.0-14 are output and after No.16 is not output. No.6-13 and 15 are output as OFF.

In the case of Execution Mode = Automatic Switch

(When the lastly executed block = Block No.3)

1st: Judgement result of Block No.3

OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
JDC 307	JDC 306	JDC 305	JDC 304	JDC 303	JDC 302	JDC 301	JDC 300

:

Afterwards, outputs to the last number of judgement expression created in Block No.3.

*Only the results of the block executed lastly are output.

Outputting Scan Count and Numerical Calculation

Scan Count and Results of Numerical Calculations can be output to “OUT0-7”of the I/O terminal block dividing in multiple times.

▶ Note

- Numerical Calculations can be set to output or not for each expression. Only the expression that is set to “Output” is output.
- Numerical calculation results to be output are integers only. A number with a decimal point is rounded off to the nearest whole number.
- The output order is Scan Count -> Judgement -> Numerical Calculation.
- When outputting a numerical calculation result while you inspect in "Automatic Switch" mode, PV outputs the result of only the block executed lastly.

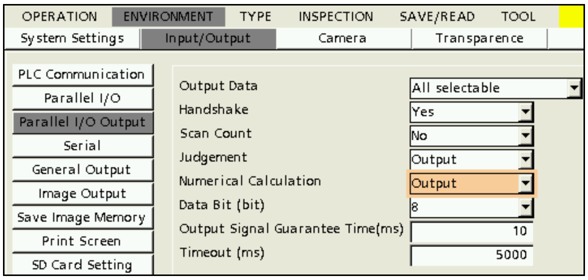
▼Refer to▼

About output timing of signals, refer to Chapter 8.3 (page 374).

1. **Select “Parallel I/O Output” in “Input/Output” setting window.**

2. **Select “All Selectable” for “Output Data”.**

3. **To output Scan Count and Numerical Calculation, select “Output” for them.**



Output Data: All selectable
Handshake: Yes
Scan Count: No
Judgement: Output
Numerical Calculation: Output
Data Bit (bit): 8
Output Signal Guarantee Time(ms): 10
Timeout (ms): 5000

4. **Set “Data Bit”.**

Select it depending on the maximum value of output data.

	Value that can be output
[8bit]:	0 to 255
[16bit]:(default)	0 to 65535
[32bit]:	-2147483648 to 2147483647 *Negative values are output in the complement number of 2.

▶ Note

When selecting “8-bit” or “16-bit”:

- Negative values cannot be output. If the values are negative, the result is output as “0”.
- The data exceeding the output range (8-bit or 16-bit) will be output as value of “0”.

Example) When “Data Bit” is 32-bit, it outputs by 8-bit in four divided data from lower bit. Refer to the next section.

5. **Set "Handshake” and “Output Signal Guarantee Time (ms)”.**
When you employ handshake, specify “Timeout (ms)”.

See the section of "Outputting All Judgement (JDC) That Have Been Set”, page 274.

Example of Bit Assignment when outputting numerical data

In the case of Data Bit: 32-bit, Bit Width: 8-bit

	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
1st	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
2nd	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
3rd	Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16
4th	Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24

Example of Output Data Assignment in Automatic Switch execution mode

In the case of outputting Numerical Calculation with Data bit: 8-bit
(When the lastly executed block = Block No.4)

	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
1st: Numerical Calculation CAC400	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
2nd: Numerical Calculation CAC401	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

:

Afterwards, outputs to the last number of numerical calculation expression created in Block No.4 and set to output.

Example of Output Data Assignment

Scan Count, Judgement, and Numerical Calculation output with Data bit: 16-bit

Scan Count = 100, Judgement=JDC000-14(15 points), Numerical Calculation CAC000=7000

	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
1st (Lower 8 bits of Scan Count)	0	1	1	0	0	1	0	0
2nd (Higher 8 bits of Scan Count)	0	0	0	0	0	0	0	0
3rd (Judgement 0-7)	JDC 007	JDC 006	JDC 005	JDC 004	JDC 003	JDC 002	JDC 001	JDC 000
4th (Judgement 8-14)	0	JDC 014	JDC 013	JDC 012	JDC 011	JDC 010	JDC 009	JDC 008
5th (Lower 8 bits of CAC000)	0	1	0	1	1	0	0	0
6th (Higher 8 bits of CAC000)	0	0	0	1	1	0	1	1

4.15.2 Outputting to COM Port/ Ethernet Port/ SD Memory Card

Specify a type of output data, destination and output condition.

Data That Can Be Output

- Scan Count: 0 - 2147483647
- Total Judgement: 1 (OK) or 0 (NG/Error)
  Regardless of “No. of Digits” setting, 1-digit data is output per judgement.
- Result of Judgement Expression (up to 1000 points): 1 (OK) or 0 (NG/Error)
  Regardless of “No. of Digits” setting, 1-digit data is output per judgement.
- Result of Numerical Calculation (up to 1000 data): -214783648.000 to + 2147483647.000.

▶ Note

Scan Count will be automatically reset and return to "0" when you turn off the power of PV200 or switch types. In addition, resetting statistics data by I/O input or command input resets Scan Count as well.

Output Destination

Serial:

To output to COM port. With certain PLCs, you can make “PLC communication” which allows to write data in a register of PLC directly. To output data through PLC communication, the following setting should be done; "ENVIRONMENT" > "PLC Communication" > "Communication Type"; [Serial]

▼Refer to▼ Refer to page 422 about PLC communication.

Ethernet:

Through Ethernet port, data can be received with PC or PLC.
(TCP/IP connection is established with PC or PLC as “TCP/IP client” and with PV200 as “TCP/IP server”.)

With certain PLCs, you can make “PLC communication” which allows to write data in a register of PLC directly. When you use a PC, prepare Hyper terminal or Telnet software. PC or PLC is needed to be in the status where they can always receive data.

Date and time can be added to the header of data to output.

To output data through PLC communication, the following setting should be done; "ENVIRONMENT" > "PLC Communication" > "Communication Type"; [Ethernet]

▶ Note In this case, the port number of PV200 is “8601”.

▼Refer to▼ Refer to page 347 for information of TCP/IP settings.

SD Memory Card:

To write data on a text file in a SD memory card attached to the memory card slot of PV200.

Time can be added to the header of data to output.

The name of a text file to write data on and saving path are as follows.

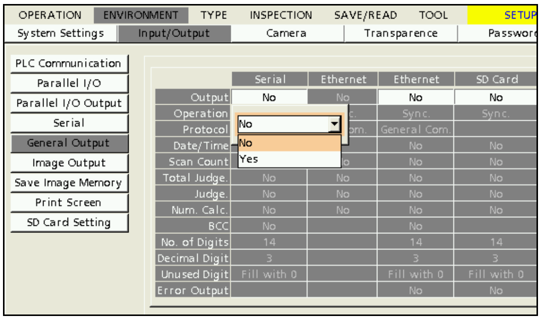
- File name: yymmdd.txt (yymmdd is read from information of the built-in calendar of PV200.)
- Path: /Panasonic-EW SUNX Vision/PV200/Result/

These settings are set in “General Output” setting window.

Displaying General Output Setting Window

1. **Select “ENVIRONMENT” > “Input/Output” from the menu bar.**

2. **Select “General Output” in “Input/Output” setting window.**



	Serial	Ethernet	Ethernet	SD Card
Output	No	No	No	No
Operation			Sync.	Sync.
Protocol			General Com.	
Date/Time			No	No
Scan Count			No	No
Total Judge.	No	No	No	No
Judge.	No	No	No	No
Num. Calc.	No	No	No	No
BCC	No		No	
No. of Digits	14		14	14
Decimal Digit	3		3	3
Unused Digit	Fill with 0		Fill with 0	Fill with 0
Error Output			No	No

Selecting Destination and Output Data

1. **Select a data destination in “Output”.**

You can select multiple interfaces as destinations.

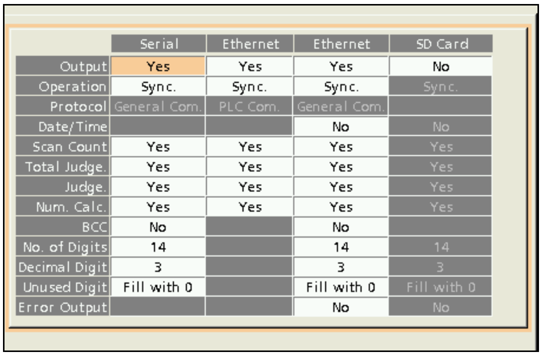
▶ Note

For PLC communication, either “Serial” or “Ethernet” can be selected.. Refer to page 422 about PLC communication.

2. **To output Date and Time, select “Yes”,**

For “SD Card” setting of destination, setting “Date/Time” to “Yes” adds “Time” to output data. Date and Time cannot be added when the destination is "Serial" or "Ethernet (PLC Communication)".

3. **To output Scan Count/ Total Judgement/ Judgement/ Numerical Calculation, select “Yes”.**



	Serial	Ethernet	Ethernet	SD Card
Output	Yes	Yes	Yes	No
Operation	Sync.	Sync.	Sync.	Sync.
Protocol	General Com.	PLC Com.	General Com.	
Date/Time			No	No
Scan Count	Yes	Yes	Yes	Yes
Total Judge.	Yes	Yes	Yes	Yes
Judge.	Yes	Yes	Yes	Yes
Num. Calc.	Yes	Yes	Yes	Yes
BCC	No		No	
No. of Digits	14		14	14
Decimal Digit	3		3	3
Unused Digit	Fill with 0		Fill with 0	Fill with 0
Error Output			No	No

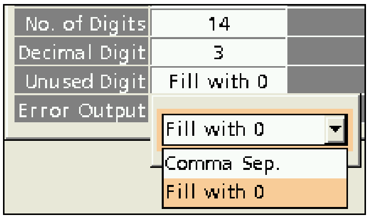
4. **To output BCC (block check code), select “Output”.**

BCC cannot be added when the destination is "SD Card" or "Ethernet (PLC Communication)".

Specifying Digit Number of Output Data

In general communication, real numbers (values including after decimal point) can be output. Set the digit number of integer and after decimal point.

1. **Specify total digits of integer part and after decimal point in “No. of Digits”.**



No. of Digits	14
Decimal Digit	3
Unused Digit	Fill with 0
Error Output	

2. **In “Decimal Digit”, specify digits for after decimal point used from the digits set in step 1.**

If you set “No. of Digits” = 14 (default) and “Decimal Digit” =3 (default), the value consisting of 11-digit integer and 3-digit decimal number is output. If you set “Decimal Digit” = 2 or 1, the value is rounded.

▶ Note

When the value exceeding the specified digits is processed, the value is output as “0” and an error signal is output.

3. **Set "Unused Digit".**

If the digit number of the data is less than the output digit number you have set, select a handling of unused digit.

Comma Separated: Unused digits are deleted. Multiple data are output in different number of digits. Data are separated with a comma (",") before being output.

Filled with '0' (default): Unused digits are filled with “0”. Although the data become longer, multiple data are output in the same number of digits.

Example of Output

Output Data:
Date: 2010/12/15
Time: 09:25:48
Scan Count: 1234 times
Total Judgement: OK
Judgement: JDC000 = OK, JDC001 = unset, JDC002 = NG
Numerical Calculation: CAC000 = 215.8, CAC001 = unset, CAC002 = -368.0

Output Condition:
Date and Time: Output (Not available when Destination is Serial or Ethernet (PLC Communication))
No. of Digits: 6
Decimal Digit: 1
Unused Digit: Filled with ‘0’
BCC: Output (Not available when Destination is SD Card or Ethernet (PLC Communication))

Output destination=”Serial”:

0 0 1 2 3 4	1	1	0	0 0 2 1 5 8	- 0 3 6 8 0	BCC	CR
Scan Count	Total Judge.	Judge-ment		Numerical Calculation 0	Numerical Calculation 2	2-digit Block Check Code	

Output destination=”SD card”:

0 9 : 2 5 : 4 8	0 0 1 2 3 4	1	1	0	0 0 2 1 5 8	- 0 3 6 8 0	CR
Time	Scan Count	Total Judge.	Judgement		Numerical Calculation 0	Numerical Calculation 2	

Output destination=”Ethernet (General Communication)”:

1 0 / 1 2 / 1 5	0 9 : 2 5 : 4 8	0 0 1 2 3 4	1	1	0	0 0 2 1 5 8	- 0 3 6 8 0	BCC	CR
Date	Time	Scan Count	Total Judge.	Judgement		Numerical Calculation 0	Numerical Calculation 2	2-digit Block Check Code	

▶ Note

Judgement JDC001 and Numeric Calculation CAC001 are not output because they are unset.

4.16 Saving/ Outputting an Inspection Image

Captured inspection images can be saved in PV200, output to a PC through Ethernet, or saved in an attached SD memory card. Also, you can read the images to change the checker settings and run a test.

Images that can be output/saved are images captured by gray or color camera. (Preprocessed images cannot be output.)

4.16.1 About Image Memory

PV200 has multiple image memories including the memory to store camera capturing images for inspection and the one to store images for settings. In addition, you can output and save images to a SD memory card or a PC connecting with the Ethernet port.

Storage Space of PV200 and External Devices to Store Images

PV200		
1	**Inspection image memory**	The memory to store images captured by camera. Inspection executes on the images.
2	**Test image memory**	An image in this memory is copied from the latest image of Inspection image memory. The image is used to make checker setting. Setting display image to “Memory” in SETUP menu shows the test image. You can call up the images from the Save image memory (No.3 below) and a SD memory card (No.5 and 6 below) to set checkers and execute a test.
3	**Save image memory**	This memory saves all or some of images stored in the Inspection image memory during inspections. Up to 150 sets* of images can be saved. Images are saved during inspections according to the preset conditions.
SD memory card		
4	**Image/Output**	The images stored in the Inspection image memory (No.1 above) are saved in this place when outputting them to a SD memory card during inspections.
5	**Image/Backup/Test**	The images stored in the Test image memory (No.2 above) are saved in this place. You can save them only when an inspection is stopped.
6	**Image/Backup**	The images stored in the Save image memory (No.3 above) are backed up in this place.
Ethernet (PC etc.)		
7	**The folder specified by Image Receiver**	The images stored in the Inspection image memory (No.1 above) can be output in Ethernet port during inspections. In this case, the PC requires the designated software "Image Receiver" which specifies a destination folder.

*) The number of sets of images can be saved varies depending on the combination of camera type and the number of them.

Connected camera and Number of storable images

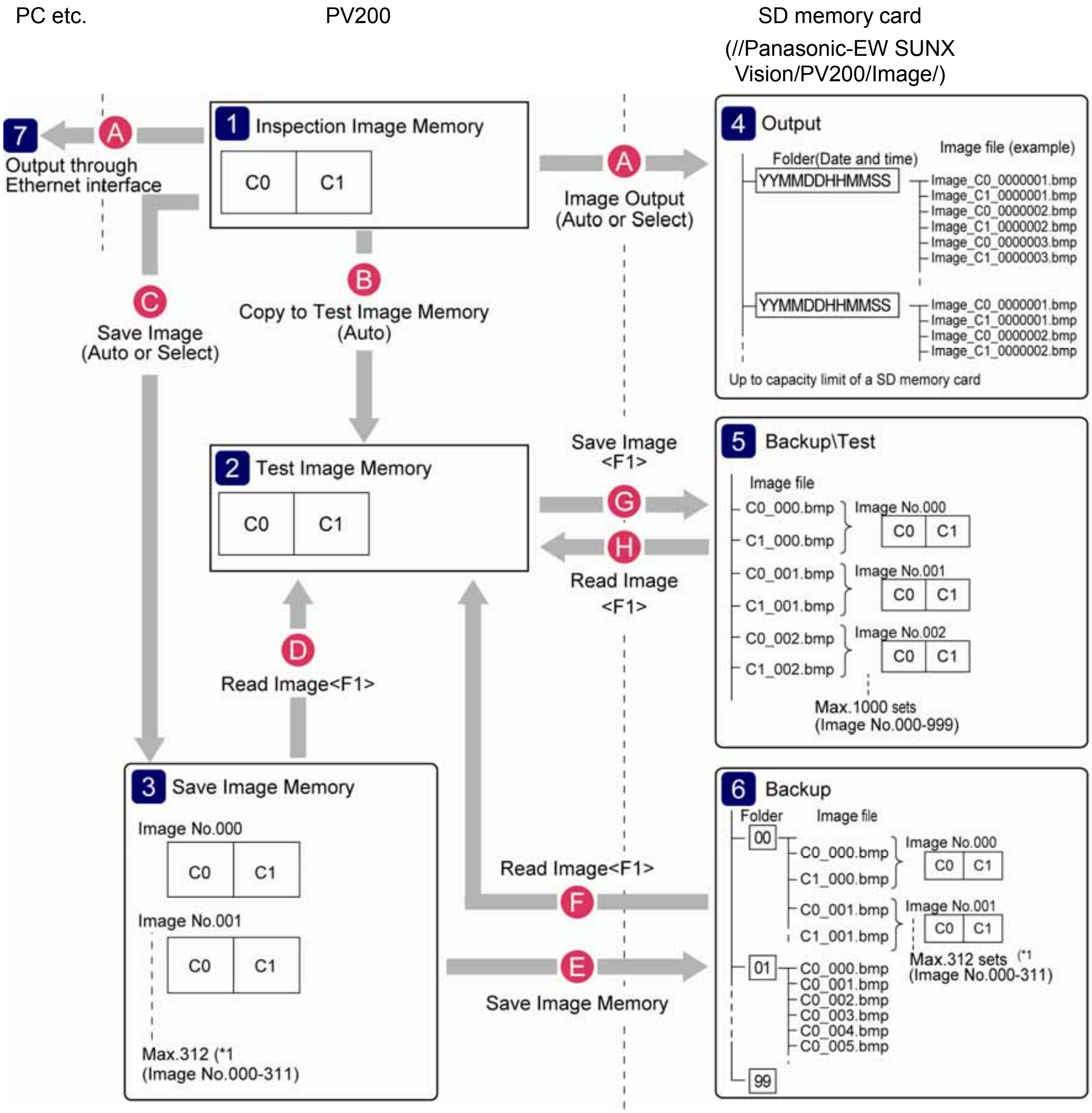
CAMERA 1		Unconnected	Gray			Color	
CAMERA 0			0.3M	2M	4M	0.3M	2M
Gray	0.3M	312	150	32	-	150	32
	2M	39	32	13	-	32	13
	4M	14	-	-	1	-	-
Color	0.3M	312	150	32	-	150	32*
	2M	39	32	13	-	32*	13*

- "-" in the above table shows a combination of two cameras is not available.
- When CAMERA1 is unconnected, the number of storable images is shown.
  When CAMERA1 is connected, the number of sets of storable images is shown.
- *) Connectable (Ver1.1 or later)

▼Refer to▼

For information on the setting of destination of print screen, refer to section 3.2.5 (page 52).

Image Memory Map



*1) The number of sets of images can be saved varies depending on the combination of camera type and the number of them.

▼Refer to▼

Ⓐ : Chapter4.16.2, page 284

Ⓑ : It is automatically copied when switching "RUN Menu" to "SETUP Menu".

Ⓒ : Chapter 4.16.3, page 287

Ⓓ : Chapter 4.16.4, page 288

Ⓔ : Chapter 4.16.3, page 287

Ⓕ : Chapter 4.16.4, page 288

Ⓖ : Chapter 4.16.4, page 289

Ⓗ : Chapter 4.16.4, page 288

4.16.2 Saving Images into External Device

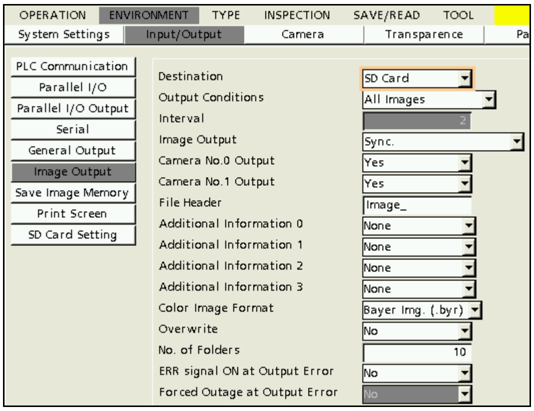
Displaying “Image Output” Setting Window

1. **Select “ENVIRONMENT” > “Input/Output” from the menu bar.**

2. **Select “Image Output” in “Input/Output” setting window.**

Selecting Destination

1. **Select a “SD Card” or “Ethernet” in “Destination”.**



Destination	SD Card
Output Conditions	All Images
Interval	2
Image Output	Sync.
Camera No.0 Output	Yes
Camera No.1 Output	Yes
File Header	Image_
Additional Information 0	None
Additional Information 1	None
Additional Information 2	None
Additional Information 3	None
Color Image Format	Bayer Img. (.byr)
Overwrite	No
No. of Folders	10
ERR signal ON at Output Error	No
Forced Outage at Output Error	No

▶ Note

When outputting through Ethernet to a PC, the port number of PV200 is “8602”.

Ver.1.30 or later of thel software for image receiving "Image Receiver for PV" needs to be installed in the PC which receives images.
You can download the Image Receiver from our web site.

http://Panasonic-denko.jp/sunx/e

(“Products” > “Machine Vision” > “PV200” > “Software”)

Downloading the software requires a user information registration.

Outputting to a SD memory card

A folder named as date and time (YYMMDDHHMMSS= year, month, day, hour, minute, second) is created in the following path of a SD memory card and image files are saved in it.

/Panasonic-EW SUNX Vision/PV200/Image/Output/

Initially, decide the number of folders to save images. When using a SD memory card with PV200, it has a limit that up to 100 files can be saved in per folder. Thus, the specified number of folders by 100 files can be saved. Select either overwriting from older files or terminating image saving when the number of files reaches the saving limits.

1. **Select "No. of Folders”.**

   The default is “10” and the range of available value is “1 to 1000”.

2. **Set "Overwrite".**

[No] (Default):	Terminates image saving.
[Yes]:	Deletes the oldest folder and all images stored in the folder and creates a new folder to continue saving when the number of folders reaches the limit or the space of a SD memory card is used up.

Outputting through Ethernet interface

When the PC has an error, such as uninvoked Image Receiver and disconnection of cables, images cannot be output correctly. Set the operation of PV200 in such case.

When "Output Conditions" is set to "Command Reception", two items described below cannot be selected. In this case, if outputting an image failed, ERROR signal will be output.

1. **Set [ERR signal ON at Output Error].**

   To turn on the ERROR signal when an error occurs, select “Yes”. (Default: No)

2. **Set [Forced Outage at Output Error].**

[No] (Default):	Continues the inspection.
[Yes]:	Terminates the inspection. Confirm the connection following the displayed message. When outputting Synchronously, images can be resent.

Specifying a Camera Image to Output

You can set images to output or not by a camera.

1. **Select “Yes” in "Camera No.0 Output" of “Image Output”.**

   Doing so makes setting that an inspection image of camera No.0 is output.

2. **In the same way, set a Camera No. to “Yes” to output its image.**

Selecting Output Condition

Other than outputting by an inspection, images can be output when the specified conditions are fulfilled.

1. **Select a condition to output images in “Output Condition”.**

[All Images](default):	Images are output at every inspection.
[NG Judgement]:	Images are output when the judgement selected in “Image Output” is NG. (If any condition is not specified, no image is output.)
[At Interval]:	Images are output per the specified number of inspections.
[Command Reception]:	Images are output when receiving the certain signal* from external device. * The signal of “Output Latest Image” assigned to one of ASSIGN0-1 and EXTRA0-2.

2. **Set an interval in “Interval”.**

   (This is the item to set when you select "At Interval" in Step 1.)
   The range of available value is 2 to 10000.
   Specifying “10” outputs an image at the first inspection, and then outputs every ten inspections as 11th time, 21st time, 31st time…

Selecting Output Timing

Set the timing to output images in "Image Output".

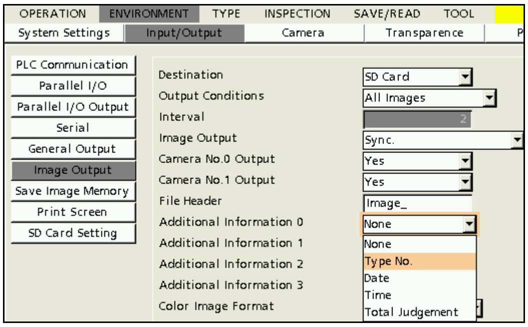
There are two settings; to output images every time one inspection is executed, to output images while PV200 is able to output them until the start of the next inspection.

Refer to page 335 for details.

Selecting Additional Information for a File Name

A file name of image consists of the following information.

Header:	Up to eight characters can be specified.
Additional information 0-3:	Four types of information can be added.
Type No.:	Type No. (000 - 255) when the image is captured.
Date:	The date (yymmdd) of built-in calendar of PV200 when the image is captured.
Time:	The time (hhmmss) of built-in calendar of PV200 when the image is captured.
Total Judgement:	Total judgement of the image (OK/NG) * Total judgement is other than OK/NG, such as NJ = Unset
Camera No.:	C0 – C1 (2 digits) Number of the camera which captured the image.
Scan Count:	Scan count: 7 digits



Destination: SD Card
Output Conditions: All Images
Interval: 2
Image Output: Sync.
Camera No.0 Output: Yes
Camera No.1 Output: Yes
File Header: Image_
Additional Information 0: None
Additional Information 1
Additional Information 2
Additional Information 3
Color Image Format

None
Type No.
Date
Time
Total Judgement

1. **Enter "File Header" with the software keyboard.**

Default: "Image_"

2. **Select an item from four types for "Additional Information 0" to "Additional Information 3".**

Select "None" when no additional information is needed.

Example)

Setting and Condition: File Header: Image_
Additional information 0: Type No. (=50)
Additional information 1: Date (=20101215)
Additional information 2: Total Judgement (=NG)
Additional information 3: None
Camera No.0
Scan Count 100

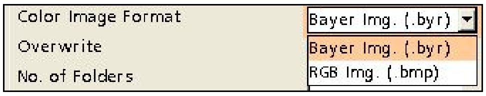
File Name: Image_050_101215_NG_C0_0000100.bmp

▶ Note

Maximum number of digits for a file name is 50.

Selecting a Format to Save Color Images

1. **Select "Bayer Img. (.byr)" or "RGB Img. (.bmp)" in "Color Image Format".**



Color Image Format: Bayer Img. (.byr)
Overwrite
No. of Folders

Bayer Img. (.byr)
RGB Img. (.bmp)

What is Bayer Image?

Bayer image is an image saved in the same array as an image sensor of a color camera.
As the file size is small and the time for saving is shortened, you should use Bayer Image to save many images.

Files saved in this format (.byr) cannot be confirmed with general applications such as a PC.
Bayer images can be confirmed on PV200, PVWIN200 or PVImageConverter. Its files size is smaller than that of RGB image (.bmp).

▶ Note

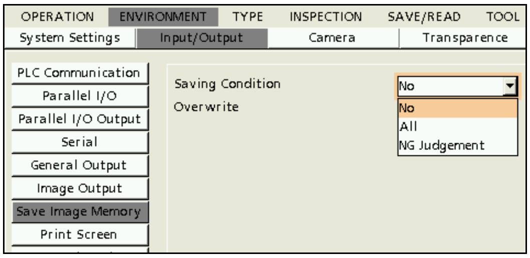
Using PVImageConverter can convert a bayer image (.byr) to a RGB image (.bmp).

4.16.3 Saving Images in the Image Memory of PV

The image memory of PV (see page 283, Image Memory Map - 3) saves up to 312 images. This image will be cleared when you cut the power of PV200. When you need to save the images, back up them in a SD memory card or a PC employing PVWIN200.

▶ Note

- The maximum number of saving sets varies depending on camera type and its combination.
- If the number of saving images reaches the upper limit of the image memory capacity before the number becomes the maximum number of sets, no more images can be saved. In the case, it overwrites images from older one or terminates image saving.
- Images are stored from No.0 of Save Image memory in ascending order. The larger image number is the more newly saved image.
- Backing up the images of the Save image memory to a SD memory card and clearing the data of Save image memory can be executed also by inputting I/O signal or sending a command from an external device.
  - See page 365 about backup by inputting an I/O signal (ASSIGN or EXTRA signal).
  - See page 404 about backup/delete by sending a command.



1. **Select “ENVIRONMENT” > “Input/Output” from the menu bar.**

2. **Select “Save Image Memory” in “Input/Output” setting window.**

3. **Select a condition to save images in “Saving Condition”.**

[No] (Default):	No image is saved.
[All]:	All inspection images are saved.
[NG Judgement]:	Images are saved when the result of judgement expression specified in “Save Image Memory” is NG. (If any condition is not specified, no image is saved.)

4. **In “Overwrite”, select an operation when the saved images reach the limit of the number or the memory.**

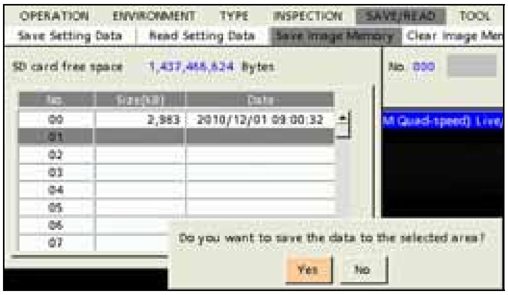
[Yes] (default):	Continues to save images overwriting the older images.
[No]:	Terminates image saving. (Inspections will be continued.)

5. **After setting is completed, press the CANCEL key.**

Backing up Images in Save Image Memory to SD Memory Card

1. **Select “SAVE/READ” from the menu bar.**

2. **Select “Save Image Memory”.**



SD card free space 1,437,468,624 Bytes

No. 000

No.	Size(kB)	Date
00	2,383	2010/12/01 09:00:32
01		
02		
03		
04		
05		
06		
07		

M Quad-speed) Live

Do you want to save the data to the selected area?

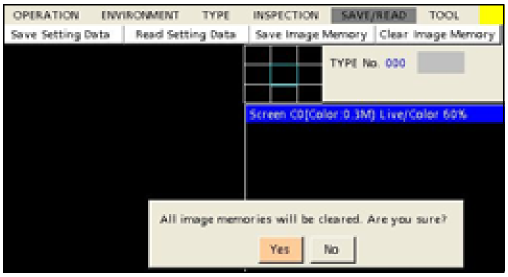
3. **Specify a folder number of the SD memory card to save.**

00 to 99 are available.
Specifying it displays a confirming message.
If you specified the number where image data already exists, the message to confirm overwriting appears.

4. **Select “Yes”.**

After the saving is complete successfully, a message appears. Press the ENTER key to close.

Clearing Images of Save Image Memory



TYPE No. 000

Screen C0[Color 0.3M] Live/Color 60%

All image memories will be cleared. Are you sure?

1. **Select “SAVE/READ” from the menu bar.**

2. **Select “Clear Image Memory”.**

A confirming message appears.

3. **Select “Yes”.**

Clearing is executed.

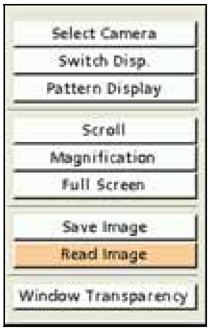
4.16.4 Operation of Test Image Memory

The Test image memory (page 283, Image Memory Map - 2) calls up images from the Save image memory or a SD memory card in SETUP menu to set checkers and execute a test.
To operate the Test image memory, use Image Menu displayed by pressing the F1 key in SETUP menu.

Calling up to Test Image Memory

The images saved in the following three areas can be called up to the Test image memory.

Ⓓ	**Image memory:**	Read from the Save image memory of PV200.
Ⓕ	**Memory image in SD:**	Backup images in a SD memory card (folder = /Image/Backup/00-99)
Ⓗ	**Test image in SD:**	Test images in a SD memory card (folder = /Image/Backup/Test)



1. **Press the F1 key to display Image menu.**

2. **Select "Read Image".**

The window to select the reading source appears.

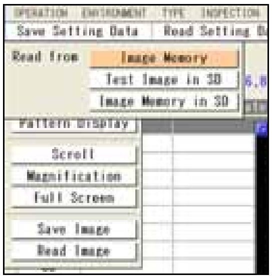
3. **Specify a reading source.**

When you specify “Image Memory in SD”, then specify a folder number.

4. **Select an image number to read.**

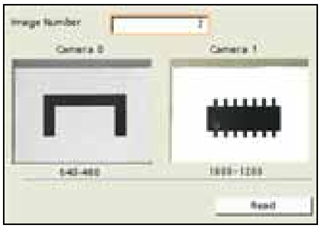
As the lastly saved image* appears, change image numbers observing the display and specify the desired image number.

(*) The larger image number is the more newly saved image. The smaller image number indicates the older image.



5. **Select “Read”.**

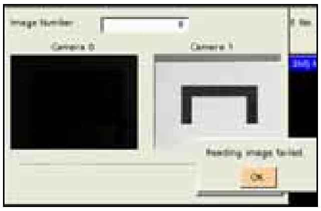
The specified image is called up.



▶ Note

In the following case, a message "Reading image failed." appears, and images cannot be read.

- When selecting an image number in which there is only an image of the camera number that has been set to "Unused" for "Camera Type" under "Camera" in PV200;
  Example) In the right example, there is only the image of camera 1 in Image number 1. If camera 1 has been set to "Unused", reading the images cannot be performed.
- When reading a color image for a gray camera or reading a grayscale image for a color camera



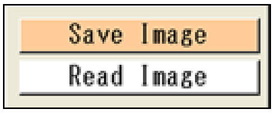
Reading image failed.

Saving Images in Test Image Memory to SD Memory Card

The images in the Test image memory can be saved in a SD memory card.

This operation is useful to pick up necessary images among the images saved in the Save image memory of PV200 and to save them.

1. **Press the F1 key to display Image menu.**



2. **Select “Save Image”.**

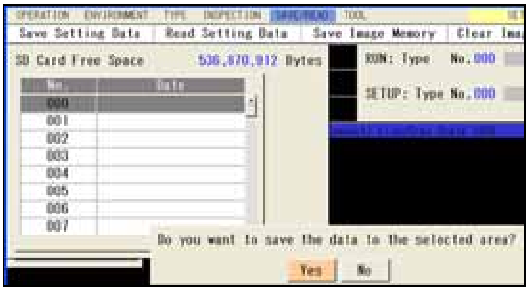
The window to specify a saved image number in the SD memory card appears.

3. **Specify the destination number.**

The confirmation message appears.

4. **Select “Yes”.**

After the saving is complete successfully, a message appears. Press the ENTER key to close.



SD Card Free Space 536,870,912 Bytes

RUN: Type No.000

SETUP: Type No.000

Do you want to save the data in the selected area?

4.17 Reading/saving Setting Data (Save/Read)

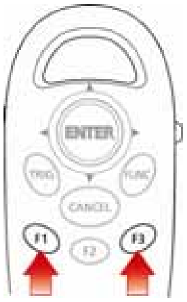
The settings set in SETUP menu and RUN menu can be saved. The information existing in the execution memory can be saved in the saving memory of PV or a SD memory card except certain data*. This information is “Setting data”.

▶ Note

*The data to be specified in [TOOL] > [General] is individual information for each PV200 and saved in the different area from the Storage Space of PV200. You cannot save in a SD memory card or copy into another PV200.

Start with Default Settings

Without loading the setting data of PV200, you can start PV200 with the default settings (execution memory initialized).



1. **Press the F1 key and the F3 key on the keypad.**

2. **Holding the keys pressed, turn on the power of PV200.**

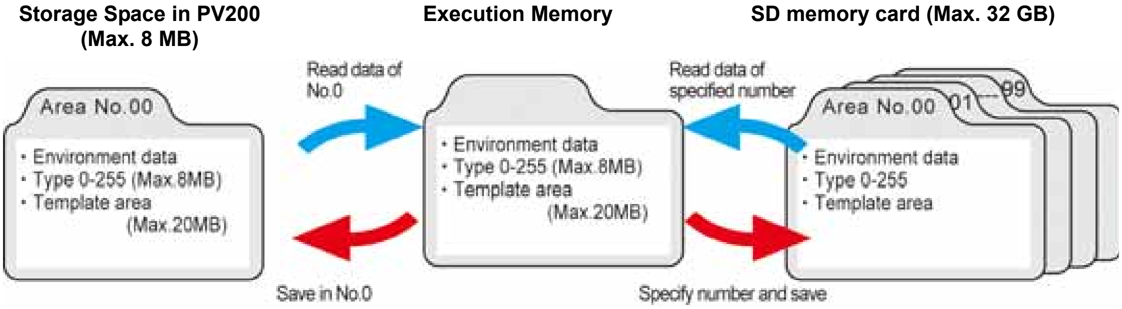
   Until RUN menu appears, hold the keys pressed.

Where to Save the Setting Data

The conditions in the execution memory are temporarily called up to execute programs and are not saved in the memory.

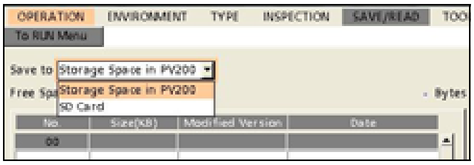
Regarding types No.0 - 255 as a set of data, PV200 saves the data in “Storage Space in PV200”. The data can be saved also in a SD memory card.

Every time PV200 starts up, it reads a set of data from the storage space in PV200 to the execution memory. And then, PV calls up a product type from the data to set inspection conditions and to execute inspections.



4.17.1 Saving Setting Data

This function saves data of 256 product types and environment data set in the execution memory into the main memory or a SD card.



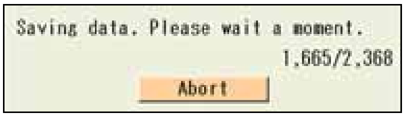
Save to: Storage Space in PV200

Storage Space in PV200
SD Card

1. **Select "SAVE/READ" from the menu bar.**

2. **Select "Save Setting Data".**

3. **Select “Storage Space in PV200” (or “SD Card”) for “Save to”.**



Saving data. Please wait a moment.
1,665/2,368

4. **Select the list and "No." to save.**

   Saving is executed.
   An overwrite confirmation message appears if data already exists. Select [Yes] to overwrite and [No] to save another area.

   To stop saving during the process, select "Abort". In this case, the destination area No. will be cleared when the destination is the storage space in PV200. When it is a SD memory card, the original data will be held.

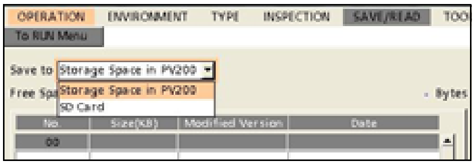
   When saving the data is completed, the saved information is displayed.
   - Size (KB): Size of the setting data
   - Version of the data created: Version of PV200 where the setting data was created
   - Date: Date and time when the data was saved. The information of data and time is referred from the calendar of PV200.

4.17.2 Reading Setting Data

The setting data registered in the Storage Space in PV200 or a SD memory card can be called up to the execution memory. The setting data that has been stored in the execution memory will be overwritten. Before reading, save the setting data as necessary.

▶ Note

You cannot read the setting data which was created in incompatible version of PV200 with the one you use.



1. **Select "SAVE/READ" from the menu bar.**

2. **Select "Read Setting Data".**

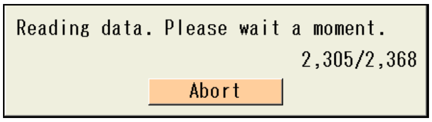
The setting data reading window is displayed.

3. **Select “Storage Space in PV200” (or “SD card”) for “Read From”.**

4. **Select the list and the data to read. Reading is executed.**

Reading is executed.

To stop reading during the process, select "Abort". In this case, the data of Type and ENVIRONMENT will be initialized.



Reading data. Please wait a moment.

2,305/2,368

4.17.3 Deleting Setting Data

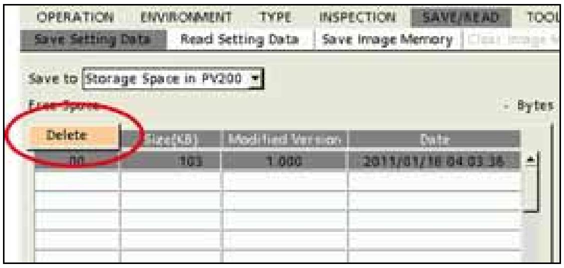
To delete the setting data registered in the Storage Space in PV200 or a SD memory card, follow the procedure below. You cannot delete multiple data. Delete one by one.

1. **Select "SAVE/READ" from the menu bar.**

2. **Select "Save Setting Data".**

The setting data saving window is displayed.

3. **Select “Storage Space in PV200” or “SD Card” for “Save to” where the data to delete exists.**



4. **Select the list and move the cursor onto the data to delete.**

5. **Press the FUNC key and select “Delete” from the displayed menu.**

The pop-up menu appears on the upper left of the window (under "Free Space").

6. **Select “Yes” following the displayed message.**

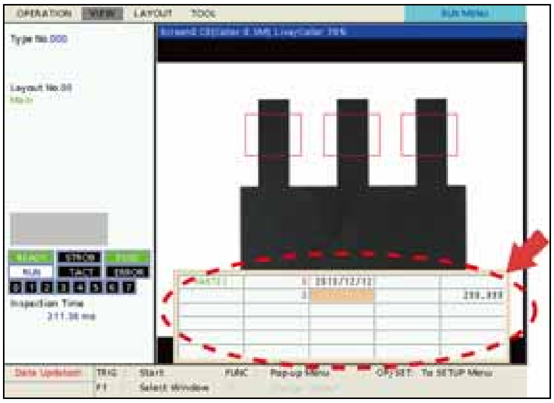
The setting data is deleted. If you select “No”, deleting is not executed.

4.18 Displaying Data on the Screen and Updating Settings (Data R/W)

In RUN menu, inspection results (judgement, data, execution time, etc.), setting values (parameters of checkers, etc.), information of PV (calendar, system register value, etc.) can be displayed. This is Data R/W (Read/Write) function.

The displayed value can be modified for some data.

The data is displayed on the Data R/W sheet. Up to two sheets of data can be set and displayed per type and a sheet can show up to 80 items (5 columns x 16 rows).



4.18.1 Setting Data R/W

Register data in Data R/W sheet. The sheet is made up by cells displaying items. Up to 80 cells can be set. (5 columns x 16 rows)

Setting Cell Number of Data R/W Sheet

Set the number of cells by specifying the number of columns and the number of rows. The settable range is 1 column x 1 row to 5 columns x 16 rows.

1. **Select "TYPE" from the menu bar.**

   The menu appears.

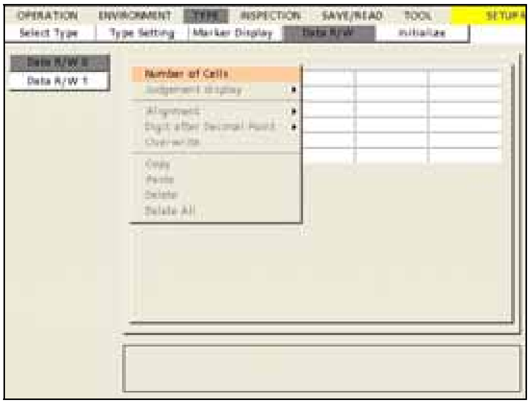
2. **Select "Data R/W".**

   “Data R/W” setting window is displayed.

3. **Select a sheet number of Data R/W to set.**

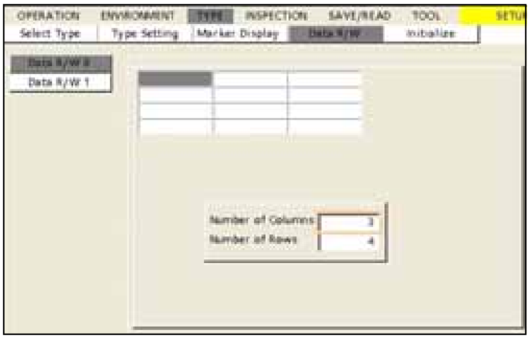
4. **Press the FUNC key and select “Number of Cells” from the pop-up menu.**

   The window to set the number of cells appears.



5. **Enter the number of columns and rows and then press the CANCEL key.**

   The specified number of cells are displayed.



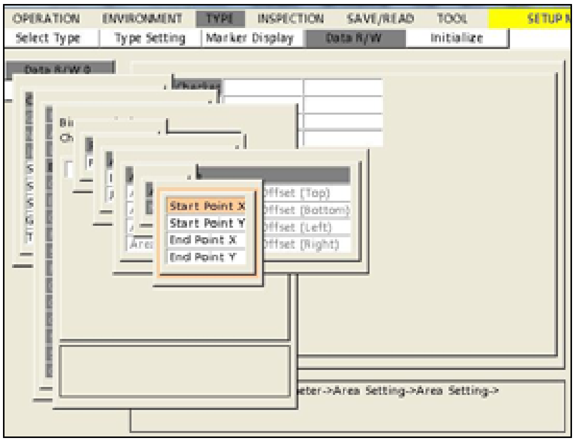
Number of Columns 3
Number of Rows 4

▶ Note

The number of cells is counted from the upper left. When setting the number of columns to “3”, the 4th column and after will be deleted even though data has been registered in them and the data also will be deleted. Note that setting the number of columns to “4” or more again cannot restore the deleted data.

Registering Data in Data R/W Sheet

1. **Select a sheet number of Data R/W to register data in Data R/W setting window.**



2. **Select a cell to register data.**

The item selecting window is displayed.

▼Refer to▼
- For the information of settable items, refer to page 298.
- When the settable items in the list are displayed in gray (when the color setting is the default), it shows that those parameters are not available or the results do not exist.
  For example, the scan pitch in the parameters of gray edge is only available when the shape of the area is "Plane". When the shape is "Line", "Scan Pitch" is displayed in gray.

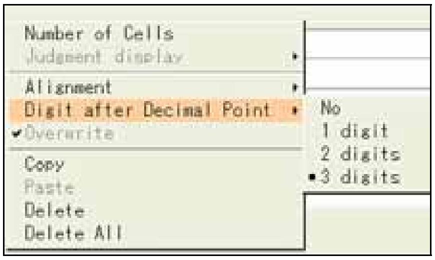
3. **Select data to register.**

Depending on data type, details including checker number or parameter are needed to be selected. Follow the window display.
For some checkers, the list of result types is displayed on multiple pages. Tilt the ENTER key left or light to change the page.

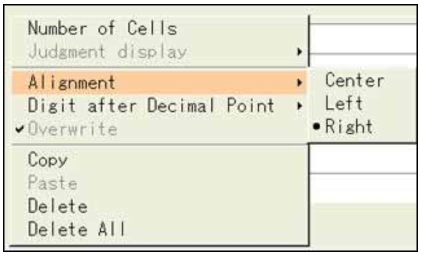
▶ Note
The description field shows the detail of registered data after registration.

Now you completed registering data. Set the following two items as necessary.
- Character alignment: Display position of characters in a cell
- Overwrite permission: Setting to permit overwriting data in RUN menu

▶ Note
- Data with value after decimal point is displayed 3-digit after the point. The display digits after decimal point can be changed from the pop-up menu displayed by pressing the FUNC key.
- In Connector (Binary Window), Connector (Gray Window), Connector (Gray Edge), you can register some types of data into Data R/W sheet from the setting windows. Refer to the description of each checker for details.



Character Alignment and Overwrite Permission



1. **Press the FUNC key and select “Alignment” from the pop-up menu.**

   Select from Right (default), Center, and Left.

2. **Select "Overwrite" from the same menu.**

   Every time you select “Overwrite”, permission status switches between on (checked) and off (unchecked). In the default setting, overwriting is permitted.
   This item is selectable only when you select the registered data that can be overwritten such as parameters of checkers.

Copying Cell

To copy the data registered in a cell to the other cell.

1. **Select the cell that you want to copy and press the FUNC key.**

   The pop-up menu appears.

2. **Select "Copy".**

3. **Move the cursor onto the destination cell and press the FUNC key.**

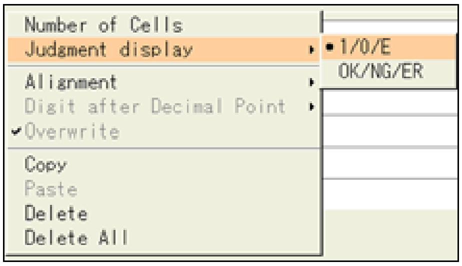
   The pop-up menu appears.

4. **Select "Paste".**

   Copying is executed.

Selecting Judgement Display

Display of Judgement can be changed. This setting is common for all Data R/W sheets. You cannot select separately for each sheet or cell.



1. **Select the cell you have set a judgement in and press the FUNC key. Then, select “Judgement Display”.**

2. **Select "1/0/E" or “OK/NG/ER”**

Judgement	1/0/E	OK/NG/ER
OK	1	OK
NG	0	NG
Error	E	ER

Deleting a Cell, Clearing a Whole Sheet

1. **Select a sheet number of Data R/W.**

2. **Select the cell you want to delete and press the FUNC key.**

   The pop-up menu appears.

3. **To delete only the selected cell, select “Delete”, and to delete a whole sheet, select “Delete All”.**

   The confirmation message appears. If you select “Yes”, the registered data of a cell or a whole sheet are deleted.

4.18.2 Data R/W in RUN Menu

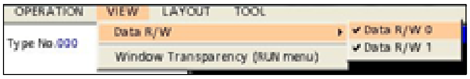
Data R/W 0 -1 are displayed in the designated window, Data R/W 0 window - Data R/W 1 window. In RUN menu, the following operations can be done; selecting a window to display, changing the position and size, and displaying frame (rule lines).

Refer to Chapter 5.3.2 Arranging Layout (page 323).

Displaying Data R/W

1. **Select "VIEW" from the menu bar in RUN menu.**

The menu appears.



2. **Select "Data R/W".**

Marked Data R/W windows are displayed and others are not displayed.

3. **Select a window number of Data R/W to display.**

The selected number of Data R/W window is marked and displayed.

Asterisk symbol (*) shown in a cell indicates that not all digits of the value can be displayed within the width of the current cell. Adjust the cell width to display the all digits.
Blue, black or green characters are displayed in cells. The color differs depending on the item referred in the cell. Each color shows that the following item is referred; Blue: Result, Black: Parameter, Green: Text
If you want to use the layout displaying Data R/W windows in future, register it in "Layout".

▼Refer to▼
In RUN menu, you can change the outlook of Data R/W including the window size and cell width. Refer to page 323 for details.

To hide the displayed Data R/W window

Select "Data R/W" from “VIEW” menu and select the number of Data R/W window to hide.

Changing Values Using Data R/W

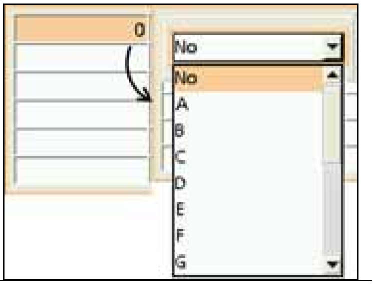
While displaying Data R/W window, you can change the data registered in Data R/W. (Some data cannot be changed such as results.)

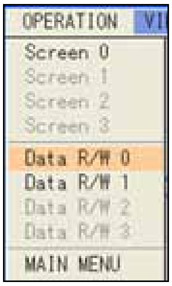
It is helpful to execute inspections changing values frequently (when introducing PV200), or to permit changing some limited values (when using password for limitation of switch to the SETUP menu to prevent to change the setting data by mistake).

▶ Note

- Only the value of the cell permitted to overwrite can be changed. Setting to permit to overwrite or not is made in the window that registers data into a Data R/W sheet (the cell which refers the parameter in "TYPE" > "Data R/W" > "Data R/W 0 or 1").
- If any parameter other than values is registered in Data R/W, it will be replaced with a value to display. The item name will not be displayed. When changing the setting, the item name is displayed in the subwindow.
  Example) When the preprocess group selected in a checker has been registered in Data R/W

Grayscale Preprocess	Display in Data R/W
No	0
A	1
B	2
C	3
D	4
: :	: :
P	16





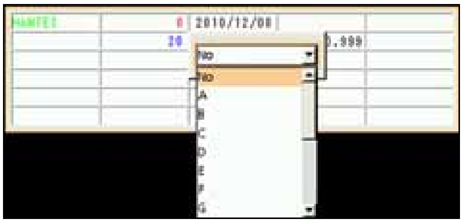
1. **Press the F1 key ("Select Window") in RUN menu.**

2. **Select a Data R/W window where the data you want to change is registered.**

   The Data R/W window is displayed and you can select a cell.

3. **Select a cell where the data to change is registered.**

   Selecting modifiable cell displays the modifying window. If you select the cell where the data cannot be changed is registered, nothing appears.



4. **Select or enter value and fix.**

   Now you completed the modification.

5. **To save the changed value, select [TOOL] -> [Save Setting Data] of the menu bar.**

   If you cut the power or read the setting data in SETUP menu before saving the changed data, the data is cleared and the values are replaced to the previous ones.

4.18.3 Registerable Items

The data that can be registered in cells of Data R/W are listed below.

Note

- “Yes” in the “Change” column indicates the value of the cell is modifiable from Data R/W sheet.
- The columns of Position Adjustment and Area Size Adjustment show that the item can be registered in Data R/W or not, when they are used for the adjustments.

Items that can be registered in Data R/W

Statistics group

A number is indicated in "Statistics" column for statistics items. See below.

No.	Numeric Statistics	All Statistics	OK Statistics	NG Statistics
2	Statistics of checker results If the checker is OK, calculates “All Statistics” and “OK Statistics”. If the judgement is NG, calculates “All Statistics” and “NG Statistics”.	Minimum	OK Judge. Min.	NG Judge. Min.
		Maximum	OK Judge. Max.	NG Judge. Max.
		Average	OK average	NG average
		Range	OK Range	NG range
		Variance	OK Variance	NG Variance
3	Judgment Statistics If the checker is OK, calculates “All Statistics” and “OK Statistics”. If the judgement is NG, calculates “All Statistics” and “NG Statistics”. When referring the statistics of judgments(JR/JD) during in RUN mode, the latest result is referred.	Scan Count (Judgment Count)	OK count	NG count

Checker

Position Adjustment (PAC)		Change	Statistics
Parameter	Base Checker Parameter No.0-3 *1)	**Yes**	No
Result	Judgement	No	3
	Inspection time	No	2
	Base Position X	No	2
	Base Position Y	No	2
	Base Position Theta	No	2
	Adjustment Amount X	No	2
	Adjustment Amount Y	No	2
	Adjustment Amount Theta	No	2
	Detect Position X	No	2
	Detect Position Y	No	2
	Detect Position Theta	No	2
	Base Judgement Results	No	3
	Base Inspection Time	No	2
	Base X-Coordinate	No	2
	Base Y-Coordinate	No	2
	Base Proj. X Axis	No	2
	Base Proj. Y Axis	No	2
Area Size Adjustment (AUC)		Change	Statistics
Parameter *2)		**Yes**	No
Result	Judgement	No	3
	Inspection time	No	2
	X coordinate	No	2
	Y coordinate	No	2
	Proj. X	No	2
	Proj. Y	No	2

*1) Applies to the items that “Position Adjustment - Base checker” column is “Yes” for each checker
*2) Applies to the items that “Area Size Adjustment” column is “Yes” for each checker

Line (LIC)			Change	Statistics
Parameter	Area Setting	Area Setting (Refer to p.309)	**Yes**	No
		Area Size Adjustment (Refer to p.309)	**Yes**	No
	Inspection Conditions	Grayscale Preprocess	**Yes**	No
		Slice Level	**Yes**	No
		Count Pixel Color	**Yes**	No
		Count Object Color	**Yes**	No
		Min. Object Size	**Yes**	No
		Min. Gap Size	**Yes**	No
		Filter	**Yes**	No
	Judgement Limits	Max. No. of Pixels	**Yes**	No
		Min. No. of Pixels	**Yes**	No
		Max. No. of Objects	**Yes**	No
		Min. No. of Objects	**Yes**	No
Result		Judgement	No	3
		Inspection time	No	2
		Pixel Judgement	No	3
		Object Judgement	No	3
		No. of Pixels	No	2
		No. of Objects	No	2

Binary Window (BWC)			Change	Statistics
Parameter	Area Setting	Area Setting (Refer to p.309)	**Yes**	No
		Area Size Adjustment (Refer to p.309)	**Yes**	No
	Inspection Conditions	Grayscale Preprocess	**Yes**	No
		Slice Level	**Yes**	No
		Target	**Yes**	No
		Filter	**Yes**	No
	Judgement Limits	OK Judge. Max.	**Yes**	No
		OK Judge. Min.	**Yes**	No
Result		Judgement	No	3
		Inspection time	No	2
		Area	No	2

Gray Window (GWC)			Change	Statistics
Parameter	Area Setting	Area Setting (Refer to p.309)	**Yes**	No
		Area Size Adjustment (Refer to p.309)	**Yes**	No
	Inspection Conditions	Preprocess	**Yes**	No
	Judgement Limits	OK Judge. Max.	**Yes**	No
		OK Judge. Min.	**Yes**	No
Result		Judgement	No	3
		Inspection time	No	2
		Gray Average	No	2

Binary Edge (BEC)			Change	Statistics	Pos. Adj. - Base checker	Area Size Adjustment
Parameter	Area Setting	Area Setting(Refer to p.309)	**Yes**	No	No	**Yes**
		Area Size Adjustment (Refer to p.309)	**Yes**	No	No	---
	Inspection Condition	Grayscale Preprocess	**Yes**	No	**Yes**	**Yes**
		Slice Level	**Yes**	No	**Yes**	**Yes**
		Edge Condition	**Yes**	No	**Yes**	**Yes**
		Detect Position	**Yes**	No	No	No
		Filter	**Yes**	No	**Yes**	**Yes**
	Search Method	Filter	**Yes**	No	**Yes**	**Yes**
		Width	**Yes**	No	**Yes**	**Yes**
	Judgement Limits	OK Judge. Max.	**Yes**	No	No	No
		OK Judge. Min.	**Yes**	No	No	No

Binary Edge (BEC)			Change	Statistics	Pos. Adj. - Base checker	Area Size Adjustment
Result		Judgement	**Yes**	No	**Yes**	**Yes**
		Inspection time	**Yes**	No	No	No
		No. of Objects	**Yes**	No	**Yes**	**Yes**
		X coordinate	**Yes**	No	**Yes**	**Yes**
		Y coordinate	**Yes**	No	**Yes**	**Yes**
		Detect Color				
		Proj. X	**Yes**	No	No	No
		Proj. Y	**Yes**	No	No	No
Gray Edge (GEC)			Change	Statistics	Pos. Adj. - Base checker	Area Size Adjustment
Parameter	Area Setting	Area Setting (Refer to p.309)	**Yes**	No	No	**Yes**
		Area Size Adjustment (Refer to p.309)	**Yes**	No	No	---
	Inspection Conditions	Grayscale Preprocess	**Yes**	No	**Yes**	**Yes**
		Scan method	**Yes**	No	**Yes**	**Yes**
		Edge condition	**Yes**	No	**Yes**	**Yes**
		Edge Threshold	**Yes**	No	**Yes**	**Yes**
		Detect Position	**Yes**	No	Only “Font and Peak”	
	Search Method	Scan Pitch	**Yes**	No	**Yes**	**Yes**
		Filter	**Yes**	No	**Yes**	**Yes**
		Width	**Yes**	No	**Yes**	**Yes**
		Average Range	**Yes**	No	**Yes**	**Yes**
	Judgement Limits	OK Judge. Max.	**Yes**	No	No	No
		OK Judge. Min.	**Yes**	No	No	No
Result		Judgement	No	3	Refer to the items of Position Adjustment (PAC)	Refer to the items of Area Size Adjustment (AUC)
		Inspection time	No	2		
		No. of Objects	No	2		
		X coordinate	No	2		
		Y coordinate	No	2		
		Differential Value	No	2		
		Proj. X	No	2		
		Proj. Y	No	2		
Feature Extraction (FEC)			Change	Statistics	Pos. Adj. - Base checker	Area Size Adjustment
Parameter	Area Setting	Area Setting (Refer to p.309)	**Yes**	No	No	**Yes**
		Area Size Adjustment (Refer to p.309)	**Yes**	No	No	---
	Inspection Conditions	Grayscale Preprocess	**Yes**	No	**Yes**	**Yes**
		Slice Level	**Yes**	No	**Yes**	**Yes**
		Target	**Yes**	No	**Yes**	**Yes**
		Filter	**Yes**	No	**Yes**	**Yes**
		Sorting	**Yes**	No	**Yes**	**Yes**
		Sorting Order	**Yes**	No	**Yes**	**Yes**
	Search Method	Labeling	**Yes**	No	**Yes**	**Yes**
		Boundary	**Yes**	No	**Yes**	**Yes**
		Perimeter	**Yes**	No	No	No
		Projection Width, Height	**Yes**	No	**Yes**	**Yes**
		Principal axis angle	**Yes**	No	No	No
		Fill Holes	**Yes**	No	**Yes**	**Yes**
	Extraction Condition	Max. Object Area	**Yes**	No	**Yes**	**Yes**
		Min. Object Area	**Yes**	No	**Yes**	**Yes**
		Max. Proj. Width	**Yes**	No	**Yes**	**Yes**
		Min. Proj. Width	**Yes**	No	**Yes**	**Yes**
		Max. Proj. Height	**Yes**	No	**Yes**	**Yes**
		Min. Proj. Height	**Yes**	No	**Yes**	**Yes**

Feature Extraction (FEC)			Change	Statistics	Pos. Adj. - Base checker	Area Size Adjustment
	Judgement Limits	OK Judge. Max.	**Yes**	No	No	No
		OK Judge. Min.	Yes	No	No	---
Result	Common Result Individual Result 1: 1/2 page	Judgement	No	3	Refer to the items of Position Adjustment (PAC)	Refer to the items of Area Size Adjustment (AUC)
		Inspection time	No	2		
		No. of Objects	No	2		
		Area	No	2		
		Gravity X	No	2		
		Gravity Y	No	2		
		Projection Width	No	2		
		Projection Height	No	2		
		Perimeter	No	2		
		Principal axis angle	No	2		
		Proj. X	No	2		
		Proj. Y	No	2		
	Individual Result 2: 2/2 page	Circumscribing Rectangle Upper Left X	No	2		
		Circumscribing Rectangle Upper Left Y	No	2		
		Circumscribing Rectangle Upper Right X	No	2		
		Circumscribing Rectangle Upper Right Y	No	2		
		Circumscribing Rectangle Lower Left X	No	2		
		Circumscribing Rectangle Lower Left Y	No	2		
		Circumscribing Rectangle Lower Right X	No	2		
		Circumscribing Rectangle Lower Right Y	No	2		

Smart Matching (SMC)				Change	Statistics	Pos. Adj. - Base checker	Area Size Adjustment
Parameter	Area Setting	Search Area (Refer to p.309)		**Yes**	No	No	**Yes**
	Inspection Conditions	Grayscale Preprocess		**Yes**	No	**Yes**	**Yes**
		Detect B/W Reversed Template		**Yes**	No	**Yes**	**Yes**
		Angle - Accuracy		**Yes**	No	No=> Position Adjustment **Yes**=> Pos/Rot Adjustment	**Yes**
		Sorting		**Yes**	No	**Yes**	**Yes**
		Sorting Order		**Yes**	No	**Yes**	**Yes**
		Template Rotated by 180d		**Yes**	No	**Yes**	**Yes**
		Ignore Dark Image		**Yes**	No	**Yes**	**Yes**
		Threshold to Ignore Dark Image		**Yes**	No	**Yes**	**Yes**
	Sequence	1st	Min. Correlation	**Yes**	No	**Yes**	**Yes**
			Max. Count	**Yes**	No	**Yes**	**Yes**
		2nd	Min. Correlation	**Yes**	No	**Yes**	**Yes**
			Max. Count	**Yes**	No	**Yes**	**Yes**
		3 rd	Min. Correlation	**Yes**	No	**Yes**	**Yes**
			Max. Count	**Yes**	No	**Yes**	**Yes**

Smart Matching (SMC)				Change	Statistics	Pos. Adj. - Base checker	Area Size Adjustment
		4th	Min. Correlation	**Yes**	No	**Yes**	**Yes**
			Max. Count	**Yes**	No	**Yes**	**Yes**
		5th	Min. Correlation	**Yes**	No	**Yes**	**Yes**
			Max. Count	**Yes**	No	**Yes**	**Yes**
		6th	Min. Correlation	**Yes**	No	**Yes**	**Yes**
			Max. Count	**Yes**	No	**Yes**	**Yes**
		Square Correlation		**Yes**	No	**Yes**	**Yes**
	Subtraction	Min. Subtracted Size		**Yes**	No	No	No
		Subtraction Threshold		**Yes**	No	No	No
		Filter		**Yes**	No	No	No
		Max. OK No. of Subtracted Objects		**Yes**	No	No	No
Result		Judgement		No	3	Refer to the items of Position Adjustment (PAC)	Refer to the items of Area Size Adjustment (AUC)
		Inspection time		No	2		
		No. of Objects		No	2		
		Detect Template No.		No	2		
		Correlation Value		No	2		
		X		No	2		
		Y		No	2		
		Angle		No	2		
		Pixels of Max. Subtracted Object		No	2		
		No. of Subtracted Objects		No	2		
		Proj. X		No	2		
		Proj. Y		No	2		
		No. of Objects (Interim)		No	2		
		Correlation (Interim)		No	2		

Flaw Detection (FWC)			Change	Statistics
Parameter	Area Setting	Area Setting (Refer to p.309)	**Yes**	No
		Area Size Adjustment (Refer to p.309)	**Yes**	No
	Inspection Conditions	Grayscale Preprocess	**Yes**	No
		Scan Direction	**Yes**	No
	Search Method	Detect Mode	**Yes**	No
		Number of Cells for Calculation Range	**Yes**	No
		Number of Cells per Shift	**Yes**	No
		Threshold	**Yes**	No
		Min. Flaw Size in Cells	**Yes**	No
	Judgement Limits	OK Judge. Max.	**Yes**	No
		OK Judge. Min.	**Yes**	No
Result		Judgement	No	3
		Inspection time	No	2
		No. of Objects	No	2
		Flaw size	No	2
		First Cell of Flaw	No	2
		X coordinate	No	2
		Y coordinate	No	2
		Proj. X	No	2
		Proj. Y	No	2

Connector - Binary Window (CBW)			Change	Statistics
Parameter	Area Setting	Area Setting (Refer to p.309)	Yes	No
		Area Size Adjustment (Refer to p.309)	Yes	No
	Inspection Conditions	Grayscale Preprocess	Yes	No
		Slice Level	Yes	No
		Target	Yes	No
		Filter	Yes	No
		Set Individually	Yes	No
	Judgement Limits	Common Judgement Max.	Yes	No
		Common Judgement Min.	Yes	No
		Individual Judgement Max.	Yes	No
		Individual Judgement Min.	Yes	No
Result		Judgement	No	3
		Inspection time	No	2
		No. of Cells	No	2
		Area	No	2
		Individual Judgement	No	3

Connector - Gray Window (CGW)			Change	Statistics
Parameter	Area Setting	Area Setting (Refer to p.309)	Yes	No
		Area Size Adjustment (Refer to p.309)	Yes	No
	Inspection Conditions	Grayscale Preprocess	Yes	No
	Judgement Limits	Set Individually	Yes	No
		Common Judgement Max.	Yes	No
		Common Judgement Min.	Yes	No
		Individual Judgement Max.	Yes	No
		Individual Judgement Min.	Yes	No
Result		Judgement	No	3
		Inspection time	No	2
		No. of Cells	No	2
		Gray Average	No	2
		Individual Judgement	No	3

Connector - Gray Edge (CGE)			Change	Statistics
Parameter	Area Setting	Area Setting (Refer to p.309)	**Yes**	No
	Inspection Condition	Grayscale Preprocess	**Yes**	No
		Detect Direction	**Yes**	No
		Scan method	**Yes**	No
		Edge condition 0	**Yes**	No
		Edge condition 1	**Yes**	No
		Detect Position	**Yes**	No
	Search Method	Scan Pitch	**Yes**	No
		Filter	**Yes**	No
		Width	**Yes**	No
		Average Range	**Yes**	No
	Threshold Adjustment	Set Individually	**Yes**	No
		Global Threshold 0	**Yes**	No
		Global Threshold 1	**Yes**	No
		Individual Threshold 0	**Yes**	No
		Individual Threshold 1	**Yes**	No
	Judgement Limits	Max. Judge. Pitch	**Yes**	No
		Min. Judge. Pitch	**Yes**	No
		Max. Distance Difference Judgement	**Yes**	No
		Min. Distance Difference Judgement	**Yes**	No

Connector - Gray Edge (CGE)			Change	Statistics
Result	Common Result 1/2 page	Judgement	No	3
		Pitch Total Judgement	No	3
		Distance Difference Total Judgement	No	3
		Inspection time	No	2
		No. of Cells	No	2
		Max. Pitch	No	2
		Min. Pitch	No	2
		Average Pitch	No	2
	Individual Result 1: 2/2 page	Pitch Individual Judgement	No	3
		Individual judgement for Distance Difference	No	3
		Pitch	No	2
		Distance Difference	No	2
		Area 0: X-Coord. Edge	No	2
		Area 0: Y-Coord. Edge	No	2
		Area 0: Edge Differential	No	2
		Area 1: X-Coord. Edge	No	2
		Area 1: Y-Coord. Edge	No	2
		Area 1: Edge Differential	No	2

Smart Edge (Circle) (SEC)			Change	Statistics	Pos. Adj. - Base checker
Parameter	Area Setting	Area Setting (Refer to P.309)	**Yes**	No	No
		Area Size Adjustment (Refer to P.309)	**Yes**	No	No
	Virtual Circle Detect Condition	Grayscale Preprocess	**Yes**	No	**Yes**
		Detection Method	**Yes**	No	**Yes**
		Edge ratio used	**Yes**	No	**Yes**
		Execution Mode	**Yes**	No	**Yes**
		Base Angle	**Yes**	No	No
		Result No. Assignment	**Yes**	No	No
	Edge Detect Condition	Scan Direction 0	**Yes**	No	**Yes**
		Scan Method 0	**Yes**	No	**Yes**
		Edge Condition 0	**Yes**	No	**Yes**
		Edge Threshold 0	**Yes**	No	**Yes**
		Detect Position 0	**Yes**	No	**Yes**
		Filter 0	**Yes**	No	**Yes**
		Width 0	**Yes**	No	**Yes**
		Averange Range 0	**Yes**	No	**Yes**
		Scan Direction 1	**Yes**	No	No
		Scan Method 1	**Yes**	No	No
		Edge Condition 1	**Yes**	No	No
		Edge Threshold 1	**Yes**	No	No
		Detect Position 1	**Yes**	No	No
		Filter 1	**Yes**	No	No
		Width 1	**Yes**	No	No
		Averange Range 1	**Yes**	No	No
	Judgement Limits	Denoising 0	**Yes**	No	No
		Denoising Range 0	**Yes**	No	No
		Denoising 1	**Yes**	No	No
		Denoising Range 1	**Yes**	No	No
		Meas.: Radius* Maximum	**Yes**	No	No
		Meas.: Radius* Minimum	**Yes**	No	No

Smart Edge (Circle) (SEC)			Change	Statistics	Pos. Adj. - Base checker
		Max. Standard Deviation	**Yes**	No	No
		Min. Standard Deviation	**Yes**	No	No
		Max. Circularity	**Yes**	No	No
		Min. Circularity	**Yes**	No	No
		Max. Unused Edge Cnt.	**Yes**	No	No
Result	Detected Result 1: 1/3 page	Max. Measurement	No	2	Refer to the items of Position Adjustment (PAC)
		Min. Measurement	No	2	
		Average Measurement	No	2	
		Standard Deviation	No	2	
		Max. Angle	No	2	
		Min. Angle	No	2	
		Center X 0	No	2	
		Center Y 0	No	2	
		Radius 0	No	2	
		Circularity 0	No	2	
		Center X 1	No	2	
		Center Y 1	No	2	
		Radius 1	No	2	
		Circularity 1	No	2	
	Common Result 2: 2/3 page	Judgement	No	3	
		Measurement Judgement	No	3	
		Standard Devation Judgement	No	3	
		Circularity Judgement	No	3	
		Unused Edge Count Judgement	No	3	
		Inspection Time	No	2	
		Used Edge Count	No	2	
		Unused Edge Count	No	2	
		No. of Cells	No	2	
	Individual Result 3: 3/3 page	Cell Individual Result: Judgement	No	3	
		Cell Individual Result: Measurement	No	2	
		Cell Individual Result: Deviation	No	2	
		Cell Individual Result: X 0	No	2	
		Cell Individual Result: Y 0	No	2	
		Cell Individual Result Differential 0	No	2	
		Cell Individual Result: X 1	No	2	
		Cell Individual Result: Y 1	No	2	
		Cell Individual Result: Differential 1	No	2	
		Cell Individual Result: Judgement Code	No	2	

Smart Edge (Line) (SEL)			Change	Statistics	Pos. Adj. - Base checker	Area Size Adj.
Parameter	Area Setting	Area Setting (Refer to P.309)	**Yes**	No	No	**Yes**
		Area Size Adjustment (Refer to P.309)	**Yes**	No	No	---
	Approximate Line Detect Condition	Grayscale Preprocess	Yes	No	Yes	Yes
		Detection Method	**Yes**	No	**Yes**	**Yes**
		Edge ratio used	**Yes**	No	**Yes**	**Yes**
		Execution Mode	**Yes**	No	**Yes**	**Yes**
		Base Angle	**Yes**	No	No	No
		Result No. Assignment	**Yes**	No	No	No
	Edge Detect Condition	Scan Direction 0	**Yes**	No	**Yes**	**Yes**
		Scan Method 0	**Yes**	No	**Yes**	**Yes**
		Edge Condition 0	**Yes**	No	**Yes**	**Yes**
		Edge Threshold 0	**Yes**	No	**Yes**	**Yes**
		Detect Position 0	**Yes**	No	**Yes**	**Yes**

Smart Edge (Line) (SEL)			Change	Statistics	Pos. Adj. - Base checker	Area Size Adj.
		Filter 0	**Yes**	No	**Yes**	**Yes**
		Width 0	**Yes**	No	**Yes**	**Yes**
		Averange Range 0	**Yes**	No	**Yes**	**Yes**
		Scan Direction 1	**Yes**	No	No	No
		Scan Direction 1	**Yes**	No	No	No
		Scan Method 1	**Yes**	No	No	No
		Edge Condition 1	**Yes**	No	No	No
		Edge Threshold 1	**Yes**	No	No	No
		Detect Position 1	**Yes**	No	No	No
		Filter 1	**Yes**	No	No	No
		Width 1	**Yes**	No	No	No
		Averange Range 1	**Yes**	No	No	No
	Judgement Limits	Denoising 0	**Yes**	No	No	No
		Denoising Range 0	**Yes**	No	No	No
		Denoising 1	**Yes**	No	No	No
		Denoising Range 1	**Yes**	No	No	No
		Meas.: Deviation* Maximum	**Yes**	No	No	No
		Meas.: Deviation* Minimum	**Yes**	No	No	No
		Max. Standard Deviation	**Yes**	No	No	No
		Min. Standard Deviation	**Yes**	No	No	No
		Max. Linearity	**Yes**	No	No	No
		Min. Linearity	**Yes**	No	No	No
		Max. Unused Edge Cnt.	**Yes**	No	No	No
Result	Common Result 1: 1/3 page	Max. Measurement	No	2	Refer to the items of Position Adj. (PAC)	Refer to the items of Area Size Adj. (AUC)
		Min. Measurement	No	2		
		Average Measurement	No	2		
		Standard Deviation	No	2		
		Max.: X	No	2		
		Max.: Y	No	2		
		Min.: X	No	2		
		Min.: Y	No	2		
		Judgement	No	2		
		Measurement Judgement	No	2		
		Judgement	No	2		
		Measurement Judgement	No	2		
		Standard Devation Judgement	No	2		
		Linearity Judgement	No	2		
		Unused Edge Count Judgement	No	2		
		Inspection Time	No	2		
		Used Edge Count	No	2		
		Unused Edge Count	No	2		
		No. of Cells	No	2		
	Detected Result 2: 2/3 page	Line 0 Start Coord. X	No	2		
		Line 0 Start Coord. Y	No	2		
		Line 0 End Coord. X	No	2		
		Line 0 End Coord. Y	No	2		
		Line 0 Element a	No	2		
		Line 0 Element b	No	2		
		Line 0 Element c	No	2		
		Line Angle 0	No	2		
		Linearity 0	No	2		

Smart Edge (Line) (SEL)			Change	Statistics	Pos. Adj. - Base checker	Area Size Adj.
		Line 1 Start Coord. X	No	2		
		Line 1 Start Coord. Y	No	2		
		Line 1 End Coord. X	No	2		
		Line 1 End Coord. Y	No	2		
		Line 1 Element a	No	2		
		Line 1 Element b	No	2		
		Line 1 Element c	No	2		
		Line Angle 1	No	2		
		Linearity 1	No	2		
	Individual Result 3: 3/3 page (Results of each cell)	Individual Judgement	No	3		
		Measurement	No	2		
		X0	No	2		
		Y0	No	2		
		Diff.0	No	2		
		X1	No	2		
		Y1	No	2		
		Diff.1	No	2		
		Judgement Code	No	2		

Color Window (CWC)			Change	Statistics
Parameter	Area Setting	Area Setting (Refer to p.309)	**Yes**	No
		Area Size Adjustment (Refer to p.309)	**Yes**	No
	Judgement Limits 1: 1/3 page	R Gray Max.	**Yes**	No
		R Gray Min.	**Yes**	No
		R Gray Ave. Max.	**Yes**	No
		R Gray Ave. Min.	**Yes**	No
		R Gray Std. Devi. Max.	**Yes**	No
		R Gray Std. Devi. Min.	**Yes**	No
	Judgement Limits 2: 2/3 page	G Gray Max.	**Yes**	No
		G Gray Min.	**Yes**	No
		G Gray Ave. Max.	**Yes**	No
		G Gray Ave. Min.	**Yes**	No
		G Gray Std. Devi. Max.	**Yes**	No
		G Gray Std. Devi. Min.	**Yes**	No
	Judgement Limits 3: 3/3 page	B Gray Max.	**Yes**	No
		B Gray Min.	**Yes**	No
		B Gray Ave. Max.	**Yes**	No
		B Gray Ave. Min.	**Yes**	No
		B Gray Std. Devi. Max.	**Yes**	No
		B Gray Std. Devi. Min.	**Yes**	No
Result	Result 1: 1/2 page	Judgement	No	No
		Inspection time	No	No
		R Judge.	No	No
		R Ave. Judge.	No	No
		R Std. Devi. Judge.	No	No
		G Judge.	No	No
		G Ave. Judge.	No	No
		G Std. Devi. Judge.	No	No
		B Judge.	No	No
		B Ave. Judge.	No	No
		B Std. Devi. Judge.	No	No

Color Window (CWC)			Change	Statistics
Result	Result 2: 2/2 page	R Max.	No	2
		R Min.	No	2
		R Std. Devi.	No	2
		G Max.	No	2
		G Min.	No	2
		G Std. Devi.	No	2
		B Max.	No	2
		B Min.	No	2
		B Std. Devi.	No	2

*1) The name varies depending on Detect Mode.
- When selecting "Distance": Max.: Distance (Min.)"
- When selecting "Width": Max.: Width (Min.)"

Geometry Calculation			Change	Statistics
Parameter	Attribute Setting	Line Display	**Yes**	No
		Angle Range	**Yes**	No
		Direction	**Yes**	No
		Intersecting Angle	**Yes**	No
	Judgement Limits	Max. X Judge.	**Yes**	No
		Min. X Judge.	**Yes**	No
		Max. Y Judge.	**Yes**	No
		Min. Y Judge.	**Yes**	No
		Max. Standard Devi. Judge.	**Yes**	No
		Min. Standard Devi. Judge.	**Yes**	No
		Max. Angle Judge.	**Yes**	No
		Min. Angle Judge.	**Yes**	No
		Max. Distance Judge.	**Yes**	No
		Min. Distance Judge.	**Yes**	No
		Max. Intersecting Angle Judge.	**Yes**	No
		Min. Intersecting Angle Judge.	**Yes**	No
		Max. Radius Judge.	**Yes**	No
		Min. Radius Judge.	**Yes**	No
		Max. Major Axis Judge.	**Yes**	No
		Min. Major Axis Judge.	**Yes**	No
		Max. Minor Axis Judge.	**Yes**	No
		Min. Minor Axis Judge.	**Yes**	No
Result	1/2 page	X	No	2
		Y	No	2
		Standard Deviation	No	2
		Angle	No	2
		Line Parameter A	No	2
		Line Parameter B	No	2
		Line Parameter C	No	2
		Distance	No	2
		Intersecting Angle	No	2
		Radius	No	2
		Major Axis	No	2
		Minor Axis	No	2
		Inspection Time	No	2

Geometry Calculation		Change	Statistics
2/2 page	Judgement	No	3
	X Judge.	No	3
	Y Judge.	No	3
	Standard Devi. Judge.	No	3
	Angle Judge.	No	3
	Distance Judge.	No	3
	Intersecting Angle Judge.	No	3
	Radius Judge.	No	3
	Major Axis Judge.	No	3
	Minor Axis Judge.	No	3

For All Checkers - Area Setting

Line, Binary Edge, Gray Edge, Smart Matching, Flaw Detection (Line, Plane), Connector (Binary Window, Gray Window), Smart Edge (Line)		Change	Statistics
Area Setting	Start Point X	**Yes**	No
	Start Point Y	**Yes**	No
	End Point X	**Yes**	No
	End Point Y	**Yes**	No
Binary Window, Gray Window, Feature Extraction, Color Window		Change	Statistics
Area Setting	Start Point X	**Yes**	No
	Start Point Y	**Yes**	No
	End Point X	**Yes**	No
	End Point Y	**Yes**	No
	Vertex X (When the shape is polygon)	**Yes**	No
	Vertex Y (When the shape is polygon)	**Yes**	No
Flaw Detection (Ellipse), Smart Edge (Circle)			
	Center X	**Yes**	No
	Center Y	**Yes**	No
	Radius X	**Yes**	No
	Radius Y	**Yes**	No
Connector (Gray Edge)			
	Start Point X0	**Yes**	No
	Start Point Y0	**Yes**	No
	End Point X0	**Yes**	No
	End Point Y0	**Yes**	No
	Start Point X1	**Yes**	No
	Start Point Y1	**Yes**	No
	End Point X1	**Yes**	No
	End Point Y1	**Yes**	No

For All Checkers - Area Setting - Area Size Adjustment

Line, Binary Window, Gray Window, Binary Edge, Gray Edge, Feature Extraction, Smart Edge (Circle), Smart Edge (Line), Color Window		Change	Statistics
Area Size Adjustment	Area Size Adjustment Offset (Top)	**Yes**	No
	Area Size Adjustment Offset (Bottom)	**Yes**	No
	Area Size Adjustment Offset (Left)	**Yes**	No
	Area Size Adjustment Offset (Right)	**Yes**	No
Flow Detection, Connector (Binary Window, Gray Window)		Change	Statistics
Area Size Adjustment	Area Size Adjustment Offset (Start)	**Yes**	No
	Area Size Adjustment Offset (End)	**Yes**	No

Numerical Calculation

			Change	Statistics
Numerical Calculation (CAC)	Parameter	Max. Judge.	**Yes**	No
		Min. Judge.	**Yes**	No
	Result	Judgement	No	3
		Result	No	2
Numerical Calculation Previous Value (OCA)	Result	Judgement	No	3
		Result	No	2

Judgement

			Change	Statistics
JRC (Internal)	Judgement	Result	No	3
JDC (External)			No	3

System Values

	Change	Statistics
Inspection Time	No	No
Inspection Cycle	No	No
Total Judgement	No	No
Scan Count	No	No
Run Type No.	No	No
Date (Y-M-D)	No	No
Time (H-M-S)	No	No

System Register

	Change	Statistics
SYS:REG0 to SYS REG7	**Yes**	No

Slice Level

Camera No. 0 - 1	Change	Statistics
Maximum value (Group A to P)	**Yes**	No
Minimum value (Group A to P)	**Yes**	No

Grayscale Preprocess

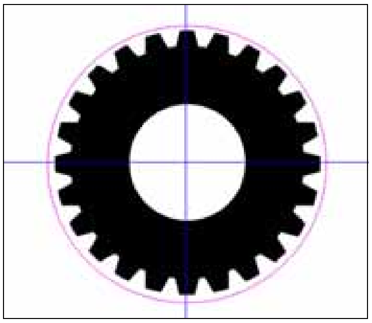
Camera No.0 - 1, Group A - P, 1st step - 10th step	Change	Statistics
Type	**Yes**	No
Parameter 0 (Parameter name) to Parameter 8 (Parameter name)	**Yes**	No

* The parameter name set for the selected step (1-10) is displayed.
It shows the parameter number without name is not used for the selected preprocess type.

Text

Text	Change	Statistics
(Up to 16 characters)	No	No

4.19 Marker



Marker is the function that displays figures of line, rectangle, circle, polygon or cross line on the screen window of RUN menu. This function can display an image on the screen like indicating a guide to position the object with no effect on the inspection time. This function also can move the created marker by inputting commands from the external device.

Up to eight markers can be set for each product type per camera.

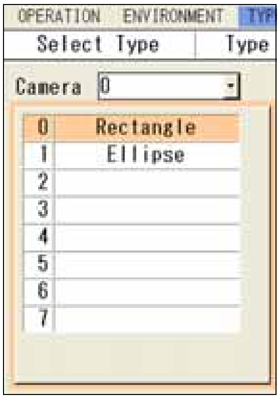
▶ Note

Creating and editing markers are operated in SETUP Menu. However, they can be displayed only in the RUN Menu. Markers cannot be displayed on the screen window in SETUP menu.

▼Refer to▼

Marker display: see page 326.

Creating Marker



Camera 0

0	Rectangle
1	Ellipse
2	
3	
4	
5	
6	
7	

1. **In SETUP menu, select "TYPE" > "Marker Display" from the menu bar.**

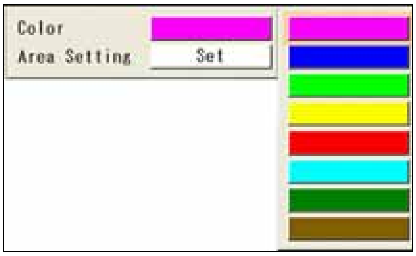
   The marker menu is displayed.
   The marker list shows marker numbers and their shapes.

2. **Specify a camera No. to set a marker.**

3. **Select the marker list and then select a marker number from 0 - 7 to create.**

   ▶ Note

   The marker shape of larger number is displayed in front on the screen window.
   For example, if you create markers in the same size and on the same position, setting No.0 in blue and No.7 in yellow, only the yellow marker No.7 is displayed on the screen.



4. **Select a color from the six colors.**

5. **Select "Set" of "Area Setting" to set area shape and area.**

   The procedure to select area shape and to specify area is the same as of checker area.
   It can be set for the captured image and a total of 9 screens surrounding it. However, in the case of the marker of cross line, it can be set and displayed only in the area of the captured image.

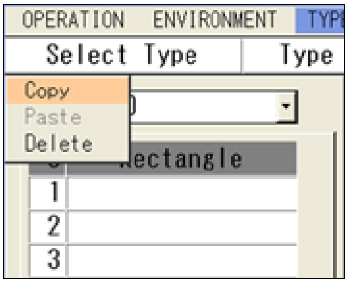
6. **After setting is completed, press the CANCEL key.**

   When you close the marker setting window, the marker on the screen disappears which was displayed while you are setting it. This is because SETUP menu cannot display markers.

Copying Marker

1. **Highlight the marker number you want to copy and press the FUNC key.**

The pop-up menu appears.



2. **Select "Copy".**

3. **Move the cursor onto the destination marker number and press the FUNC key.**

The pop-up menu appears.

4. **Select "Paste".**

The same marker as the copied one is pasted.

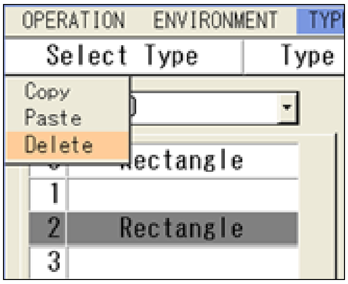
▶ **Note**

If a marker already exists in the destination, the message of overwrite confirmation appears. Selecting “Yes” executes copying the marker.

Deleting Marker

1. **Highlight the marker number you want to delete and press the FUNC key.**

The pop-up menu appears.



2. **Select "Delete".**

The confirmation screen is displayed.

3. **Select “Yes”.**

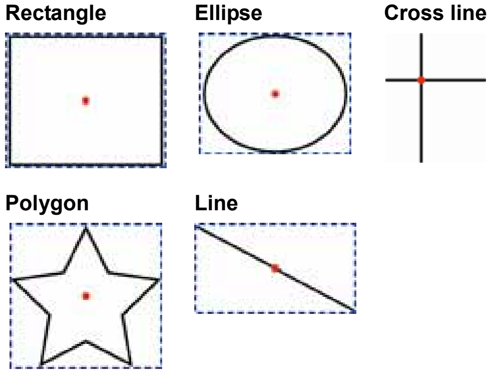
The marker is deleted. Select "No" to cancel.

Moving Marker (Inputting Command from External Device)

The created marker can be moved by inputting commands (*1) from the external device. It is also possible to read the current position.

The position of the marker is based on the coordinate of the middle point of the circumscribing rectangle of the marker (the intersection point of two lines for Shape: Cross line).

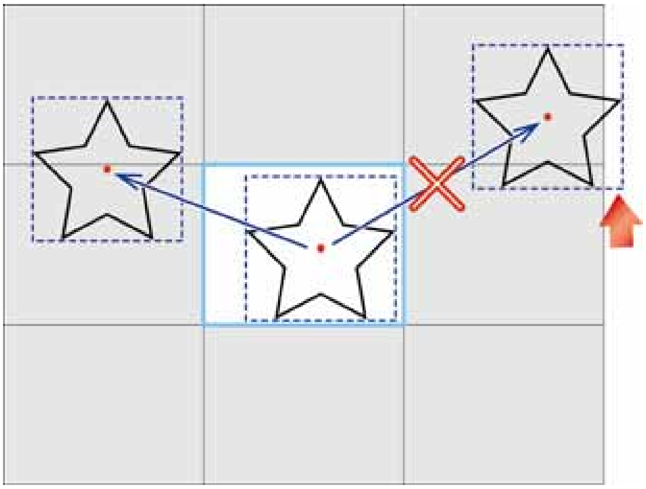
In the example on the right, the solid line shows the created marker, the dotted line shows the circumscribing rectangle of the marker, and the point in the center shows the middle point. The circumscribing rectangle and the middle point are not displayed on the screen window.



Movable range

As a result of moving through the distance specified with the command parameter from the current position, if the circumscribing rectangle of the marker (the intersection point of two lines in the case of cross line) is located within the nine screens (which are the captured image and eight surrounding screens), the marker can be moved.

As a result of the move, if only a part of the circumscribing rectangle goes out of the nine screens, the marker cannot be moved and an error occurs



Note

- Moving the marker is performed by specifying the moving distance from the current position. It is not possible to specify the coordinate of the destination to move.
- The position to be read and the specified moving distance is in units of pixel. It is not possible to read and specify the moving distance in the unit after calibration.
- Reading the marker position and writing the moving distance is performed with a set of X and Y coordinates. Reading (writing) is not available by specifying only X coordinate or Y coordinate.

Refer to

(*1) Read Command and Write Command: From page 409

Chapter 5

Setting of Operation and RUN Menu

5.1 Start /Stop RUN Mode

Perform inspections along with the settings made in the previous chapter.

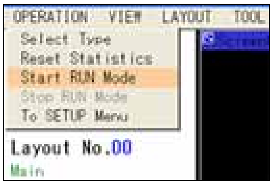
Start RUN mode

1. Switch to RUN menu by operating the “OPE/SET” switch.

If you switched to SETUP menu from RUN menu during an inspection stoppage, follow the procedure described below to restart the operation.
In other cases, switching to RUN menu starts the operation automatically.
You can check whether the operation stops or is running in the lower left of the screen.

2. Select "OPERATION” > “Start RUN Mode” from the menu bar.

When the dialog message appears, select “Yes” to start the operation.
The sign of “RUN” appears in the lower left of the screen.



Stop RUN mode

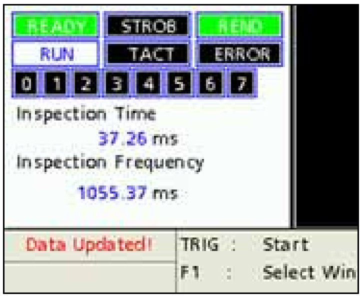
To stop RUN mode, follow the procedure below.

1. Select "OPERATION” > “Stop RUN Mode” from the menu bar.

When the dialog message appears, select “Yes” to stop the operation.
The sign of “STOP” appears in the lower left of the screen.

Inspection Time and Inspection Cycle

Executing an inspection shows "Inspection Time" or both of "Inspection Time" and “Inspection Cycle” in ms units in the lower left of the screen.



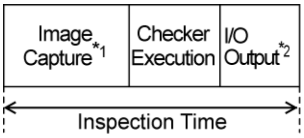
Inspection Time
37.26 ms
Inspection Frequency
1055.37 ms

Data Updated!

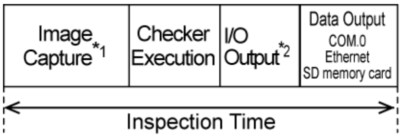
TRIG : Start
F1 : Select Win

Inspection Time

When “Inspection Process” is set to "Serial", Inspection Time equals "READY signal OFF time" which is the time from START signal input to I/O output.

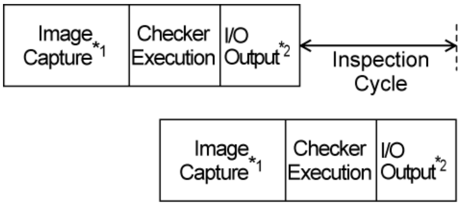


When you output data to COM.0 port, Ethernet port, or a SD memory card, or when you output inspection images in "Synchronous" method, Inspections Time is the time from Start signal input to completion of the data output.

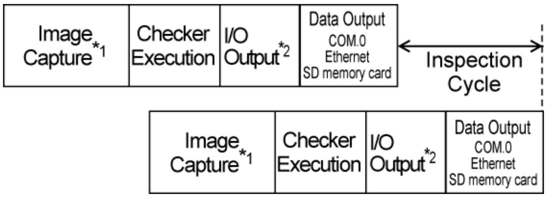


Inspection Cycle

The time from the I/O output of the previous inspection to the I/O output of the current inspection. It is displayed only when “Inspection Process” is set to "Parallel".



When you output data to COM.0 port, Ethernet port, or a SD memory card, or when you output inspection images in "Synchronous" method, it is the time from the completion of the previous inspection data output to the completion of the current inspection data output.



▶ Note

*1) The time of Image Capture includes the time of capture delay.

*2) When the data is output in several times, it indicates the I/O output to the last one.

5.2 Control in RUN Menu

The settings and operation listed below are available in RUN menu.

Select Type (OPERATION)	Switches types to execute.	▶ Page 318
Reset Statistics (OPERATION)	Resets the statistics data of the current type.	
Modification and registration of the display (VIEW, LAYOUT)	Sets the screen layout. Arranges the screen window, selects contents to display, specifies the size and position of a data R/W window, and sets the window transparency. this information can be registered as layout data.	▶ page 321
Save setting data (TOOL)	Saves the settings modified in RUN menu in the storage space in PV200 or a SD memory card.	▶ Page 319
Save/clear image memory (TOOL)	Erases images saved during inspections and backups them in a SD memory card.	
Information (TOOL)	Displays the information of PV.	
□ Eject SD memory card (TOOL)	Prepares to eject the SD memory card.	
□ Data modification from the Data R/W window (Data R/W)	Modifies the modifiable data registered in the Data R/W.	▶ page 297

5.2.1 Control of “OPERATION” Menu

Switching Types

▶ Note

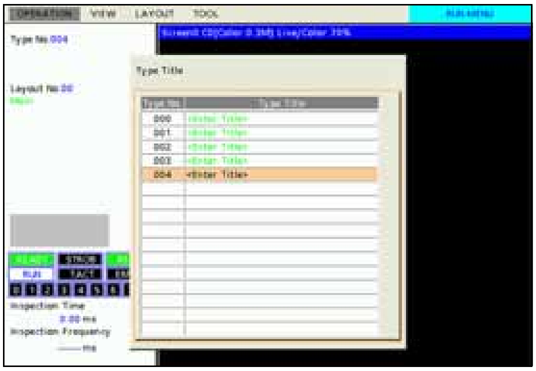
In RUN menu, you can switch types but modify them such as adding, deleting, copying types and entering a title.

1. **Select "OPERATION” > “Select Type” from the menu bar.**

   The list of product types appears.

2. **Select a Type No. to switch.**

   The type is switched.
   When it is operating, the inspection will be continued on the switched type.



Type No.	Type Title
000	<Enter Title>
001	<Enter Title>
002	<Enter Title>
003	<Enter Title>
004	<Enter Title>

Resetting Statistics Data

1. **Select "OPERATION” > “Reset Statistics” from the menu bar.**

   When the dialog message appears, select “Yes”.
   If you select “No”, resetting is canceled.

5.2.2 Control of “TOOL” Menu

Ejecting SD Memory Card

1. **Select "TOOL” > “Eject SD Card” from the menu bar.**

The message appears.

2. **Select “Yes”.**

The message saying “The SD card can be ejected safely,” appears. Select “OK” to eject the SD memory card.

Saving Setting Data

Saves the settings modified in RUN menu (or modified by a command of the external device).

If you cut the power before saving the settings, the modified data will be cleared.

▶ Note

It is displayed only when data saving in RUN menu is permitted.

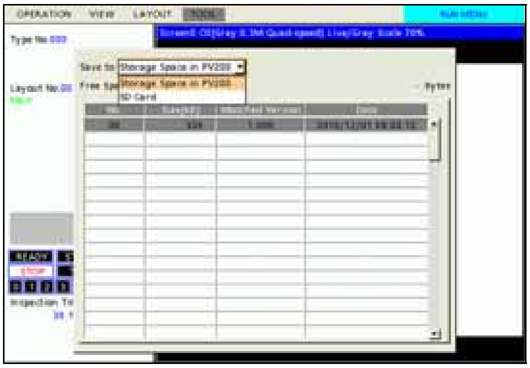
Refer to the setting of “ENVIRONMENT” > “Password” > “Save Changes in RUN menu” in SETUP menu.

1. **Select "TOOL" > "Save Setting Data".**

The destination selecting window is displayed.

2. **Select a place to save it.**

Select “Storage Space in PV200” (or “SD card”) for “Save to”.



Save to: Storage Space in PV200

▶ Note

Data cannot be saved in a SD card when "Write When Cover is Open" has been set to "Disable" and the cover of PV200 is open. (Refer to page 341 for details.)

3. **Select a “No.” of a saving area.**

When the dialog message appears, select “Yes” to save.

If you select “No”, saving is canceled.

▶ Note

When "Storage Space in PV200" is selected, the saving area number is always 00.

4. **After saving is completed, press the CANCEL key.**

Backing Up Saved Image

Backups the images saved in the image memory during inspections to a SD memory card. Backupping cannot be executed during operations (RUN).

1. **Select "TOOL" > "Save Image Memory".**

The message is displayed if it is operating. To stop the operation and backup the images, stop it from “OPERATION” menu.

2. **Select a place in the SD memory card to save them.**

When the confirmation message appears, select “Yes”.

▶ Note

Data cannot be saved in a SD card when "Write When Cover is Open" has been set to "Disable" and the cover of PV200 is open. (Refer to page 341 for details.)

3. **After the saving is complete, the message appears. Select “OK” and press the CANCEL key.**

Deleting Saved Image

Deletes the images saved in the image memory during inspections.

1. **Select "TOOL" > "Clear Image Memory".**

When the dialog message appears, select “Yes”.
When the message disappears, deleting the images is complete.

Displaying Information of PV

1. **Select "TOOL” > “Information” from the menu bar.**

The list of PV information is displayed.

5.3 Setting Display in RUN Menu

Set the contents to display in RUN menu.

“Layout” is a combination of display contents described below. Up to 16 layouts can be registered and switched by a signal of the keypad or the external device.

Seven types of layouts are initially registered in PV200. These are "Preset Layout”.

Selecting Display Window / Size and Position of Windows

RUN menu can display up to two screen windows which show images and up to two Data R/W windows which show and modify the data. The size, number and position of screen windows cannot be changed from the seven types of preset layouts. The size and position of data R/W windows can be changed freely.

Contents Displayed in Screen Window

The contents displayed in each screen window are type and magnification of an image, checker pattern, or calibration scale. Set them with “Image Menu” from each screen window.

Window Transparency (RUN menu)

The transparence of Data R/W windows can be changed. Higher transparency of the window helps to observe the image.
This information is not included in the layout information.

▶ Note

- The information of layout and window transparency is initialized by executing “Initialize” of “ENVIRONMENT” in SETUP menu.
- After being initialized, layout information will be three preset layouts registered as layout 0 - 6 and window transparency will be “0%”.
- At startup, the layout number specified with the startup setting is called up. Refer to Chapter 6.2.1, page 333 about the setting procedure

5.3.1 Screen Window Arrangement: Selecting a Preset Layout

PV200 has preset layouts to select. Based on a selected preset layout, you can arrange the layout and register it as a custom layout.

1. **Select "LAYOUT" > “Layout” from the menu bar.**

The layout setting window is displayed.

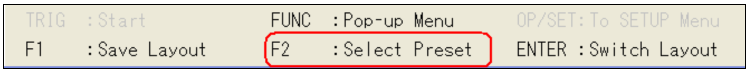
2. **Select a layout No.**

Layout No.00 - 15 can be selected.

▶ Note

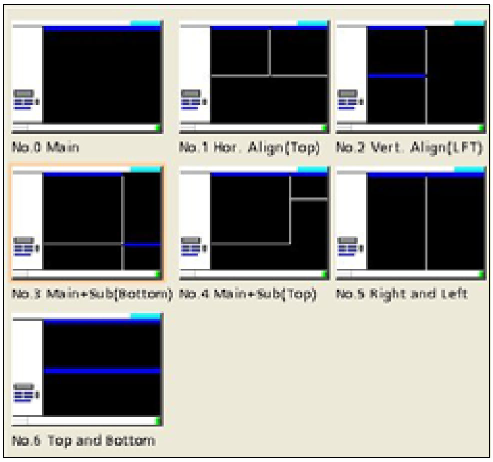
In the layout No.00 - 06, preset layouts 00 - 06 are registered initially.
Specifying No.00 - 06 here can select a preset layout.

3. **Press the F2 (: Select Preset) key or press the FUNC key and select “Select Preset” from the displayed menu.**



TRIG : Start	FUNC : Pop-up Menu	OP/SET: To SETUP Menu
F1 : Save Layout	F2 : Select Preset	ENTER : Switch Layout

The window for selecting the preset layout No.0 - 6 appears. Seven patterns of layouts (number of screen windows, the size, and the position) are preset. Display image of every pattern is set to Live and Gray.

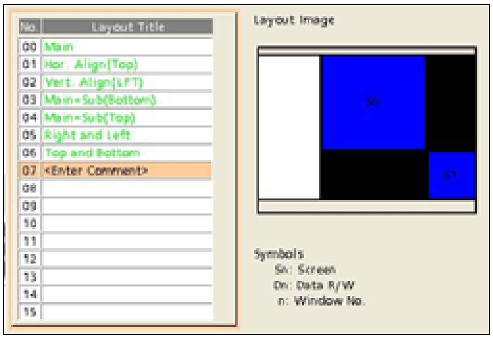


4. **Operate the ENTER key to select the desired preset layout number.**

The window returns to the layout registering window. The selected layout image is displayed on the right.

▶ Note

If a preset layout is registered in the layout number that has been already set, a message appears. Select “Yes” to save it. Select "No" to return to the previous layout.



No.	Layout Title
00	Main
01	Hor. Align(Top)
02	Vert. Align(LFT)
03	Main+Sub(Bottom)
04	Main+Sub(Top)
05	Right and Left
06	Top and Bottom
07	<Enter Comment>
08	
09	
10	
11	
12	
13	
14	
15	

Symbols
Sn: Screen
Dn: Data R/W
n: Window No.

5. **Press the ENTER key.**

The screen returns to RUN menu and shows the windows in the layout you selected.

▶ Note

The layout has not been saved in PV200 yet. For the details of registering layout, refer to page 328.

5.3.2 Arranging Layout

Now we select displayed screen windows (up to two windows ;No.0 - 1) and R/W windows (up to two windows; No.0 - 1), and arrange the size, position and other display settings of the R/W windows.

Note that Data R/W windows are displayed in front of screen windows and cannot be displayed in behind.

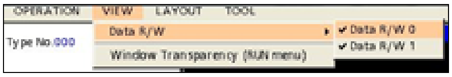
▶ Note

Be sure to save the setting data by registering the layout after layout arranging from “Layout”. If you switch to the other layouts or turn off the power of PV200 before registering and saving the setting, the arranged layout will be cleared.

Selecting a Data R/W Window

1. **Select "VIEW" from the menu bar.**

   The menu is displayed.



Type No.000

2. **Select “Screen” to select a screen window number to display.**

   The selected number of screen window is checked and the Image menu is displayed.

3. **Press the Cancel key.**

4. **Select "Data R/W" from “VIEW” menu and select the number of Data R/W window to hide.**

   The window number is unchecked and the data R/W window is hidden.

Selecting Image Type Displayed on Screen Window

See Chapter 3.2.2 , page 37.

Arranging a Data R/W Window

The data and the number of cells displayed in a Data R/W window can be specified from “TYPE” > “Data R/W” in SETUP menu.

In RUN menu, the items listed below can be set.

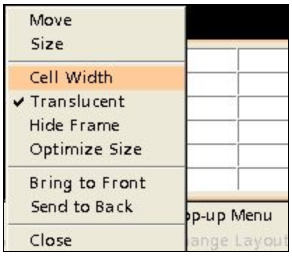
Position/ size:	Changes the position and size of the windows.
Cell width:	Sets the width of cells to display data by the columns.
Translucent:	Sets whether the transparence applies to Data R/W windows or not.
Frame display:	Displays or hides the frame when multiple cells are shown.

1. **Press the F1 key.**

   The list of currently displayed window is displayed.

2. **Operate the ENTER key to select a Data R/W window to modify.**

   The selected data R/W window is highlighted.



3. **Press the FUNC key and select “Move” from the pop-up menu.**

4. **Move the window by operating the ENTER key and press the ENTER key to fix the position.**

   The frame of the window is displayed as white broken line while the window is moved.

5. **Select "Size".**

6. **Move the start point of the screen window by operating the ENTER key and press the ENTER key to fix the position.**

7. **Move the end point of the screen window and press the ENTER key to fix it.**

8. **Select the column to change the cell width and press the FUNC key.**

   The cell width can be specified by a column basis.

9. **Select "Cell Width" from the pop-up menu.**

   The setting window is displayed. Specify it in pixels according to the digit of the displayed data.

   ▶ Note

   Even when Calibration is employed, specify the cell width in pixels.

10. **Specify the value and press the ENTER key.**

    The cell width is changed. Change the cell width of other columns if needed.

11. **Press the FUNC key and select “Translucent” from the pop-up menu.**

    The Data R/W window is displayed in the “Transparence” specified in VIEW menu.
    As you open the pop-up menu, "Translucent" is checked.
    Selecting “Translucent” again cancels to apply the transparence and the window is displayed in 0% of transparence.

12. **Press the FUNC key and select “Hide Frame” from the pop-up menu.**

    The frame line is undisplayed.
    As you open the pop-up menu, "Hide Frame" is checked.
    Selecting “Hide Frame” again displays the frame.

Optimizing Window Size (Optimize Size)

Adjust the window size so that it displays all cells and no margin. This is optimization.

While you can adjust the window size by modifying the start/end point by “Size”, using “Optimize Size” allows adjusting efficiently in one operation.

1. **Press the FUNC key to display the pop-up menu.**

2. **Select "Optimize Size".**

   The size of the Data R/W window is changed.

Changing Window Transparency of Data R/W Window

The transparence of Data R/W windows can be changed. This is a function that helps to observe images and other windows when they are displayed overlapping with the window. You can select whether to apply the transparency setting or not to each data R/W window.

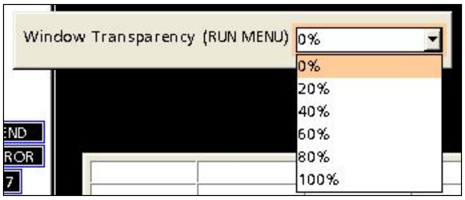
▶ Note

The information of window transparency is not included in the layout information.

1. **Select "VIEW" from the menu bar.**

2. **Select "Window Transparency (RUN menu)".**

   The transparence setting window is displayed. Default value is 0%. The larger value, the higher transparence.



3. **Select desired transparency.**

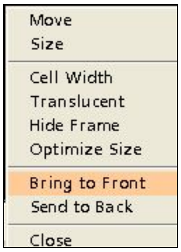
4. **After setting is completed, press the CANCEL key.**

Changing Sequence Order of Data R/W Windows

When two data R/W windows are displayed and are overlapping each other, using this function brings a selected window to the front of the other window or sends to the back.

1. **Press the F1 key.**

   The list of currently displayed windows is displayed.



2. **Operate the ENTER key to select a Data R/W window to change the order.**

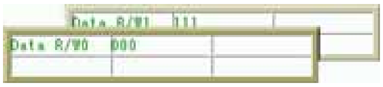
   The selected data R/W window is highlighted.

3. **Press the FUNC key and select “Bring to Front” or "Send to Back" from the pop-up menu.**

4. **After setting is completed, press the CANCEL key.**

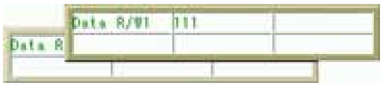
   Now, the order of the data R/W windows changes.

Before replacement



Replacing Data R/W
0 and 1

After replacement

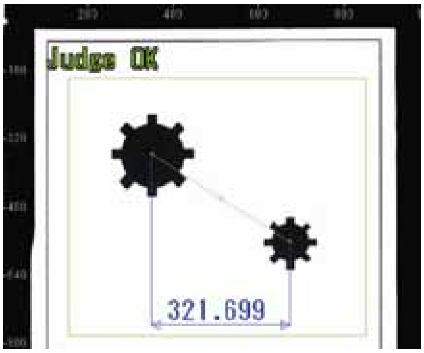


Selecting Pattern Display

Select patterns to display on the screen window.

The patterns that can be selected to display or hide are as follows.

- Inspection area, arrow showing a scan direction and detect position of a checker
- Result of geometry calculation
- Figures set in character/figure drawing
- Marker
- Calibration scacle



▶ Note

About types of display images and magnification, refer to Chapter 3.2.2 Selecting a Display Image (Image Menu), page 37.

1. **Press the F1 key.**

The list of currently displayed window is displayed.

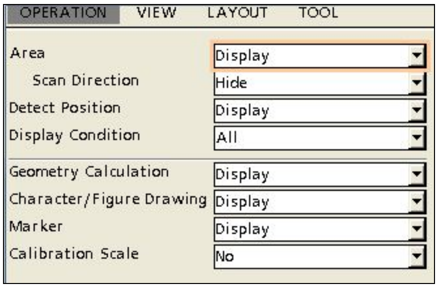
2. **Operate the ENTER key to select a screen window to set.**

3. **Select "Pattern Display".**

Pattern Display setting window is displayed.

4. **Select “Display” or “Hide” for "Area".**

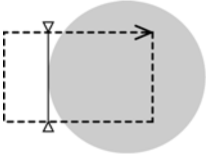
Area is an inspection area frame of each checker.
In the right figure, it is indicated with a dotted line.



Area: Display
Scan Direction: Hide
Detect Position: Display
Display Condition: All
Geometry Calculation: Display
Character/Figure Drawing: Display
Marker: Display
Calibration Scale: No

5. **Select “Display” or “Hide” for "Scan Direction".**

This item is available only when selecting "Display" for "Area".
"Scan Direction" is an arrow to indicate the scan direction of a checker.
In the right figure, it is indicated at the right edge of the upper side.
Target Checker
Binary Edge / Gray Edge / Connector (Gray Edge) / Smart Edge (Circle) / Smart Edge (Line)
(including Position Adjustment and Area Size Adjustment)



6. **Select “Display” or “Hide” for "Detect Position".**

Detect Position is a line or mark indicating a position detected by each checker.
The detect position in the right figure is the line and mark at the edge of the circle.

7. **Select “All” or “Display NG checkers only”. for “Display Condition”.**

Display NG Checkers Only:
Displays the area and detect position of checkers judged as NG.
(Only when selecting "Display" for each item.)
All (Default):
Displays the areas and detect positions of all checkers (only when selecting "Display") regardless of an inspection result.

▶ Note

The "Display Condition" can be set only for the inspection area, scan direction and detected position of a checker.

8. **Select “Display” or “Hide” for "Geometry Calculation", "Character/Figure Drawing" and "Marker" respectively.**

9. **Select “No” or “Yes” for “Calibration Scale”.**

[No] (Default): Not display a calibration scale.
[Yes]: Displays a calibration scale.

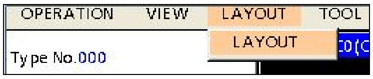
5.3.3 Registering/copying/deleting a Layout

Registering a Layout

An arranged display can be saved as a layout (up to 16 layouts). Saving it can switch layouts by a keypad operation or a signal input from the external device.
Be sure to register the adjusted layout and save the setting data by following procedure after layout arranging. If you switch to the other layouts or turn off the power of PV200 before registering the setting, the arranged layout will be cleared.

1. **Select "LAYOUT" > “Layout” from the menu bar.**

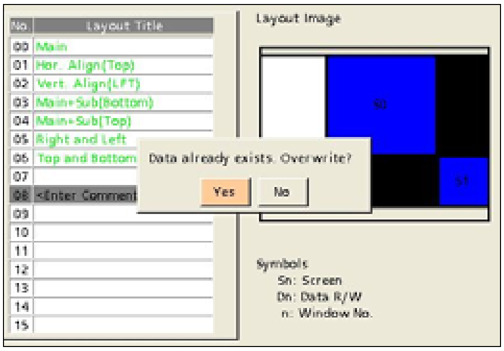
The layout setting window is displayed.



2. **Move the cursor onto the layout number to register.**

3. **Press the F1 key to register the current layout.**

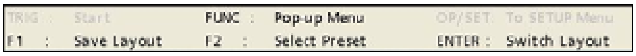
If another layout has been registered in the selected layout No., a confirmation message appears to overwrite. Select “Yes” then.
Now you completed registering.



No.	Layout Title
00	Main
01	Hor. Align(Top)
02	Vert. Align(LFT)
03	Main+Sub(Bottom)
04	Main+Sub(Top)
05	Right and Left
06	Top and Bottom
07	
08	<Enter Comment
09	
10	
11	
12	
13	
14	
15	

Data already exists. Overwrite?

▶ Note
Press the F1, F2 or ENTER key while the cursor on the layout number list to make the settings for layout. The operation of each key is shown in the key guide. The operation of each key is as below.
F1: Save Layout
F2: Select Preset
ENTER: Switch Layout



4. **Press the FUNC key and select “Enter Title” from the pop-up menu.**

Enter a title with the software keyboard as necessary.

5. **Press the CANCEL key.**

6. **Switch to SETUP menu.**

7. **Select "SAVE/READ" -> “Save Setting Data”.**

8. **Save the data in the Storage Space in PV200 or a SD memory card.**

▶ Note
Select "TOOL" > "Save Setting Data" to save data in RUN Menu.

Copying/deleting Layout

1. **Select "LAYOUT" > “Layout” from the menu bar.**

The layout setting window is displayed.

2. **Move the cursor onto the layout number to copy (or delete).**

3. **Press the FUNC key and select “Copy” from the pop-up menu.**

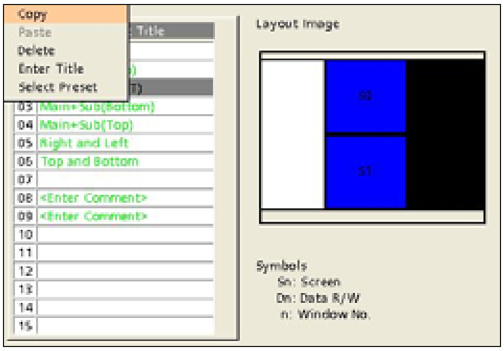
If you want to delete it, select “Delete”.

4. **Move the cursor onto the destination layout number, press the FUNC key, and select “Paste” from the pop-up menu.**

The layout is copied.

5. **To display or modify the pasted layout, press the ENTER key.**

As you press the CANCEL key, the screen shows the layout of the previous number displayed before displaying the setting window. Also in this case, copying is complete.



5.3.4 Switching a Layout

The current layout can be switched to the registered layout. With keypad, you can switch from the layout list or pressing the F2 key.

▶ Note

You can also switch it by inputting a signal from the external device.

Selecting from Layout List

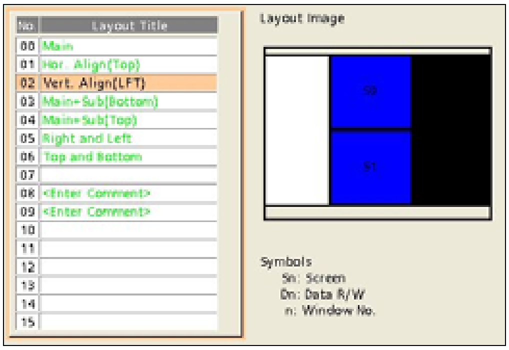
When many layouts are registered, switching from the layout list is suitable.

1. **Select "LAYOUT" > “Layout” from the menu bar.**

   The layout setting window is displayed.

2. **Select a layout No. to switch to.**

   The screen returns to RUN menu and the selected layout is shown.



No.	Layout Title
00	Main
01	Hor. Align(Top)
02	Vert. Align(LFT)
03	Main+Sub(Bottom)
04	Main+Sub(Top)
05	Right and Left
06	Top and Bottom
07	
08	<Enter Comment>
09	<Enter Comment>
10	
11	
12	
13	
14	
15	

Symbols
Sn: Screen
Dn: Data R/W
n: Window No.

Switching a Layout with the F2 Key

When registered layouts are less than 10, switching with the F2 key is suitable.

1. **Press the F2 key (: Change Layout) in RUN menu.**

   The screen switches to the layout of the next number.

2. **Pressing the F2 key again switches to the layout of the next number.**

   Each time you press the F2 key, the screen switches the layout in the registering order.

Chapter 6

Environment Settings (Changing System Settings)

6.1 Overview of ENVIRONMENT

In ENVIRONMENT in SETUP menu, the following items can be set including inspection conditions except checkers. The settings in ENVIRONMENT are the common settings for all Types.

System Settings

This menu sets the status of PV200 at startup and in the execution mode.

• Startup setting	Page 333
• Operation	
- Operation when switching to SETUP menu	Page 343
- Inspection sequence and output timing of results and images	Page 335
- Operation on a template of Smart Matching	Page 133
• System Register	Page 336

Input/output

(Page 337)

This menu sets items on communication with external devices such as parallel I/O and serial port.

Camera

This menu sets camera type to use and the polarity of FLASH signal output from PV200.

• Camera	Page 58
• FLASH polarity	Page 59

Transparence

(page 342)

This menu changes transparence of dialogue window in SETUP menu.

Password

This is the function to protect from operational errors. Inputting a password is required when switching from RUN menu to SETUP menu. The function prevents changing the inspection conditions by mistake.

▼Refer to▼

For the information of operation to switch to SETUP menu, refer to page 343.

Initialize

This menu initializes all settings under ENVIRONMENT menu.

6.2 System Settings

6.2.1 Setting Startup Status (Startup Setting)

From this menu, you can specify product type to call up at startup of PV200 and display contents (layout).

When you read up the setting data from the storage space of PV200 or a SD memory card, Type and Layout you specified with this menu are called up.

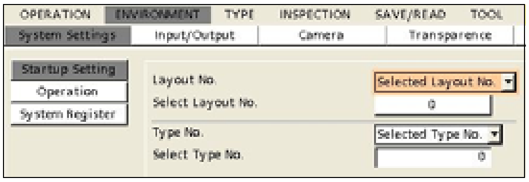
Select Layout at Startup

Select a layout as a startup in RUN menu from the registered layout number.

If the specified layout No. does not exist, the window is displayed in the default layout (same as the preset layout No.0). At that time, the current layout number displayed on the screen appears as "--".

▼Refer to▼

For details about adjustment or registration of layouts, refer to Chapter 5.3, page 321.



Layout No. Selected Layout No.
Select Layout No. 0
Type No. Selected Type No.
Select Type No. 0

1. **Select "Startup Setting" in “System Settings” setting window.**

2. **Set “Layout No.”.**

Last Layout No.:	Reads the layout again selected right before turning off the power. The setting is done if you select this.
Selected Layout No. (default):	Reads the layout No. specified after.

3. **Select “Select Layout No.” (default: 0).**

   The list of layout number is displayed.

4. **Select a desired layout No.**

5. **Press the CANCEL key.**

▶ Note

The last layout No. is held by using the backup battery. When the battery runs out or no battery is installed, the layout number 00 is read. If the layout number 00 is not set, the preset layout number 0 is read.

Selecting a Type to Be Read at Startup

Select a type to read at startup.

▼Refer to▼

Also from the type switching window, the setting of a type to read at startup can be changed. Refer to page 55 for details.

1. **Select "Setup Setting" in “System Settings” setting window.**

2. **Select “Type No.”**

Last Type No. (default):	Reads again the type selected right before turning off the power. The setting is done if you select this.
Selected Type No.:	Reads the type No. specified after.

3. **Specify a type No. to read in “Select Type No.”.**

4. **After setting is completed, press the CANCEL key.**

▶ Note

The last type No. is held by using the backup battery on the back of PV200. When the battery runs out or no battery is installed, the type with the smallest number from the existing types is called up. Also, if the type specified in "Select Type No." does not exist at startup, the type with the smallest number from the existing types is called up.

6.2.2 Inspection Process and Output Timing

Selecting Inspection Process

To reduce inspection time when the tact time is short, change operation mode.

Serial processing

The inspection time displayed on the screen is as shown in the right figure.

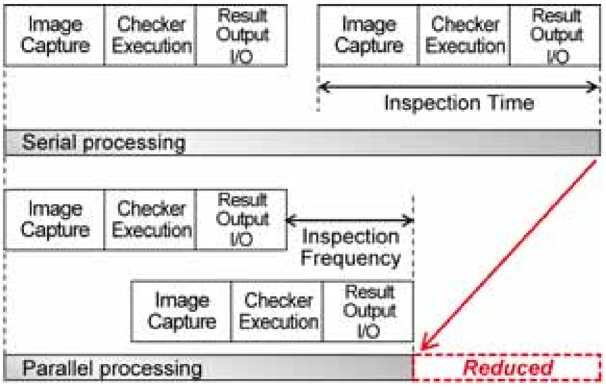
In serial processing, the process from "Image Capture" to "Result Output" in the right figure is regarded as one process. The START signal of the next inspection can be accepted after all those operations are completed.
START signal cannot be input until READY signal turns on.

Parallel processing

Parallel processing is a mode to perform inspections concurrently.

As the next image can be captured after image capturing is complete, the inspection time can be reduced as the right figure.
However, the third image capturing cannot executed until the first inspection result is output.
The third START signal can be input after REND signal turns on.

The screen shows time and cycle of inspection.



1. **Select “System Settings” > "Operation".**

   The setting window of operation is displayed.

2. **Select “Serial” or “Parallel” for “Inspection Process”.**

   Default: Serial

Parallel I/O Reset Condition

This item is to select reset timing of OUT signal when outputting inspection result through Parallel I/O connector and Parallel I/O terminal.

Hold (default):	To hold until outputting the next result. When the first and second inspections turn on OUT0 signal, the signal keeps ON until the third output of inspection result without turning off.
Reset:	All OUT signals turn off when TACT signal turns off.

▼Refer to▼

Refer to Chapter 8.3 “Timing Chart” (page 374) for details.

Inspecting with Internal Trigger (Continuous Inspection)

This method executes inspections repeatedly before receiving START signal from the external device. This is "Continuous Inspection" and helpful to inspect continuously due to a long object. A signal input from the external device can stop repeating inspections. To stop inspections with the keypad, press the TRIG key when inspections are executed repeatedly. Press the TRIG key again to restart inspections repeatedly.

1. **Select "System Settings" > "Operation".**

   The setting window of operation is displayed.

2. **Select whether you inspect repeatedly in "Continuous Inspection".**

No (Once) (default):	Executes an inspection by START signal input.
Automatic: After Trigger:	After PV200 starts up, inputting START signal at the start of the first inspection executes inspections repeatedly.
Automatic: After Power On:	After PV200 starts up, inspection is repeatedly executed soon. START signal input is not necessary.

6.2.3 Setting Default Variable (System Register)

PV200 offers eight value registers. These registers can be used in an expression of numerical calculation, or can be referred for a drawing position or figure size of character/figure drawing.

The values of the registers can be changed by inputting a command through COM interface or Ethernet interface from the external device.

Setting Default Value to Store in Registers

The value can be changed and read from the external device.

1. **Select "System Register" in "System Settings" setting window.**

2. **Select register No. to change the value.**

3. **Specify the value and press the ENTER key.**

   The available values range from -9,999,999.999 to +9,999,999.999.

6.3 Input/output

This function assigns functions of signals input from the external device to PV200, and makes settings on outputting result data and images.

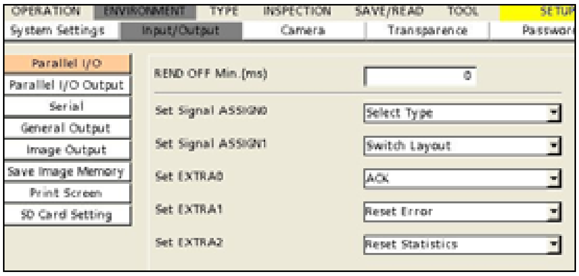
Parallel I/O:	Setting of the minimum OFF time of READ END signal, and assignment of ASSIGN0-1 and EXTRA0-2 signals.	▶ Page 339
Parallel I/O Output:	Setting of outputting inspection results through I/O interface (Selecting the destination and output data, setting output method)	▶ Page 273
Serial:	Setting of communication condition of COM.0 port (transmission format)	▶ Page 338
General output:	Setting of outputting inspection results through COM(serial), Ethernet and SD memory card interface.	▶ Page 279
Image output:	Setting of outputting inspection images to the external device (Selecting the destination and output camera image, setting output method)	▶ Page 282
Save Image Memory:	Setting to save inspection images in the image memory of PV	▶ Page 287
Print Screen:	Selecting a saving place of screen capture	▶ Page 52
SD Card Setting	Setting to allow writing when the cover of the SD card insertion slot is open.	▶ Page 341

Displaying Input/Output Window

1. **Select "ENVIRONMENT" from the menu bar.**

2. **Select "Input/Output".**

   The screen of communication setting is displayed.



REND OFF Min.(ms): 0

Set Signal ASSIGN0: Select Type

Set Signal ASSIGN1: Switch Layout

Set EXTRA0: ACK

Set EXTRA1: Reset Error

Set EXTRA2: Reset Statistics

Selecting Output Timing of General Results and Images

Specify output timing of inspection results (general results) and inspection images to the external devices.

Output Results:

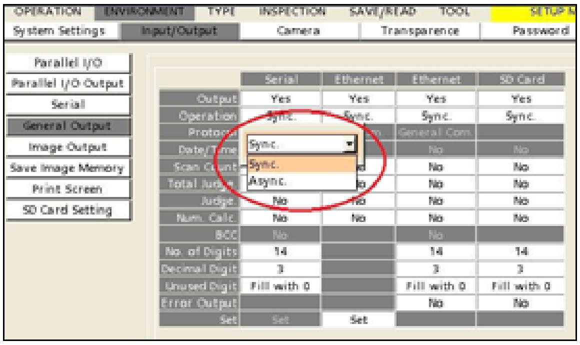
Synchronous:	When outputting all results are completed, an inspection is complete. Because the time of outputting general results is included, its inspection time is longer than Asynchronous processing.
Asynchronous:	An inspection is complete before outputting results, and PV200 completes data output until the next inspection result output. Because the time of outputting general results is NOT included, its inspection time is shorter than Synchronous processing.

Image Output:

Synchronous:	An inspection is complete after image output is completed. Because the time of outputting images is included, its inspection time is longer than the other two options.
Asynchronous (image output first):	An inspection is complete before outputting images, and then PV200 outputs images when it can. When the interval of START signal input (the period between inspection start and the next inspection start) is short, and Image Output is not completed after several inspections, PV200 completes Image Output by delaying the next inspection start.
Asynchronous (inspection first):	An inspection is complete before outputting images, and then PV200 outputs images when it can. When the interval of START signal input (the period between inspection start and the next inspection start) is short, and image output is not completed, PV200 internally stores images up to a certain number as images to be output. If the number of images exceeds the storable capacity, new images cannot be stored in PV200 until enough space for storing is created by outputting the images that have been stored in PV sequentially. Inspections are executed on images that cannot be stored, however, image output is not executed.

1. **Select "Input/Output" > "General Output".**

The setting window of General Output is displayed.
Select a destination.



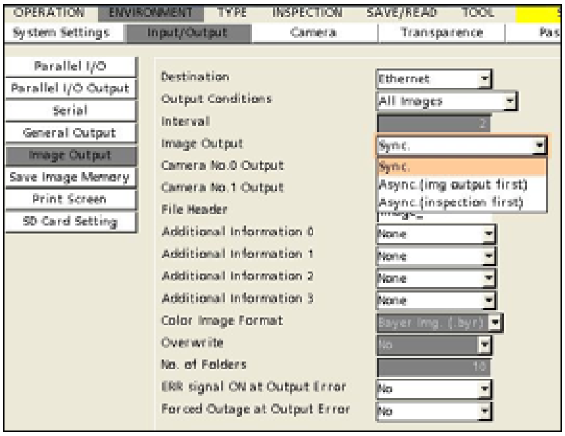
	Serial	Ethernet	Ethernet	SD Card
Output	Yes	Yes	Yes	Yes
Operation	Sync.	Sync.	Sync.	Sync.
Protocol	[illegible]	[illegible]	General Com.	
Date/Time	[illegible]	[illegible]	No	No
Scan Count	[illegible]	[illegible]	No	No
Total Judge	[illegible]	[illegible]	No	No
Judge	No	No	No	No
Num. Calc.	No	No	No	No
BCC	No		No	
No. of Digits	14		14	14
Decimal Digit	3		3	3
Unused Digit	Fill with 0		Fill with 0	Fill with 0
Error Output			No	No
Set	Set	Set		

2. **Specify "Operation".**

Default: Synchronous

3. **Select "Input/Output" > "Image Output".**

The setting window of Image Output is displayed.



Destination: Ethernet
Output Conditions: All images
Interval: 2
Image Output: Sync.
Camera No.0 Output
Camera No.1 Output
File Header: image_
Additional Information 0: None
Additional Information 1: None
Additional Information 2: None
Additional Information 3: None
Color Image Format: Bayer Img. (.byr)
Overwrite: No
No. of Folders: 10
ERR signal ON at Output Error: No
Forced Outage at Output Error: No

4. **Specify "Image Output".**

Default: Synchronous

6.3.1 Changing Setting of I/O Terminals (Parallel I/O)

Set the minimum OFF time of READ END signal and Error signal OFF Timing. And also, assign functions to ASSIGN0-1 and EXTRA0-2 when operating by inputting signals toy/O terminals ASSIGN0-1 and EXTRA0-2 from the external device.

▶ Note

See chapter 8: Operation and Data Output through I/O Terminals, page 359.

1. **Select "Parallel I/O" in the input/output setting window.**

   The parallel setting window is displayed.

2. **Specify “REND OFF Min.”.**

   Settable Range: 0 (default) to 1000
   Set these items when external devices such as a PLC cannot detect signal switch between ON and OFF because the OFF time of READ END signal is too short.

3. **Specify “ERR Signal Off Timing” and “ERR ON Min.(ms)” .**

Auto (default)	Set these items when external devices such as a PLC cannot detect signal switch between OFF and ON because the ON time of ERR signal is too short. The ERR signal is ON until the normal end of the next operation (such as inspection execution or command input) from the occurrence of the error, and then turns OFF. However, if the next operation normally ends before the ERR ON Minimum Time, the ERR signal stays ON for the specified time and then turns OFF. Measuring the ERR minimum time is started when the ERR signal turns ON from OFF, and will not be reset until the ERR signal turns OFF. When an error reset is input from parallel I/O or communication port, the ERR signal turns OFF regardless of the set time of “ERR ON Min.”. ERR ON Min.(ms) Settable Range: 0 (default) to 1000 (ms)
External Input	After the occurrence of an error, the ERR signal stays ON until an error reset is input from the parallel I/O or communication port. The ERR signal does not turn OFF even if the next operation (such as inspection execution or command input) normally ends.

4. **In “Set Signal ASSIGN0” to "Set Signal ASSIGN1" and “Set EXTRA0” to "Set EXTRA2, assign functions as needed.**

   Default assignment setting
   ASSIGN0: Select Type
   ASSIGN1: Switch Layout
   EXTRA0: ACK
   EXTRA1: Reset Error
   EXTRA2: Reset Statistics

   ▶ Note

   Refer to page 365 for details of assignable functions.

5. **After setting is completed, press the CANCEL key.**

6.3.2 Changing Communication Condition of COM port (Serial)

This is a setting of the COM port for RS-232C communication. Specify the setting values to the same as that for the external device to communicate.

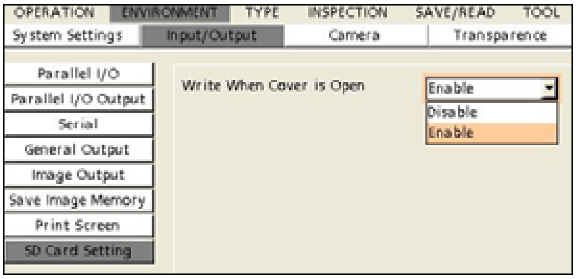
Item	Option	Description
Baud Rate (bps)	1200/ 2400/ 4800/ 9600/ 19200/ 38400/ 57600/ 115200 (Factory default: 9600)	Transmission speed for communication. The higher number the faster communication speed.
Bit Length	7 / 8 (Factory default: 8)	To set the bit number per letter.
Stop Bit	1 / 2 (Factory default: 1)	To set the bit number of the signal that recognizes the end of data.
Parity Check	None/ Odd/ Even (Factory default: Odd)	To set the number of overhead bits to check for proper data transmission.
Flow Control	None/Soft Flow (Factory default: None)	To set how to control the handshake flow.

▶ Note

- When the communication type for "PLC Communication" is set to [Serial], [Default [PLC]] can be selected. By using this function, you can easily change the setting to the default for the selected PLC model.
- When "PLC Type" is set to "Mitsubishi: MELSEC-FX" or "Fuji: MICREX-SX" and "PLC Communication" is selected for the serial protocol, the communication condition is fixed and cannot be changed according to that of the destination PLC.

6.3.3 Enabling to Write in SD Memory Card

Set whether or not to allow writing in a SD memory card if the cover is open when outputting results, images, and saving them, or printing screens.



Write When Cover is Open: Enable

1. **Select "SD Card Setting" in the input/output setting window.**

   The window of SD Card Setting is displayed.

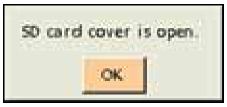
2. **Specify "Write When Cover is Open".**

   Disable: Writing is not available when the cover is open.
   Enable: Writing is available regardless of whether or not the cover is open.

Messages displayed when operating keypad

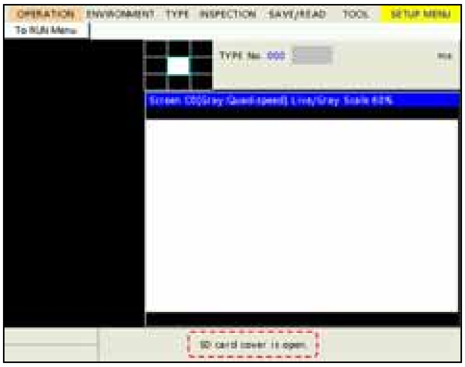
If a writing error occurs when operating with the keypad in SETUP menu and RUN menu, either of two messages shown on the right is displayed on the monitor.

Displayed in the center of monitor



SD card cover is open.

Displayed in the key guide



SD card cover is open.

Error messages in RUN menu

In RUN menu, when writing cannot be executed as the setting of "Write When Cover is Open" is "Disable", either of the following error numbers is displayed.

Those messages are displayed when a signal to write(*) is sent from an external device. When a writing error occurs due to the keypad operation, the above messages are displayed, and the error codes are not displayed.

However, as for general output and image output, the codes are displayed even when an inspection start signal is input with the keypad.

* Input by parallel signals (ASSIGN0-1, EXTRA0-2), communication command input through serial, Ethernet

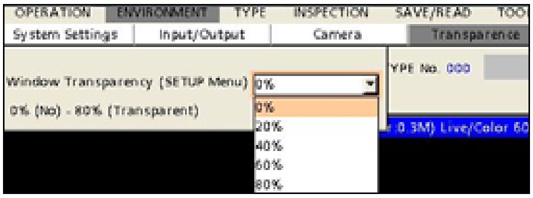
Error No.	Situation when error occurred	Details
0216	When saving setting data (to SD card)	Communication command : %CW
0255	When outputting general result (to SD card)	When selecting SD Card in “ENVIRONMENT” > "Input/Output" > “General Output”, and setting "Error Output" to “Yes”
0255	When outputting image	When selecting SD Card in “ENVIRONMENT” > "Input/Output" > "Image Output", and setting "Error signal ON at Output Error" to “Yes”
0260	When saving images stored in Image Memory of PV into SD card	Communication command : %SS
0265	When printing screen	Communication command : %PS

6.4 Changing Window Transparency

You can change the transparence of the setting window displayed after selecting the submenu. You can recognize a screen window behind the setting window. It is useful to observe an image while making settings.

▶ Note

The procedure for setting transparence described below is for SETUP menu. The transparence in RUN menu needs to be set with the VIEW setting in RUN menu.



1. **Select “ENVIRONMENT” > “Transparence” from the menu bar.**

2. **Select "Window Transparency (SETUP Menu)".**

   Default value is 0%. The larger value, the higher transparence.

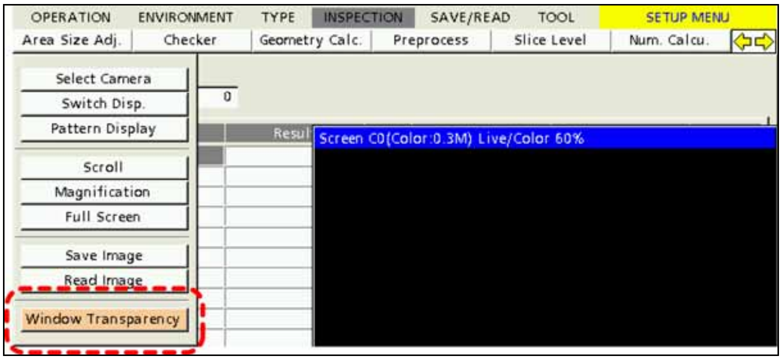
3. **Select desired transparence.**

   Only highlighting a value updates the transparence of the window. Observe it to set.

4. **After setting is completed, press the CANCEL key.**

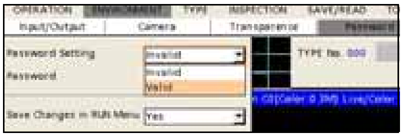
▶ Note

The window transparency (SETUP Menu) can be also changed in the "Image Menu" opened by pressing the F1 key.



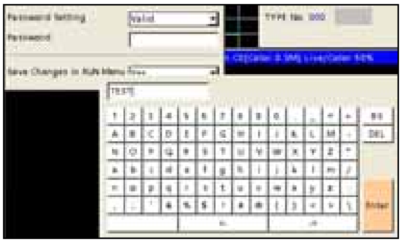
6.5 Protecting the Setting Data Using a Password

This is the function to protect from operational errors. Inputting a password is required when switching from RUN menu to SETUP menu. The function prevents changing the inspection conditions by mistake.



1. Select "Password".

The password setting window is displayed.

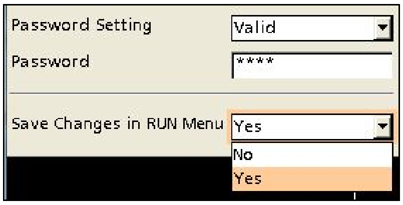


2. Set "Password Setting” to “Valid".

Valid:
Inputting a password is required when switching to SETUP menu.
Invalid (default):
You can switch to SETUP menu without a password.

3. Select “Password” and enter a password with the software keyboard.

Set a password in 15 letters.



Password Setting: Valid
Password: ****
Save Changes in RUN Menu: Yes
No
Yes

4. Select “Yes” or “No” for "Save Changes in RUN Menu".

Some data can be modified in RUN menu where a password is not required. Select whether you permit saving modified data.
Yes (default):
To add [Save Setting Data] menu in [Tool] of RUN menu to save the data also in RUN menu .
No:
Not to display [Save Setting Data] menu under "TOOL" in RUN menu.

Prohibiting the operation from the keypad

The PV200 has "Keypad is invalid" function to disable various operations such as switching the menu to SETUP MENU with the keypad and editing in RUN MENU as a function to protect the PV200 from incorrect operations. When this function has been specified, "Keypad is invalid" is displayed in the key guide space on the window.

Switching the keypad operation between Invalid and Valid is executed with an exclusive communication command. Refer to page 412 for details.

▶ Note

While PV200 is not energized, the information on keypad operation status is saved with the power of the backup battery. To use this function, open the cover on the back and connect the battery with PV200. (Before shipment, the battery and PV200 are not connected.)

Refer to How to attach a backup battery: page 11

6.6 Initializing Environment Settings

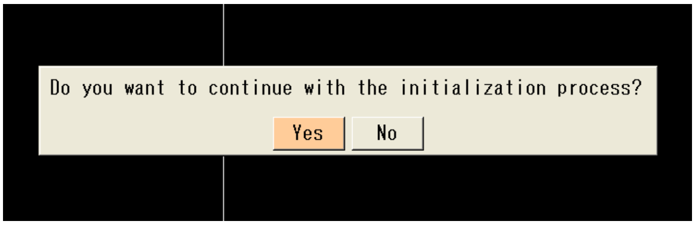
This function initializes the Environment data and restores it to the default settings.

1. **Select “ENVIRONMENT” > “Initialize” from the menu bar.**

The confirmation message appears.

2. **Select “Yes”.**

Environment data are initialized.
If you select “No”, initializing is canceled.



Do you want to continue with the initialization process?

▶ Note

As the information of layouts specified in RUN menu is included in "ENVIRONMENT", it is also initialized by executing "Initialize" of "ENVIRONMENT".

Initializing Environment might shows the message below when “Common” is selected for “Template Registration” in “System Settings” > “Operation”.

Free space for template areas is used up. You cannot change the setting of “Template Registration” to “Per Checker”.

In the case, the settings are initialized except “Template Registration” setting which holds “Common”. Refer to page 133 about the reason why you cannot change to “Per Checker”.

Chapter 7

Changing Configuration (TOOL)

7.1 Overview of TOOL

With “TOOL” in SETUP menu, the following can be performed; settings, information display, and updating of PV200 you use, adjustment support of optical parts and communication test at the introduction. In addition, you can switch the mode to communication with PVWIN200, which is software of setting and simulation for PV series.

PC Communication

This switches the mode to communication with PVWIN200, which is software of setting and simulation for PV200.

General Settings

- Network
  This is necessary setting to perform Ethernet communication.
- Calendar
  It adjusts the calendar in PV200.
  ▶ Note
  Be sure to use this function attaching the backup battery (refer to page 11).
- Language
  This switches between languages of the menus.
- Initialize
  This restores the settings of PV to the default.

SD Property

This is for confirming the property of a SD memory card (such as saved contents or information of a SD memory card).

Eject SD Card

Select this before ejecting a SD memory card from PV.

Information

It displays the version information on your PV200 and memory usage.

Setting Help

This function supports to make setting of optical parts of PV200, to confirm the communication, and its adjustment for introduction.

• Focus Adjustment	To adjust focus of the lens. Rotate the focus ring of the lens following the displayed message.
• Aperture Adjustment	To adjust aperture of the lens. Rotate the aperture ring (iris ring) of the lens following the displayed message.
• Gray Data Analysis	To display the grayscale level of the image in the linear area in a graph form.
• Capture Delay Control	To decide optimum capture conditions by capturing and displaying images while changing the condition for each camera.
• I/O Test	To check the connections of I/O connector and I/O terminal block with the external devices.
• Communication Test	To test the communication with the external devices connected to COM port and Ethernet port.

Update

It performs upgrading of PV200 and customizing the splash screen.

7.2 General Settings

The settings made in “General” are saved in PV200. You cannot backup the data into the storage space in PV200 or a SD memory card.

▶ Caution

As you press the CANCEL key to return to the upper menu hierarchy from “General”, the screen displays a message to save the modified settings. Be sure to select “Yes” to save the data in PV when you modified the settings.

7.2.1 Changing Network Setting

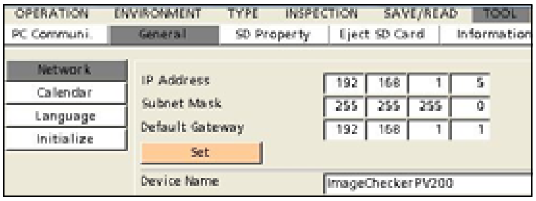
Set a device name and make TCP/IP setting which is necessary to perform Ethernet communication.

▶ Note

The port number of PV200 depends on type of communication data.

- General output: 8601
- Image output: 8602
- Command* communication: 8604 (*See page 404.)

Changing IP address



IP Address 192 168 1 5
Subnet Mask 255 255 255 0
Default Gateway 192 168 1 1
Device Name ImageChecker PV200

1. **Select "TOOL” > “General” from the menu bar.**

2. **Select "Network".**

3. **Change "IP Address”.**

Change the subnet mask and default gateway as necessary.
Default setting
IP Address: 192. 168. 1. 5
Subnet Mask: 255. 255. 255. 0
Default Gateway: 192. 168. 1. 1

4. **After setting is completed, press “Set” button.**

Pressing the CANCEL key before the “Set” button clears the change.

Changing Device Name

1. **Select “Device Name” in “Network” setting window.**

2. **Enter a device name with the software keyboard.**

3. **After inputting is completed, select the ENTER on the keyboard.**

The entered name is displayed.

4. **Press the CANCEL key to close the “General” setting window.**

You do not need to press the “Set” button.

7.2.2 Adjusting Calendar Date

Set the date and time of the built-in clock. The date recorded when outputting data is the date of this calendar.

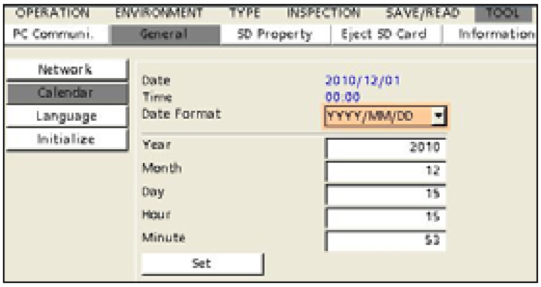
While PV200 is not energized, the information on calendar is saved with the power of the backup battery. To use calendar function, connect the battery inside the battery case lid on the front face with PV200. (Before shipment, the battery and PV200 are not connected.)

▼Refer to▼

For the information of how to attach a battery, refer to page 11.

Adjusting Calendar Date

1. Select "TOOL” > “General” from the menu bar.



Date 2010/12/01
Time 00:00
Date Format YYYY/MM/DD
Year 2010
Month 12
Day 15
Hour 15
Minute 52

2. Select "Calendar".

3. Select “Date Format”.

For example, the date of August 1st in 2010 is displayed as bellow by format.
[YYYY/MM/DD] (default) : 2010/12/01
[MM/DD/YYYY]: 12/01/2010
[DD/MM/YYYY]: 01/12/2010

4. Adjust year, month, day, hour, and minute.

5. After setting is completed, press “Set” button.

The changed date is saved and the adjusted date and time are displayed on the top of the setting window. Pressing the CANCEL key before the “Set” button clears the change.

6. After setting is completed, press the CANCEL key.

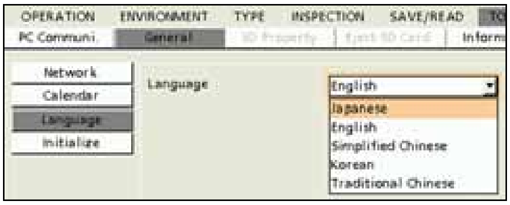
▶ Note

Calendar date can be read and written with communication port.

7.2.3 Switching Language

The displayed language can be switched.

1. Select "TOOL” > “General” from the menu bar.



Language English

2. Select "Language".

Settable languages are displayed.
Japanese
English
Simplified Chinese
Korean
Traditional Chinese

3. Select a language to use.

4. Press the CANCEL key.

When the confirmation message appears, select “OK" to switch the language on the screen.

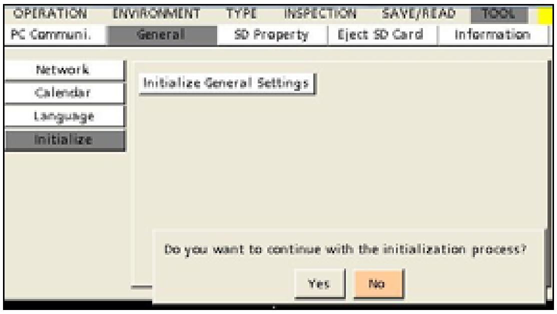
7.2.4 Initializing General Settings

This menu initializes the configuration. The items and their values to be initialized are listed below.

Item		Value after initialization
Startup setting	Start with Memory Area No.:	0
Network	IP Address	192.168.1.5
	Subnet Mask	255.255.255.0
	Default Gateway	192.168.1.1
	Device Name	ImageCheckerPV200

Language and the calendar (date and time) are not initialized.

1. **Select "TOOL" > "General" from the menu bar.**



Do you want to continue with the initialization process?

2. **Select "Initialize" > "Initialize General Settings".**

   The confirmation message appears.

3. **Select "Yes" to initialize it.**

   Initialization is executed. At the moment, the initialized values are saved in PV.

   ▶ Note

   Select "No" to cancel.

4. **Press the CANCEL key twice.**

   The confirmation message appears.
   The initialized values are saved in PV at the time of initialization. You can either "Yes" or "No". (Even if you select "No", the values are not restored.)

   ▶ Note

   When you changed a value of another item after initialization, select "Yes" to save the changed value in PV.

7.3 Information Display and Ejection of SD Memory Card

“SD Property” shows information of a SD memory card when attaching it in the slot.

“Eject SD Card” prepares to eject a SD memory card.

7.3.1 Displaying Information of SD Memory Card

You can confirm the information of a SD memory card attached to the SD memory card slot of PV200.

The information includes capacity and free space of the SD memory card, the saving date of the files, and their size.

1. **Select "TOOL” > “SD Property” from the menu bar.**

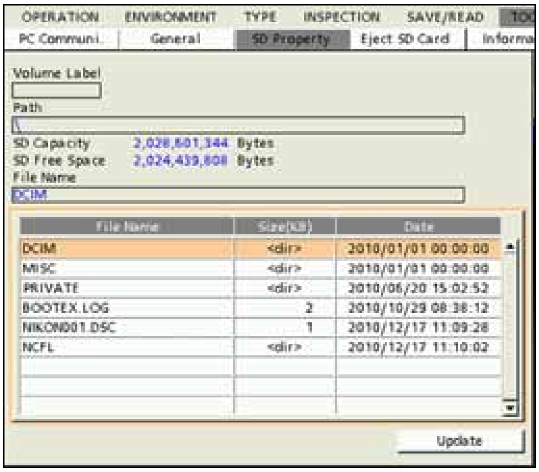
The information is displayed.

2. **Select the file list.**

The files saved in the place are listed.

▶ Note

To go up to the upper hierarchy, select “..”.
A file can be added while the information is displayed. Selecting “Update” shows the latest status.



Volume Label

Path \

SD Capacity 2,028,801,344 Bytes
SD Free Space 2,024,439,808 Bytes

File Name DCIM

File Name	Size(KB)	Date
DCIM	<dir>	2010/01/01 00:00:00
MISC	<dir>	2010/01/01 00:00:00
PRIVATE	<dir>	2010/06/20 15:02:52
BOOTEX.LOG	2	2010/10/29 08:38:12
NIKON001.DSC	1	2010/12/17 11:09:28
NCFL	<dir>	2010/12/17 11:10:02

7.3.2 Preparing to Eject SD Memory Card (Eject SD Card)

If you forcibly eject a SD memory card while the device is accessing its memory, the SD memory card and PV200 might be damaged. Be sure to prepare to eject the card by following the procedure described below before withdrawing it from the slot.

1. **Select "TOOL” > “Eject SD Card” from the menu bar.**

The confirmation message appears.

2. **Select “Yes”.**

When it is ready for ejection, the message saying “The SD card can be ejected safely.” appears. Select “OK".

Now, the preparation to eject the card is complete.
Push the SD memory card into the inserting direction and remove the ejected card from the slot.

7.4 Setting Help

This function supports to make setting of optical parts of PV200, to confirm the communication, and its adjustment for introduction.

Focus Adjustment:	To adjust focus of the lens. Rotate the focus ring of the lens following the displayed message.
Aperture Adjustment:	To adjust aperture of the lens. Rotate the aperture ring (iris ring) of the lens following the displayed message.
Gray Data Analysis:	To display the grayscale level of the image in the linear area in graph form.
Capture Delay Control:	To decide optimum capture conditions by capturing and displaying images while changing the condition for each camera.
I/O Test:	To check the connections of I/O connector and I/O terminal block with the external devices.
Communication Test:	To test the communication with the external devices connected to COM port and Ethernet port.

7.4.1 Adjustment of Focus and Aperture

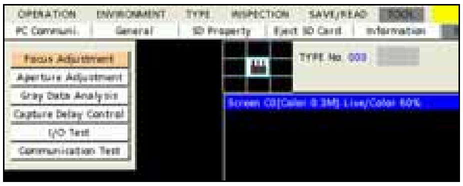
This feature makes it easy to properly adjust the focus and the aperture of the lens.

Focus and aperture can be adjusted by the same procedure.

1. **Adjust the position of the camera to display the inspection object or the object with feature on the monitor screen.**

2. **Select “TOOL” > "Setting Help".**

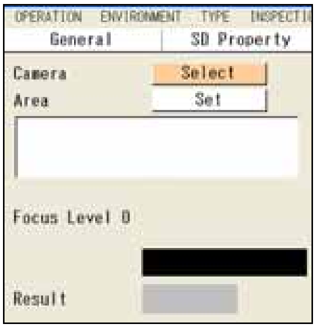
   The Setting Help menu appears.



3. **Select “Focus Adjustment” or “Aperture Adjustment”.**

   The window for focus adjustment (or aperture adjustment) appears.

4. **From “Camera”, select a camera image to adjust focus or aperture.**



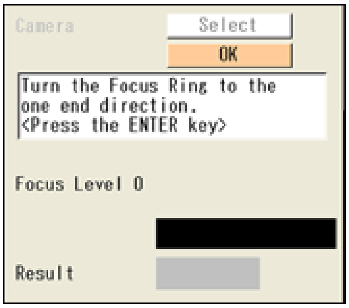
5. **Select “Area” and set an inspection area on a captured object or a position where feature of the object exists.**

   The place where the feature of the object exists is the position where the difference of brightness is observed.

6. **Rotate the focus ring (or aperture ring) of the lens following the displayed message.**

7. **Rotate the ring until “Result” field shows “OK”.**

   A level bar showing consistent percentage is displayed in the “Focus Adjustment Level” area.

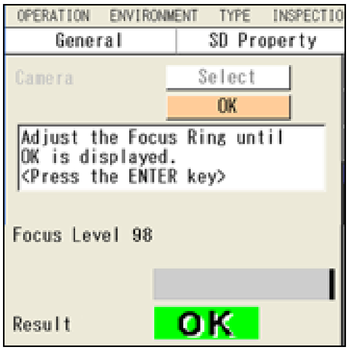


Turn the Focus Ring to the one end direction.
<Press the ENTER key>

Focus Level 0

8. **When “OK” is displayed, stop turning the ring and then press the ENTER key.**

   Now you completed the adjustment.



Adjust the Focus Ring until OK is displayed.
<Press the ENTER key>

Focus Level 98

Result OK

7.4.2 Gray Data Analysis

This function graphs gray values in the pixels on a horizontal or vertical line. You can observe the gray data on a preprocessed or binarized image.

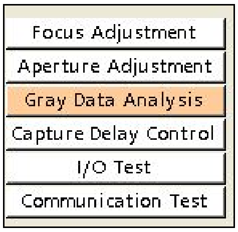
1. **Adjust the position of the camera to display the inspection object or the object with feature on the monitor screen.**

2. **Select “TOOL” > “Setting Help”.**

   The Setting Help menu appears.

3. **Select “Gray Data Analysis”.**

   The Gray Data Analysis window appears.



4. **Select a camera in “Camera”.**

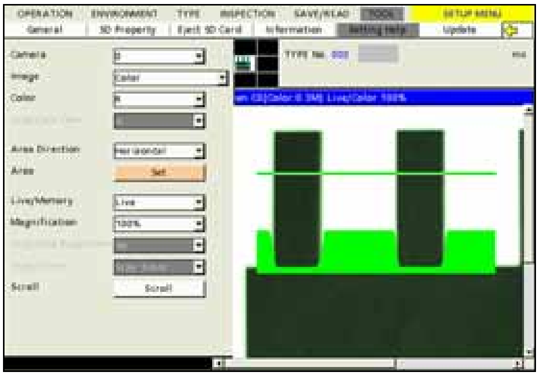
   Make the following setting to analyze an image captured with a color camera.

   - Color (Color/Converted Gray Img.)
   Color: Analyzes grayscale data on either element of R(Red), G(Green) and B(Blue) of a color image. Then, select a color.
   Converted Gray Img.: Analyzes an grayscale image converted from a color image. Then, select a group for grayscale conversion.

5. **Set an area on the position where you want to observe its gray data from "Area" and "Area Direction".**

When you completed the area setting, the graph of gray data appears in green.

The larger green area indicates the brighter pixel (gray value is higher), and the smaller area indicates the darker pixel (gray value is lower).



6. **Change the other items as necessary to change the type or size of the image.**

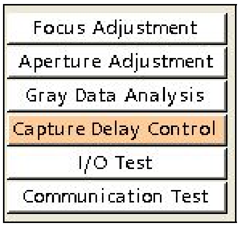
Live/Memory:	To switch the image between Live and Memory.
Magnification:	To change the display size of an image.
Grayscale Preprocess:	To confirm the gray data of a preprocessed image.
Gray/Binary:	To switch between Gray image and Binary image (slice level A-P).
Scroll:	To move the displaying area when the magnification of an image is set to high.

7.4.3 Capture Delay Control

This function helps to decide optimum capture conditions* by capturing and displaying images while changing the conditions for each camera.
*) Shutter speed, Camera gain, Capture delay, FLASH delay, FLASH span

1. **Select “TOOL” > “Setting Help”.**

The Setting Help menu appears.



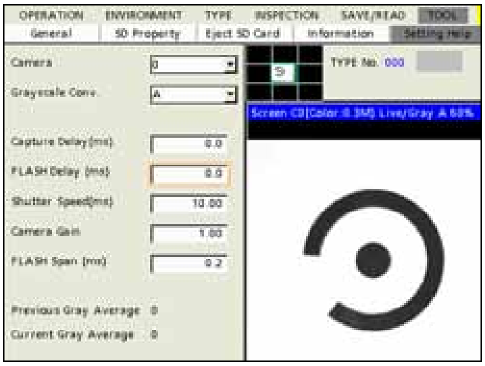
2. **Select “Capture Delay Control”.**

A live image and the capturing conditions appear.

3. **Specify a camera to display on the screen window from “Select Camera.**

4. **Change the capturing conditions.**

An image is captured under the changed conditions and the displayed image is updated.
Then, the setting window shows the gray value of the entire screen.
The current gray average and the previous gray average are displayed.



Camera 0
Grayscale Conv. A
TYPE No. 000
Screen C0[Color 0.3M] Live/Gray A 60%
Capture Delay(ms) 0.0
FLASH Delay (ms) 0.0
Shutter Speed(ms) 10.00
Camera Gain 1.00
FLASH Span (ms) 0.2
Previous Gray Average 0
Current Gray Average 0

5. **When you decide the optimum capturing conditions, enter the values in “Camera Gain”.**

▶ Note

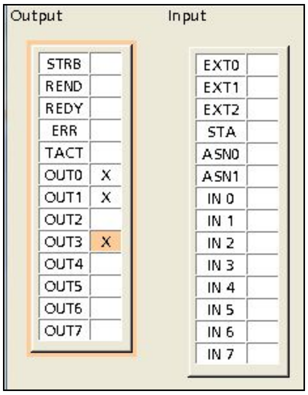
To set values in “Camera”, select “TYPE” > “Type Setting”.

7.4.4 I/O Test

This function checks the connections by forcibly outputting signals and monitoring input signal of the I/O terminal or I/O connector.

1. **Select “TOOL” -> “Setting Help”.**

The Setting Help menu appears.



Output		Input	
STRB		EXT0	
REND		EXT1	
REDY		EXT2	
ERR		STA	
TACT		ASN0	
OUT0	X	ASN1	
OUT1	X	IN 0	
OUT2		IN 1	
OUT3	X	IN 2	
OUT4		IN 3	
OUT5		IN 4	
OUT6		IN 5	
OUT7		IN 6	
		IN 7	

2. **Select “I/O Test”.**

The list of output signals and input signals (from the external device) of PV200 is displayed.

3. **Select a signal to carry out an output test.**

In the cell of the signal you selected, “X” is displayed. This symbol indicates that the specified signal is ON.

4. **Check the signal you turned on is input correctly from the external device.**

5. **Input a signal from the external device to PV200**

In the cell of the signal you input, “X” is displayed in the same way as the output signals.

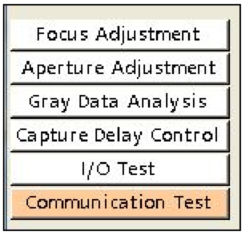
▶ Note

After processing output test, closing the I/O test window while the signals are turned on turns off the signals.

7.4.5 Communication Test

This function tests the communication with the external devices connected to COM port and Ethernet port.

Selecting a Port



1. **Select “TOOL” > “Setting Help”.**

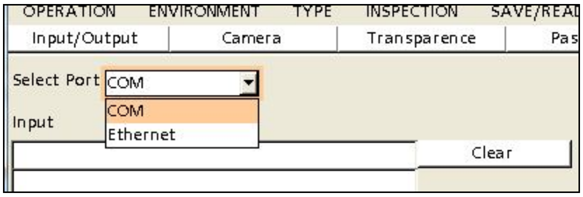
   The Setting Help menu appears.

2. **Select “Communication Test”.**

   The Communication Test window appears.

3. **Select a port to carry out communication test in “Select Port”.**

   After you select a port, PV200 can receive commands from the external device.



Select Port: COM

Receive and Send Test of Command

1. **Select a port in the Communication test window and send a command from the external device.**

   The received command is displayed in “Input” field. To clear “Input” field, press the “Clear” button.

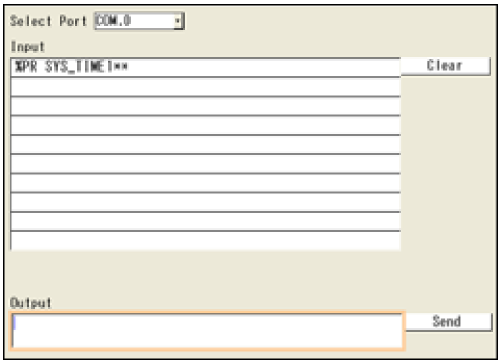
2. **Tilt the ENTER key up/down to select “Output”.**

   A software keyboard is displayed.

3. **Enter characters, such as response to a command and output data, to output to the external device.**

4. **Tilt the ENTER key up/down to select “Send”.**

   The entered characters are sent to the external device from the specified port. Check if the device receives them correctly.



Select Port: COM.0

Input: %PR SYS_TIME1**

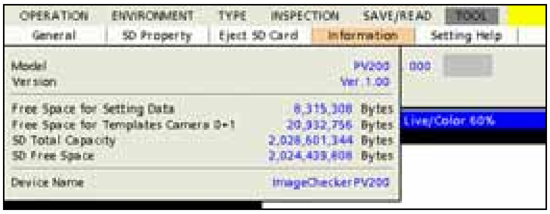
7.5 Information Display and Updating of PV200

7.5.1 Displaying PV Information

It displays the version information of your PV200 and memory usage.

1. **Select "TOOL" > "Information" from the menu bar.**

   The information of PV200 is displayed.



Model PV200
Version Ver 1.00
Free Space for Setting Data 8,315,308 Bytes
Free Space for Templates Camera 0+1 20,332,756 Bytes
SD Total Capacity 2,028,601,344 Bytes
SD Free Space 2,024,439,808 Bytes
Device Name ImageCheckerPV200

Model	PV200 (fixed)
Version	Version of PV200 you are using
Free Space for Setting Data	Free space in the memory for setting data which sets up to 256 product types. (except the memory for template)
Free Space for Templates Camera 0+1	Free space in the memory for template of Matching checker created for Camera 0 and Camera 1.
SD Total Capacity	This is displayed only when a SD memory card is attached.
SD Free Space	
Device Name	"ImageCheckerPV200" This can be changed. Refer to page 347 on how to change it.

7.5.2 Version Upgrading of PV200

By using the file we provide, you can upgrade your PV200. Upgrading requires a SD memory card.

Preparing a Version Upgrade File

1. **Obtain a version upgrade file.**

   Download the file for upgrading from our website.

2. **Decompress the downloaded ZIP file.**

3. **Prepare a SD memory card and save the decompressed version-upgrade file (*.PRG) in the path below.**

   Drive: /Panasonic-EW SUNX Vision/PV200/Update/

4. **Attach the SD memory card of the step 3 to the PV200 you want to upgrade.**

Now you completed the preparation of the version upgrade file.

Version Upgrading

1. **Select "TOOL” > “Update” from the menu bar.**

   Update window is displayed.

2. **Select "Firmware".**

   The list of the version upgrade files saved in the SD memory card is displayed.

   ▶ Note

   If the file list is not displayed, check the following conditions.
   - The SD memory card is attached correctly?
   - The version upgrade files are saved in the correct place?

3. **Select a desired version upgrade file.**

   When the confirmation message appears, select “Yes” to start upgrading.
   Selecting “No” cancels upgrading and the screen returns to the previous one.

   ▶ Caution

   Do not turn off the power of PV200 during the upgrading. If you turn off the power during the upgrading, the system might be damaged and might not be able to start or function correctly.

4. **Reboot the PV200 following the displayed message after the operation is complete.**

7.5.3 Customizing Splash Screen (Update)

A splash screen of PV200 is the blue screen showing the product name and the version at startup. The screen can be changed to another one. Changing the screen requires a SD memory card.

Preparing a File

1. **Prepare an image to display as a splash screen.**

Modify and save the image file to meet the following conditions.
- 24-bit bitmap file
- Image size: Max. 640 (w) x 480 (h) pixels

2. **Prepare a SD memory card and save the image to display as “Logo.bmp” in the path below.**

Drive: /Panasonic-EW SUNX Vision/PV200/Logo

3. **Attach the SD memory card of the step 2 to the PV200.**

Now you completed the preparation of the image file to use for a splash screen.

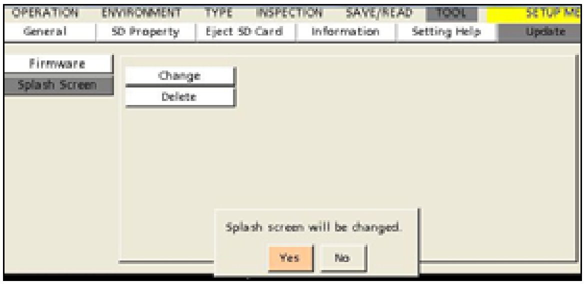
Changing Splash Screen

1. **Select "TOOL” > “Update” from the menu bar.**

Update window is displayed.

2. **Select “Splash Screen” > “Change”.**

When the confirming message appears, select “Yes” to execute the change. After the change is completed, a message is displayed.



Splash screen will be changed.

▶ Note

If you cannot change it, the following can be considered as reasons. Check the conditions.
- A nonqualified file is saved. (A different file format or too large file size.)
- The file is saved in the wrong place.
- The file name is not “Logo.bmp”.
- A SD memory card is not available.

3. **As the message appears telling that the change is completed, select “OK”.**

The changed splash screen will be displayed after the next startup.

Initializing Splash Screen

Delete the custom splash screen and replace it with the original image.

1. **Select “Splash Screen” in “Update” window.**

2. **Select "Delete".**

When the confirmation message appears, select “Yes” to start initializing.

3. **As the message appears telling that the process is completed, select “OK”.**

The initial splash screen will be displayed after the next startup.

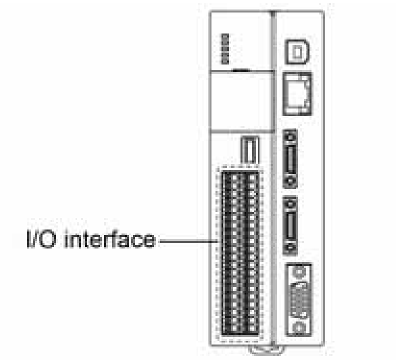
Chapter 8

Operation and Data Output through I/O Terminals

8.1 Main Items that can be Communicated through I/O Interface

PV200 is provided with I/O interface as below.

- Input: 14 pins
- Output: 15 pins



Input

The operations shown in the table below can be executed by input from the external devices.

		Terminal Block	Command*3
Execute inspection		STRT	%S
Execute reinspection		(ASN, EXT)*1	%R
Execute type switch		(ASN, EXT)+IN0-7*1	%X
Set template		(ASN, EXT)+IN0-7*1	%A
Switch layout		(ASN, EXT)+IN0-3*1	%I
Switch between RUN/STOP		(ASN, EXT)*1	%RM
Reset statistics data		(ASN, EXT)*1	%Q
Reset error signal		(ASN, EXT)*1	%E
Save setting data	Storage Space in PV200	(ASN, EXT)*1	%MW
	SD memory card	(ASN, EXT)+IN0-6*1	%CW
Read setting data	Storage Space in PV200	(ASN, EXT)*1	%MR
	SD memory card	(ASN, EXT)+IN0-6*1	%CR
Abort Save/read Setting Data		(ASN, EXT)*1	%CD
Operate image memory of PV	Save in a SD memory card (backup)	(ASN, EXT)*1	%SS
	Delete	(ASN, EXT)*1	%SR
Print screen		(ASN, EXT)*1	%PS
Save the latest inspection image in a SD memory card or PC etc. through Ethernet		(ASN, EXT)*1	---
Abort inspection/process		(ASN, EXT)*1	%CC

*1: Up to five functions are available because five points of ASN0 to 1 and EXT0 to 2 are assigned functions.
*2: Command to control with interface of RS-232C and Ethernet. Refer to page 404 for details.

Output

	Terminal Block
Scan Count	OUT0-7
Judgement (JDC)	OUT0-7
Numerical calculation result	OUT0-7

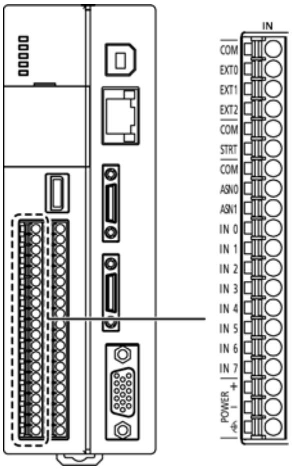
▶ Note To set whether to output or not, select “ENVIRONMENT” > “Input/Output” > “Parallel I/O Output”.

8.2 Specification of I/O Interface

8.2.1 I/O Connector

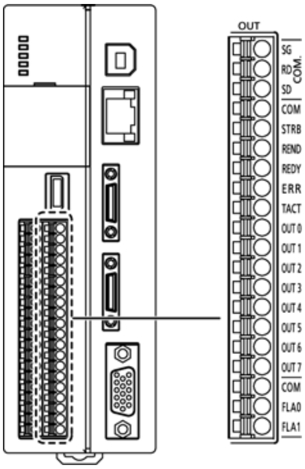
Pin Arrangement

Input



No.	Signal	Name	Description
1	COM	EXTRA COMMON	Common for Extra
2	EXT0	EXTRA0	Function assignment 0-2 (select from 18 functions)
3	EXT1	EXTRA1	
4	EXT2	EXTRA2	
5	COM	START COMMON	Common for START
6	STRT	START	Execute inspection
7	COM	IN COMMON	Common for Input
8	ASN0	ASSIGN0	Function assignment 0-1 (select from 18 functions)
9	ASN1	ASSIGN1	
10	IN0	IN0	Input data 0-7
11	IN1	IN1	
12	IN2	IN2	
13	IN3	IN3	
14	IN4	IN4	
15	IN5	IN5	
16	IN6	IN6	
17	IN7	IN7	
18	24V+		24V power input
19	0V		
20	F.G.		

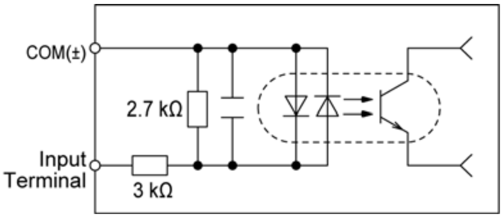
Output



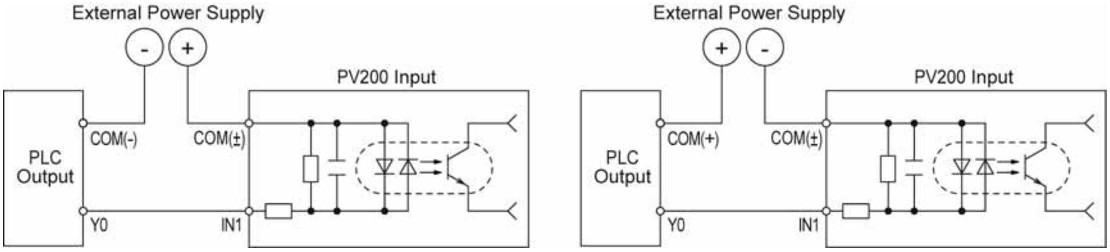
No.	Signal	Name	Description
1	GND (SG)	SG	RS232C
2	RD	RD (Rxd)	
3	SD	SD (Txd)	
4	COM	OUT COMMON	Common for output
5	STRB	STROB	Data output complete
6	REND	REND	Image capture with Camera complete
7	REDY	READY	Ready completion signal
8	ERR	ERROR	Error signal
9	TACT	TACT	Timing of reading inspection data
10	OUT0	OUT0	Output data 0-7
11	OUT1	OUT1	
12	OUT2	OUT2	
13	OUT3	OUT3	
14	OUT4	OUT4	
15	OUT5	OUT5	
16	OUT6	OUT6	
17	OUT7	OUT7	
18	COM	FLASH COMMON	Common for Flash
19	FLA0	FLASH0	Camera 0 Flash
20	FLA1	FLASH1	Camera 1 Flash

Input Circuit

Circuit Diagram



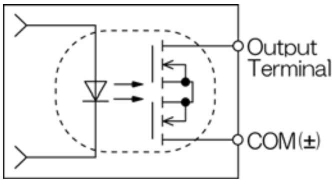
Connection Example



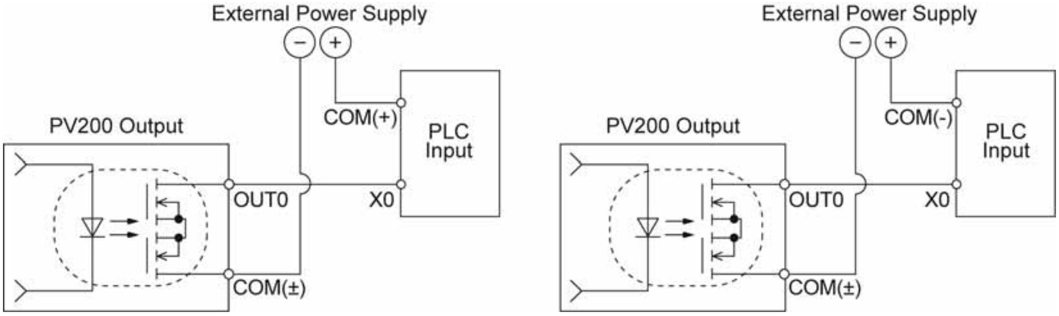
Rated input voltage: 24 V DC
Voltage range: 21.6 to 26.4 V DC
Appropriate wire size: AWG#24 to 16, 0.2 to 1.5 mm2
Uncovered wire length: 10 mm

Output Circuit

Circuit Diagram



Connection Example



Output load voltage: 5 to 24 V DC
Output circuit: PhotoMos output
Maximum load current: 24 mA/ terminal
Appropriate wire size: AWG#24 to 16, 0.2 to 1.5 mm2
Uncovered wire length: 10 mm

Wiring with Terminal Block

▶ Caution

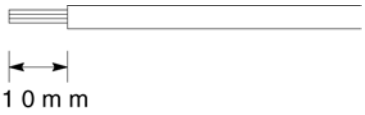
Be sure to cut the power of PV200 before wiring. Wiring while the power is supplied might cause damage of PV200 and the connecting external device.

About Terminal Block Socket

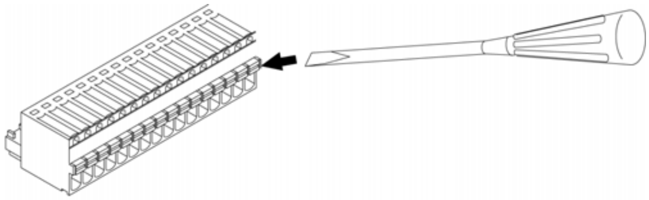
Terminal block socket (included):	Manufactured by PHOENIX CONTACT Model number: FMC1.5 / 20-ST-3.5
Applicable size of wire:	AWG#24 - 16, 0.2 - 1.5 mm^2

How to Wire

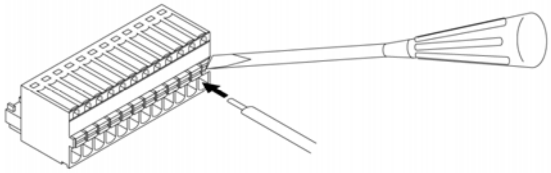
1. **Remove the wire shield.**



2. **Push the orange part into the socket with a slotted screwdriver.**

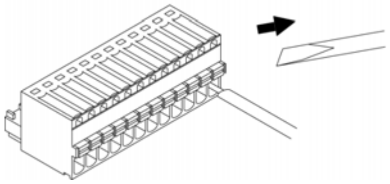


3. **Insert the lead wire all the way into it pressing the orange part.**



4. **Release the screw driver.**

The lead wire is connected.
Connect the lead wire with the pins as necessary.



5. **After wiring is complete, attach it to the I/O terminal block.**

8.2.2 Main Function of Signals

Input Signal

START (STRT): Inspection Start Signal

This is start signal of an inspection. Inputting this signal starts capturing an image.

ASSIGN0 - 1 (ASN0-1), EXTRA0 - 2 (EXT0-2) : Function Assignment

The functions shown in the table below can be performed by a signal from the external device.
To assign a function to ASSIGN and EXTRA signals, select “ENVIRONMENT” > “Input/Output” > “Parallel I/O” in SETUP menu.

Select Type:	Use this signal to switch product types by a signal from the external device. Inputting the type number (0 - 255) to switch to “IN0 - 7”and inputting a Select Type signal executes switching types.
Switch Layout:	Use this signal to switch layouts displayed on the monitor by a signal from the external device in RUN menu.
ACK:	Use this signal with output STROB signal (which is a data output completion signal during handshake) when outputting result data output from OUT0 - 7 to the external device while performing handshake. During handshake, PV200 turn on STROB signal after outputting data. The external device receives data at rising edge of STROB ON signal. Turn on Reception completion signal after reception is complete. PV200 receives the reception completion signal with ACK terminal.
Reset Error:	Turns off ERROR.
Reset Statistics:	Input this to clear the statistics data and scan count.
Template Setting:	Use this signal to update the template (base image) of Matching checkers by inputting signals from the external device. Specifying a checker number (0 - 31) to set for "IN0 - 4" and a template number (0 - 7) for "IN5 - 7", and inputting the template setting signal executes template setting. ▶ Note When executing template setting through I/O interface, the allowable range of checker numbers is 0 to 31, the range of template numbers is 0 to 7. When setting "Template Registration" to "Common" and using Common template, the procedure of template setting is the same as the above. However, executing template setting requires attention because the template image is overwritten automatically when a Smart Matching checker in another product type uses the same template due to common template for all types.
Switch Run/Stop:	Use this signal to switch between Run and Stop of PV200 by a signal from the external device. The status change of signal from OFF to ON (or rising edge of the signal) switches between RUN and STOP.
Save Data in PV:	All product type data currently registered in “execution memory” will be saved in “memory for store” of PV.
Save Data in SD:	All product type data currently registered in “execution memory” will be saved in a SD memory card. Input a data save signal to the SD memory card after specifying an area number (0 - 99) with "IN0 - IN6".
Read Data from PV:	The setting data registered in the storage space in PV200 will be called up to “execution memory”.
Read Data from SD:	The setting data registered in a SD memory card will be called up to “execution memory” of PV. Input a data read signal from the SD memory card after specifying an area number (0 - 99) with "IN0 - IN6".

Reinspect:	Input this to reinspect without capturing an image. Enter a block number (0 - 9) to execute with “IN0 - IN3”.
Save Image Memory in SD:	Backs up all images saved in the image memory to a SD memory card. Creates a folder named one of "00" to "99" which does not exist in "Panasonic-EW SUNX Vision/PV200/Image/Backup" in a SD memory card and saves images in the folder.
Output Latest Image:	Outputs the latest inspection image. The destination (SD memory card or PC connected with Ethernet cable) and the file name can be set from “ENVIRONMENT” > "Input/Output" > "Image Output" menu. ▶ Note • In “ENVIRONMENT” > "Input/Output" > "Image Output", set "Output Conditions" to "Command Reception". • Image Receiver needs to be activated on the destination PC when "Destination" is set to "Ethernet". • ERR signal is output if an output errror occurs when "ERR signal ON at Output Error" is set to “Yes” for outputting images through Ethernet interface.
Clear Image Memory:	All image data registered in the Storage Space in PV200 will be cleared.
Print Screen:	The currently displayed screen (entire contents the monitor displaying) will be captured and saved in a SD memory card or a PC through Ethernet. You can specify destination from “ENVIRONMENT” > “Input/Output” > “Print Screen”.
Abort Inspection/Process	Cancels the following active operations, and restores into the previous status before the operation. • Cancellation of the operation of a serial command which has been received • Abort of output in the status waiting for result output after an inspection is complete • Abort of image saving from Image Memory to a SD memory card • Cancellation of template re-registration
Abort Save/read Setting Data	Cancels saving or reading the setting data.
Read PLC Communication Command (Available from Ver1.2)	Reads commands through PLC communication. When "Command Read Type" is not set to "Parallel Input" in "ENVIRONMENT" > "Input/Output" > "PLC Communication", the ERR signal is output by the input of "Read PLC communication command" signal.

List of acceptable input signals

The items that can be input from an external device vary depending on the used operation mode. Also, some items can be accepted even when READY signal is off.

Yes:Acceptable
No:Not acceptable

OPERATION MODE	**RUN**		**STOP**
READY	**ON**	**OFF**	**OFF**
Execute Inspection	Yes	No	No
Select Type	Yes	No	No
Switch Layout	Yes	Yes	No
Reset Error	Yes	Yes	Yes
Reset Statistics	Yes	Yes	No
Template Setting	Yes	No	No
Switch Run/Stop	Yes	Yes	Yes*
Save Data in PV	Yes	No	No
Save Data in SD	Yes	No	No
Read Data from PV	Yes	No	No
Read Data from SD	Yes	No	No
Reinspect	Yes	No	No
Save Image Memory in SD	Yes	No	No
Output Latest Image	Yes	Yes	No
Clear Image Memory	Yes	Yes	No
Print Screen	Yes	Yes	Yes
Abort Inspection/Process	Yes	Yes	No
Abort Save/read Setting Data	Yes	Yes	No

*** Not acceptable in SETUP Menu.**

IN0 - 7: Input data

These are signals to input the values for switching type, reading/saving setting data when you execute the functions. Specify values in binary data as follows.

Example 1) Specifying No.6

IN7	**IN6**	**IN5**	**IN4**	**IN3**	**IN2**	**IN1**	**IN0**
0	**0**	**0**	**0**	**0**	**1**	**1**	**0**

Example 2) Specifying No.237

IN7	**IN6**	**IN5**	**IN4**	**IN3**	**IN2**	**IN1**	**IN0**
1	**1**	**1**	**0**	**1**	**1**	**0**	**1**

Output Signal

READY (REDY): Inspection start ready completion signal

Use this as condition signal to input START signal when inspecting in “Serial” mode as inspection process mode. READY signal turns on when PV can receive START signal and turns off when it starts capturing an image.

Use “REND” signal as ready completion signal to inspect in “Parallel” mode.

REND: Image capture completion signal

Use this as condition signal to input START signal when inspecting in “Parallel” mode as inspection process. Receiving a START signal for inspection, REND signal turns off when capturing an image and turns on after capturing is complete.

FLASH 0 - 1: Flash synchronization signal

The signals of FLASH0 – FLASH1 correspond to CAMERA0 – CAMERA1 respectively.
When the specified time of FLASH delay passes after START signal turns on, FLASH signal is output in the specified length. Whether turning on FLASH signal or turns off at the time of output, you can select for every FLASH signal from ENVIRONMENT > “Camera” > “FLASH Polarity”. This setting is common to all product types.

▶ Note

Delay time and output width of FLASH signal can be set for each product type and each FLASH signal from “TYPE” > “Type Setting” > “Camera” in SETUP menu.

TACT (TACT): Result read timing

The signal turns on when outputting the data using OUT 0 - 7 at the timing of output.
It turns on when PV starts outputting a result, and turns off after set “Output signal guarantee time” passes.
Obtain a result with the external device at rising edge of TACT signal.
When data is output in multiple times, perform handshake with STROB signal described below.

▶ Note

- To set Inspection Process, Serial or Parallel, select as follow.
  SETUP menu > “ENVIRONMENT” > “System Settings” > "Operation" > “Inspection Process”
- To set image capturing trigger, Common or Individual, select as follow.
  “SETUP menu” > “TYPE” > “Type Setting” > “Camera” > “Camera Trigger”
- To set “Output signal guarantee time”, select “ENVIRONMENT” > “Input/Output” > “Parallel I/O Output”.

STROB: Read timing

Use this signal to output result data with OUT 0 - 7 to the external device in multiple times or re-register templates.
Each time result data is output, STROB signal turns on.

Result read timing when Handshaking is employed:
Use the signal with ACK signal for input (assigned to ASSIGN or EXTRA terminals) in pairs.
PV200 turn on STROB signal after outputting data. The external device receives data at rising edge of STROB ON signal. Turn on Reception completion signal after reception is complete. PV200 receives the reception completion signal with ACK terminal (assigned to ASSIGN or EXTRA terminals).

Inspection data read timing when Handshaking is not employed (When "Data Output" is "All Selectable"):
Inspection data are output at intervals of set “Output signal guarantee time”. STROB signal turns on each time outputting the data.
Receive data with the external device after rising edge of STROB ON signal and in the output signal guarantee time.
When "Output Data" is set to "Once, Judgement(8 bit)", STROB signal does not turn on.

▶ Note

To set “Output signal guarantee time”, select “ENVIRONMENT” > “Input/Output” > “Parallel I/O Output”.
To set “Output Data", select “ENVIRONMENT” > “Input/Output” > “Parallel I/O Output” > "Output Data".

Re-registration area display timing when template is re-registered:
STROB signal turns on after displaying the re-registered area in Template Setting. Input a template setting signal and register a template with the external device after rising edge of STROB ON signal.

ERROR (ERR): Error in executing an inspection, outputting a result or command error

About ERR signal
Some functions do not output ERR signals.

	Terminal Block	**Command**	**Existence of ERR signal** **A: ERR is available** **N/A: ERR is not available**
Execute Inspection	STRT	%S	A
Select Type	ASN･EXT	%X	A
Switch Layout	ASN･EXT	%I	A
Reset Error	ASN･EXT	%E	N/A
Reset Statistics	ASN･EXT	%Q	N/A
Template Setting	ASN･EXT	%A	A
Switch Run/Stop	ASN･EXT	%RM	A
Save Data in PV	ASN･EXT	%MW	A
Save Data in SD	ASN･EXT	%CW	A
Read Data from PV	ASN･EXT	%MR	A
Read Data from SD	ASN･EXT	%CR	A
Reinspect	ASN･EXT	%R	A
Save Image Memory in SD	ASN･EXT	%SS	A
Output Latest Image	ASN･EXT	-	A
Clear Image Memory	ASN･EXT	%SR	N/A
Print Screen	ASN･EXT	%PS	A
Abort Inspection/Process	ASN･EXT	%CC	N/A
Abort Save/read Setting Data	ASN･EXT	%CD	A
Key emulating	-	%K	N/A
Keypad operation (Command prohibiting/permitting keypad operation)	-	%BS	A
Keypad operation (Command checking the status of keypad operation)	-	%BC	N/A
Parameter (Read)	-	%PR	A
Parameter (Read pairs)	-	%PRP	A
Parameter (Change)	-	%PW	A
Parameter (Change pairs)	-	%PWP	A

When a error occurs and ERR signal turns on while waiting for a detect trigger, the waiting state is cancelled.
While the error signal is ON, inputting the signals again operates correctly and turns off the error signal. Also, ERR signal can be reset forcibly by inputting an error reset signal assigned to one of ASSIGN0 to 1 and EXT0 to 2, or by inputting the designated command.

8.2.3 Cause of Turning On ERROR Signal

Turning on the signal of ERROR indicates that processes such as executed inspection or type switching have not completed correctly.

Check if PV200 makes the causes of turning on the error signals. And then, to prevent those causes, adjust the settings of PV200 or recheck the signal and the command that the external device sends to PV200.

Cause of Turning on ERROR Signal

ERROR 0 signal turns on when an error occurs while the device executes an inspection or template setting.

Cause	Error Code	Solution, etc
The following errors when sending a command to PV200. • BCC (Block check code) error • An undefined command was sent. (including the case of sending a part of command such as only delimiter(CR))	E0100	
Command receive buffer overflow of PV200	E0110	Decrease commands to send to PV200.
Communication error (communication timeout or sum check error) occurred during PLC communication.	E0111	Connect and set correctly.
Parallel Handshake Timeout occurred. (No ACK signal indicating that the external device has received data was input to PV200 within the Timeout.)	E0112	Input ACK signal within Handshake Timeout.
When "Parallel Input" has not been selected for "Command Read Type", the "Read PLC Communication Command" signal was input.	E0114	Select "Parallel Input".
Values exceeded the following ranges during calculation. Effective range of values during calculation = -2147483648 to +2147483647 (- 2^{31} to (2^{31} – 1))	E0151	Check the expression of Numerical Calculation or Judgement which shows “E” sign in the Checker List.
Denominator became “0” in the division that is specified as a numeric calculation.	E0152	
Any item that does not exist is referred to the Numeric calculation, Judgement. (If the referred item is deleted although it existed when it was set.)	E0153	
Position adjustment for a detect trigger is unset or a base position is unset when you use “Detect Trigger (common)”.	E0160	Register a Position Adjustment for the detect trigger.
While PV200 stops the operation, a command to execute one of the following is sent.		
• Start executing an inspection • Execute template setting of Smart Matching Type switch • Select type • Save the setting data (in the storage space in PV or a SD memory card) • Read the setting data (from the storage space in PV or a SD memory card) • Save images saved in the save image memory to a SD memory card • Clear the save image memory • Print screen • Reset statistics • Layout change • Read or write parameters	E0200	Operate (run) PV200 and execute again.
The command specifying a block number was sent when setting execution mode to “Execute All” or “Automatic Switch”.	E0201	Send an inspection start command which specifies no block number.
The inspection start command specifying no block number was sent when setting execution mode to "User Defined".	E0202	Specify block numbers correctly.

Cause	Error Code	Solution, etc
Image capturing error occurred. • No camera is connected. • Disconnection of the camera cable, loose connection of the camera connector. • No image exists in Inspection image memory when executing reinspection (without capturing any image after PV starting up) • Both two cameras of PV200 are set to "Unused".	E0203	Connect and set correctly. If the error reoccurs, try the following procedures. • Cut the power and reconnect the camera cable. • Replace the cable.
During continuous inspection, the signal to execute "Reinspection" is input or the command is sent.	E0204	You cannot reinspect during continuous inspection.
Although a command (except PIO) to be activated by checking that the READY signal is on was requested, it was not accepted more than one second because the READY signal was off (e.g. Detect trigger or Continuous inspection start was processing, or setting data was being saved to the PV).	E0205	
The inspection command was sent while reading setting data in continuous inspections.	E0206	
• The specified product number does not exist. • Other number than 000-255 was specified for a product number.	E0210	Specify a type number correctly.
Other number than 00-99 was specified as an area number when saving or reading setting data to or from PV or a SD memory card.	E0212	
When reading setting data from a SD memory card;		
• No SD memory card is attached or cannot be accessed. • No data file in the designated area of a SD memory card.	E0213	Check attachment of the SD memory card or presence of data file.
• The data file is not data of PV200. • The data file is incompatible. (Data of the later version, etc.) • The number and types of cameras connected to PV200 is different from the Camera setting of the data file. (Example: Camera was disconnected unexpectedly.)	E0214	Prepare a correct data file.
When saving setting data in a SD memory card; • No SD memory card is attached, the card cannot be accessed, or used up its capacity. • The SD memory card is write-protected. • The file with the specified storage number already exists, and the property of the file is "Read-only". • "Write When Cover is Open" is set to "Disable", and the cover is open.	E0216	Correctly attach a SD memory card which is writable and has enough free space.
When aborting save/read setting data, • The command to abort is sent other than when saving/reading setting data. • Aborting failed.	E0217	
When you make Template setting with the following conditions;		
• It was executed when Detect trigger was processing or Continuous Inspection was used.	E0230	Stop Detect trigger and Continuous Inspection, and then execute Template setting.
• It was executed during parallel I/O output when setting "Area Display" to “Yes”.		Execute Template setting after the completion of parallel I/O output.
• While “Area Display” is set to “Yes”, the command for Send 2 (%A) was sent when Send 1 was supposed to. • While “Area Display” is set to “Yes”, the command for Send 1 (%Accc,??) was sent when Send 2 was supposed to. • While "Area Display" is set to "No", the command "%A" was sent.		Enter a command correctly.
• The specified number of checker or template is not create. • Any other number than 0-999 for checker number, or 0-63 for template was specified. (for serial command)	E0231	Specify a correct checker number or template number.

Cause	Error Code	Solution, etc
• Template cannot be set because no image has been captured after PV200 started up when you select “Use the Last Image” for “Template Setting.	E0232	Execute an inspection, or change the setting to “Capture New Image” to execute Template setting.
• No feature on the image of template registration area. • An error occurs in Position adjustment when you use it.	E0233	Che.ck the captured image.
• Template registration area is outside of the captured image (image partially captured when executing partial imaging).		Adjust the whole registration area to be in the range of the captured image.
When switching between Run and Stop;		
• Specification of the parameter is wrong. (A number other than 0 and 1 was specified.)	E0240	Specify correct parameters.
• PV200 sent a command in the following inoperable state. • When selecting "TOOL" > "General", "Settign Help" or "Update		Make PV200 be operable.
• A command was sent when saving in image memory.		
When switching layout;		
• Other number than 00-15 is specified for layout number. • No layout has been registered in the specified layout number.	E0246	Specify a correct layout number.
When sending parameter write command (%PW, %PWP);		
• Specification of the parameter is wrong. (e.g. Undefined parameter is specified.)	E0251	Specify correct parameters.
• The specified parameter does not exist. (e.g. The number of uncreated checker is specified as a parameter.) • The specified parameter value is out of the settable range. (e.g. Maximum value of slice level is being set to over 256.) • The specified values led to the status of “Maximum value < Minimum value” when entering them. • When specifying the moving distance of the marker, a part of the circumscribing rectangle of the marker (the intersection point when Shape is Cross line) after move was out of the nine screens where checker area is settable.	E0252	
• When the number of write commande received by PV200 exceeds the receivable number when executing one inspection.	E0253	Decrease commands to send to PV200.
When outputting general result		
When the general result could not output when "Error Output" is set to “Yes”; • Ethernet communication cannot be established (with connection problems such as cable unconnected or disconnection). • No SD memory card is attached, the card cannot be accessed, or used up its capacity. • The SD memory card is write-protected. • "Write When Cover is Open" is set to "Disable", and the cover is open.	E0255 *1	Correctly connect Ethernet. Correctly attach a SD memory card which is writable and has enough free space. Close the cover.
When outputting inspection image		
When the latest inspection image could not output when "ERR signal ON at Output Error" is set to “Yes”; • Ethernet communication cannot be established (with connection problems such as cable unconnected or disconnection). • Image Receiver is not activated or stops. • No SD memory card is attached, the card cannot be accessed, or used up its capacity. • The SD memory card is write-protected. • "Write When Cover is Open" is set to "Disable", and the cover is open.	E0255 *1	Correctly connect Ethernet. Activate Image Receiver, and set it to "CONN: Standby". Close the cover.
The latest image output command was sent when waiting for the execution of detect trigger.	E0257 *1	

Cause	Error Code	Solution, etc
When outputting the latest inspection image to a SD memory card or Ethernet interface(Output Latest Image);		
When the latest inspection image could not output to Ethernet interface when "ERR signal ON at Output Error" is set to “Yes”; • No SD memory card is attached, the card cannot be accessed, or used up its capacity. • The SD memory card is write-protected. • "Write When Cover is Open" is set to "Disable", and the cover is open.	E0255 *1	Correctly attach a SD memory card which is writable and has enough free space. Close the cover.
• Output Condition* of Image Output is not set to [Command Reception].	E0256	Set Output Condition to [Command Reception].
• • There is no image captured.	E0257	Capture an image.
When saving Image memory of PV200 in a SD memory card; *3		
• No SD memory card is attached, the card cannot be accessed, or used up its capacity. • The SD memory card is write-protected. • "Write When Cover is Open" is set to "Disable", and the cover is open.	E0260	Correctly attach a SD memory card which is writable and has enough free space. Close the cover.
• When saving Image memory of PV200 in a SD memory card, there is no blank folder. (All of 00-99 are used.)		Delete all or some folders of 00 - 99 in the “Backup” folder of the SD memory card.
• No image is saved in the image memory.		
When saving Print screen in a SD memory card or a PC through Ethernet;		
• No SD memory card is attached, the card cannot be accessed, or used up its capacity. • The SD memory card is write-protected. • "Write When Cover is Open" is set to "Disable", and the cover is open.	E0265	Correctly attach a SD memory card which is writable and has enough free space. Close the cover.
• Ethernet communication cannot be established (with connection problems such as cable unconnected or disconnection)Image Receiver is not activated.		Correctly connect Ethernet. Activate Image Receiver, and set it to "CONN: Standby".

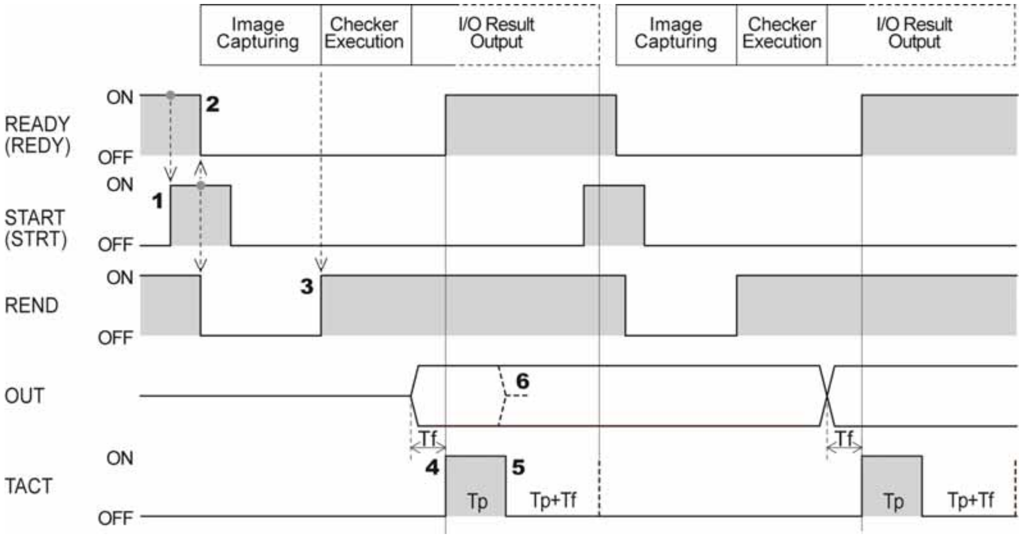
*1: The error processings in PV200 are classified into "Error in executing an inspection, outputting a result" and "Command error".
The same error code may be returned for "Error in executing an inspection, outputting a result" and "Command error". Judge which error is indicated by the error code according to the content of the instruction.
*2: “ENVIRONMENT” > “Input/Output” > "Image Output" > "Output Conditions”
*3: When setting “ENVIRONMENT” > "Input/Output" > "Save Image Memory" > "Overwrite" > “Yes”, if the capacity of a SD memory card is full even though the number of saved folders is less than the specified number of folders, the oldest folder is deleted.

8.3 Timing Chart

8.3.1 Typical Operations in Inspections

Common Trigger

In serial processing mode



Tf: 400μs (fixed), Tp (1-1000ms): Data output guarantee time (default: 10 ms)

1. **Make sure that REDY signal is ON and then turn on STRT signal for more than 1 ms.**

2. **PV200 turns off REDY signal and REND signal, and starts capturing an image.**

   The OFF time of REDY signal is called "inspection time" up to No.4.

   ▶ Note

   The delay time mentioned on the right may occur from the input of STRT signal until the start of image capture (REND signal is OFF) when displaying a live image.

   4-Mega Camera:
   Max. 63 msec + Shutter speed
   2-Mega Camera:
   Max. 40 msec + Shutter speed
   0.3-Mega Camera:
   Max. 9 msec + Shutter speed

3. **After image capturing is completed, PV turns on REND signal and executes checkers.**

4. **As the inspection ends, a result is output through I/O interface and TACT signal and REDY signal are turned on after the period of “Tf”.**

   When PLC communication or synchronous output (general output and image output) is operated, REDY signal turns on after the operation is complete.
   After REDY signal turns ON, the device can receive the next STRT signal.
   Obtain a result after more than 1 ms of wait time when TACT signal turns on.

   ▶ Note

   The time from when TACT signal turns on till when the result output (OUT signal) is determined varies according to the condition of the connected load or ambient temperature.

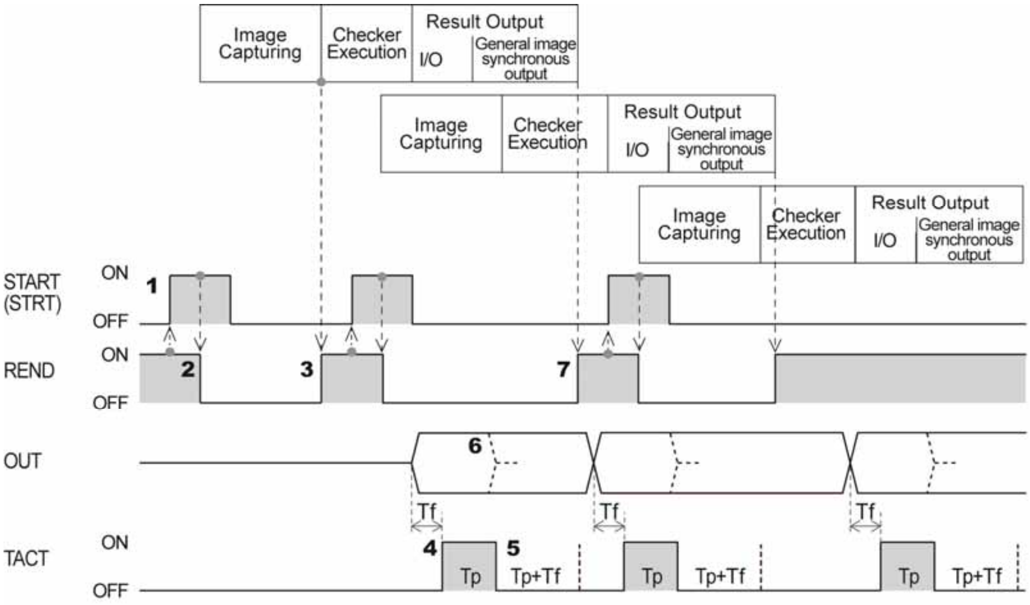
5. **TACT signal is turned on for the time of “Tp”, and then turned off for the time of “Tp + Tf”.**

   While the signal is off, result of the next inspection is not output.

6. **Out signal keeps on status until the next output (Hold), or turns off when TACT signal turns off (Reset).**

   To select “Hold” or “Reset”, select “ENVIRONMENT” > “System Settings” > “Operation” > “Parallel I/O Output Reset Condition”.

In parallel processing mode



Tf: 400μs (fixed), Tp (1-1000ms): Data output guarantee time (default: 10 ms)

1. **Make sure that REND signal is ON and then turn on STRT signal for more than 1 ms.**

2. **PV200 turns off REND signal and starts capturing an image.**

   ▶ Note

   The delay time mentioned on the right may occur from the input of STRT signal until the start of image capture (REND signal is OFF) when displaying a live image.

   4-Mega Camera:
   Max. 63 msec + Shutter speed
   2-Mega Camera:
   Max. 40 msec + Shutter speed
   0.3-Mega Camera:
   Max. 9 msec + Shutter speed

3. **After image capturing is completed, PV turns on REND signal and executes checkers.**

   After REND signal turns on, PV200 can receive STRT signal (or capture and image).
   At the timing when it starts capturing the next image, input STRT signal.

4. **As the inspection ends, a result is output through I/O interface and TACT signal is turned on after the period of "TV".**

   Obtain a result after more than 1 ms of wait time when TACT signal turns on.

   ▶ Note

   The time from when TACT signal turns on till when the result output (OUT signal) is determined varies according to the condition of the connected load or ambient temperature.

5. **TACT signal turns on for the time of “Tp”, and then turns off for the time of "Tp + Tf".**

   You cannot output the next result while the signal is off and the device is in the status of waiting for output.

6. **OUT signal keeps on status till the next output (Hold), or turns off when TACT signal turns off (Reset).**

   To select “Hold” or “Reset”, select “ENVIRONMENT” > “System Settings” > “Operation” > “Parallel I/O Output Reset Condition”.

7. **After the second image capturing is completed, PV executes checkers. If the first data has been output at the time, REND signal is turned on. If it has not, PV waits until the data is output and turns on REND signal.**

   After REND signal turns on, PV200 can receive STRT signal (or capture and image).
   At the timing when it starts capturing the next image, input STRT signal.

▶ Note

Setting “Image Output” to “Async.(inspection first)” turns on REND signal and allows capturing the third image after the second image capturing or the first synchronous result output (general output through I/O and synchronously) whichever completed later, before outputting the general result and the image of the first inspection is completed.

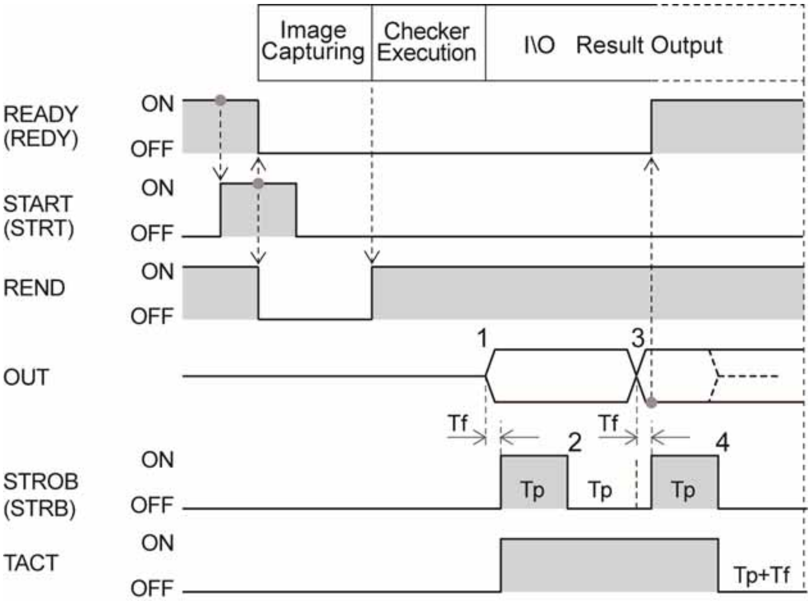
8.3.2 Outputting All Results (Output = All)

When the Handshake Function Is Set to “No”

Inspection data are output at intervals of set “Output signal guarantee time (Tp)”. STRB signal turns on each time outputting the data.

Receive data with the external device after rising edge of STRB ON signal and before the next STRB signal turns on.

The following is an example of outputting data dividing into three times in Serial mode.



Tf: 400μs (fixed), Tp (1-1000ms): Data output guarantee time (default: 10 ms)

1. **As the inspection ends, the first data (OUT signal) is output through I/O interface and turned on STRB signal and TACT signal.**

   Obtain the first result after more than 1 ms of wait time when STRB signal turns on.

   ▶ Note

   The time from when STRB signal turns on till when the result output (OUT signal) is determined varies according to the condition of the connected load or ambient temperature.

2. **STRB signal turns off after the time of Tp passes.**

3. **As the time of Tp passed from STRB signal turns off, the second data is output and STRB signal and REDY signal turn on(*).**

   Obtain the second result after more than 2 ms of wait time when STRB signal turns on.

   ▶ Note

   When synchronous output is operated in addition to I/O output, including data output to COM port and Ethernet port, and inspection image output, READY signal stays OFF until the operation is completed.

4. **STRB signal and TACT signal turn off after the time of Tp passes. Setting "Parallel I/O Output Reset Condition" to "Reset" resets OUT signal at this timing.**

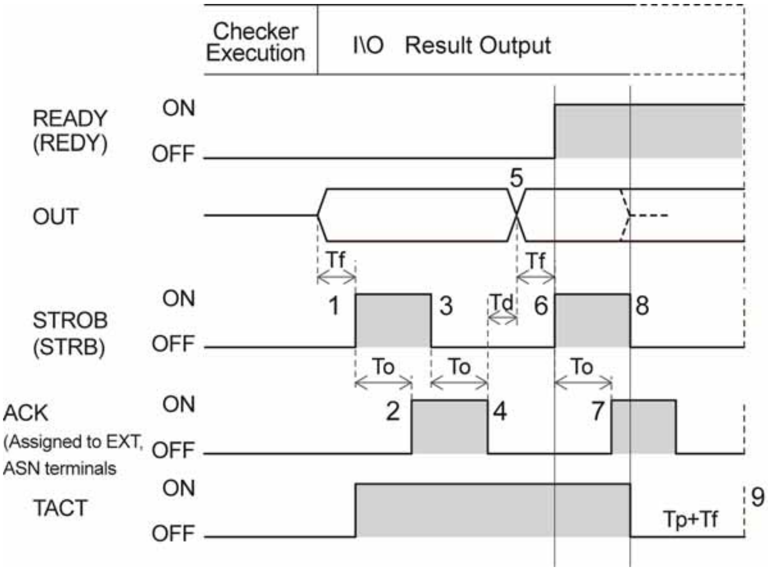
5. **I/O result output is complete after the time of "Tp+Tf" passes from TACT signal turns off.**

   ▶ Note

   You cannot output the next result while the time of "Tp+Tf" is passing in Parallel mode, and the device is in the status of waiting for output.

When the Handshake Function Is Set to “Yes”

Use STRB signal (PV200 -> the external device) and ACK signal (The external device -> PV200) in pairs.



Tf: 400μs (fixed)、Tp: Data output guarantee time, 1-1000ms (default: 10 ms)

To: Timeout period, 4 - 20000 ms (default: 5000 ms)
Exceeding this time causes a timeout error, terminates output processing, and outputs ERR signal.

1. **As the inspection ends, the first data is output through I/O interface and turned on STRB signal and TACT signal.**

2. **As for an external device, obtain the first result after more than 1 ms of wait time(*) when STRB signal turns on, and turn on ACK signal.**

   Be sure to turn on ACK signal in the time of "To" after turning on STRB signal.

   ▶ Note

   (*) The time from when STRB signal turns on till when the result output (OUT signal) is determined varies according to the condition of the connected load or ambient temperature.

3. **PV200 checks that ACK signal is ON and turns off STRB signal.**

4. **Check STRB signal if OFF with the external device and turn off ACK signal in the time of “To”.**

5. **PV200 outputs the second (last) data in 100μsec (Td) after turning off ACK signal.**

6. **As the time of “Tf” passed from data output, turn on STRB signal and REDY signal.**

   ▶ Note

   When synchronous output is operated in addition to I/O output, including data output to COM port and Ethernet port, and inspection image output, REDY signal stays OFF until the operation is completed.

7. **As for an external device, obtain the second result after more than 2 ms of wait time(*) when STRB signal turns on, and turn on ACK signal.**

   Be sure to turn on ACK signal in the time of To after turning on STRB signal.

8. **PV200 checks that ACK signal is ON and turns off STRB signal and TACT signal. Setting "Parallel I/O Output Reset Condition" to "Reset" resets OUT signal at this timing.**

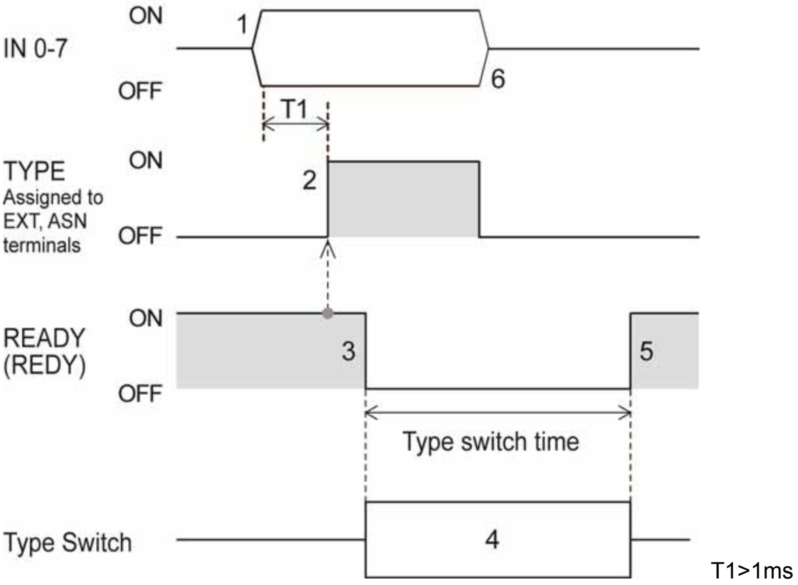
   Check STRB signal is OFF with the external device and turn off ACK signal. If the time from turning on of TACT signal is less than “Tp”, wait until the time passes and turn off TACT signal.

9. **I/O result output is complete after the time of "Tp+Tf" passes from TACT signal turns off.**

   ▶ Note

   You cannot output the next result while the time of "Tp+Tf" is passing in Parallel mode, and the device is in the status of waiting for output.

8.3.3 Type Switch (TYPE)



1. **Specifying the number of the product type that you want to call using IN0- 7.**
   Input IN0-7 more than 1 ms before TYPE signal input.

   How to specify product number to IN0-7

Type	IN7	IN6	IN5	IN4	IN3	IN2	IN1	IN0
000	off	off	off	off	off	off	off	off
001	off	off	off	off	off	off	off	**ON**
002	off	off	off	off	off	off	**ON**	off
003	off	off	off	off	off	off	**ON**	**ON**
004	off	off	off	off	off	**ON**	off	off
				:				
252	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**	off	off
253	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**	off	**ON**
254	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**	off
255	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**

2. **Check the REDY signal ON and then input the TYPE signal (Type switch execution signal).**

3. **PV200 checks that TYPE signal is ON and turns off REDY signal**

4. **PV200 executes type switch.**

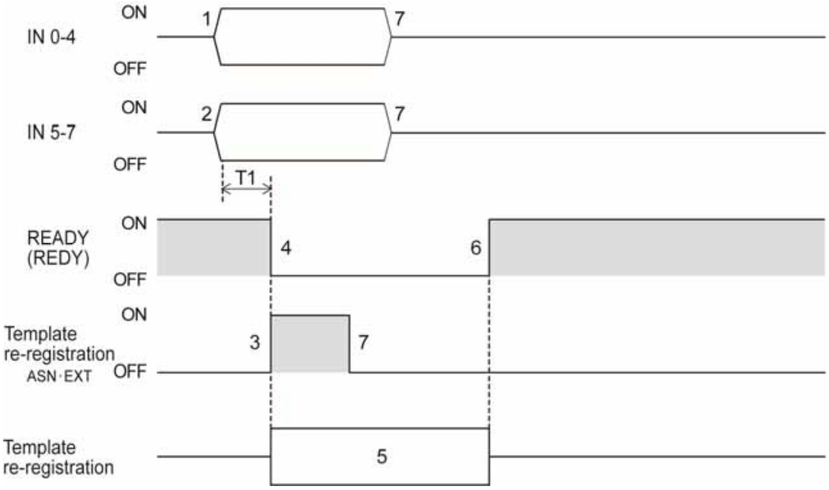
5. **After type switching completed, REDY signal turns on.**

6. **Turns off TYPE signal and IN0-7 signals before inputting a signal, such as STRT, to PV200.**

8.3.4 Re-registering Templates

“Use the Last Image” > "Set Position"

When Area Display is "No"



T1>/=1msec

1. **Specifying the number of the checker that you want to re-register using IN0-4.**
   Input IN0-4 more than 1 msec before Template re-registration signal input.

How to specify product number to IN0-4

Checker No.	IN4	IN3	IN2	IN1	IN0
0	off	off	off	off	off
1	off	off	off	off	**ON**
2	off	off	off	**ON**	off
	:				
29	**ON**	**ON**	**ON**	off	**ON**
30	**ON**	**ON**	**ON**	**ON**	off
31	**ON**	**ON**	**ON**	**ON**	**ON**

2. **Specifying the number of the template that you want to re-register using IN5-7.**
   Input IN5-7 more than 1 msec before Template re-registration signal input.

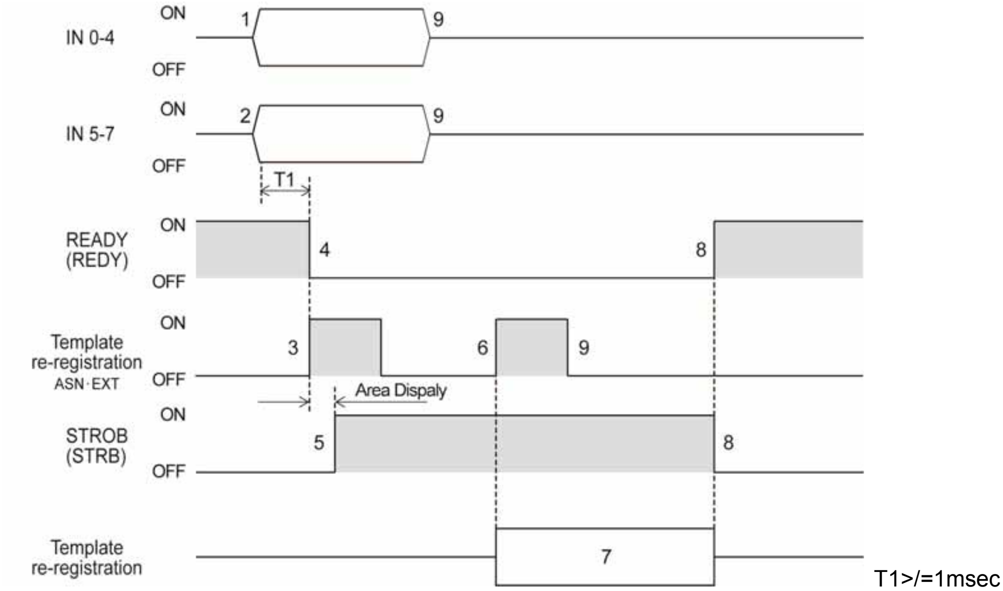
How to specify product number to IN5-7

Template No.	IN7	IN6	IN5
0	off	off	off
1	off	off	**ON**
2	off	**ON**	off
	:		
5	**ON**	off	**ON**
6	**ON**	**ON**	off
7	**ON**	**ON**	**ON**

3. **Check the REDY signal ON and then input the template re-registration signal.**
4. **PV200 checks that the template re-registration signal is ON and turns off REDY signal.**
5. **PV200 executes template re-registration.**
6. **After template re-registration completed, REDY signal turns on.**
7. **Turns off the template re-registration signal and IN0-7 signals before inputting a signal, such as STRT, to PV200 the next time.**

“Use the Last Image” > "Set Position"

When Area Display is “Yes”



1. **Specifying the number of the checker that you want to re-register using IN0-4.**
   Input IN0-4 more than 1 msec before Template re-registration signal input.

How to specify product number to IN0-4

Checker No.	IN4	IN3	IN2	IN1	IN0
0	off	off	off	off	off
1	off	off	off	off	**ON**
2	off	off	off	**ON**	off
	:				
29	**ON**	**ON**	**ON**	off	**ON**
30	**ON**	**ON**	**ON**	**ON**	off
31	**ON**	**ON**	**ON**	**ON**	**ON**

2. **Specifying the number of the template that you want to re-register using IN5-7.**
   Input IN5-7 more than 1 msec before Template re-registration signal input.

How to specify product number to IN5-7

Template No.	IN7	IN6	IN5
0	off	off	off
1	off	off	**ON**
2	off	**ON**	off
	:		
5	**ON**	off	**ON**
6	**ON**	**ON**	off
7	**ON**	**ON**	**ON**

3. **Check the REDY signal ON and then input the template re-registration signal.**

4. **PV200 checks that the template re-registration signal is ON and turns off REDY signal.**

5. **PV200 executes area display and then turns on STRB signal.**

6. **Check the STRB signal ON and then input the template re-registration signal with the external device.**

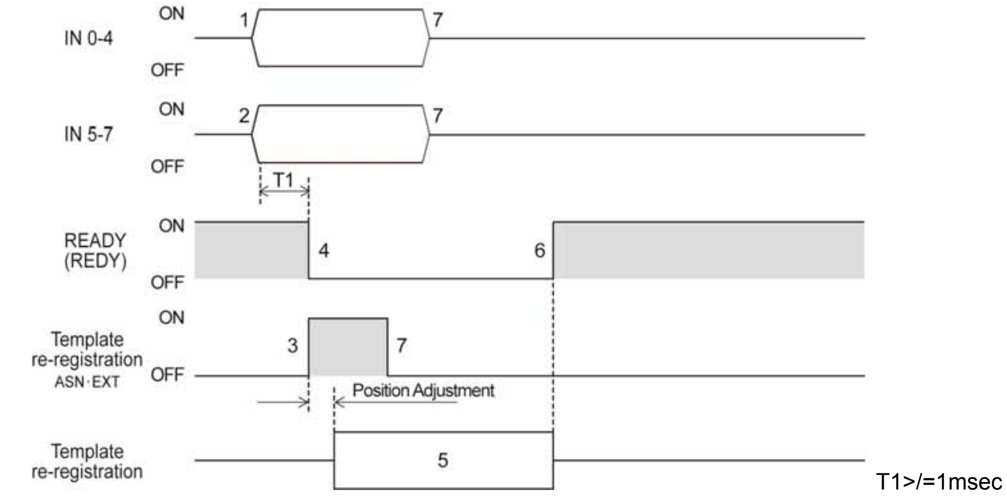
7. **PV200 executes template re-registration.**

8. **After template re-registration completed, STRB signal turns off and REDY signal turns on.**

9. **Turns off the template re-registration signal and IN0-7 signals before inputting a signal, such as STRT, to PV200 the next time.**

“Use the Last Image” > "Adjusted Position"

When Area Display is "No"



1. **Specifying the number of the checker that you want to re-register using IN0-4.**
   Input IN0-4 more than 1 msec before Template re-registration signal input.

   How to specify product number to IN0-4

Checker No.	IN4	IN3	IN2	IN1	IN0
0	off	off	off	off	off
1	off	off	off	off	**ON**
2	off	off	off	**ON**	off
	:				
29	**ON**	**ON**	**ON**	off	**ON**
30	**ON**	**ON**	**ON**	**ON**	off
31	**ON**	**ON**	**ON**	**ON**	**ON**

2. **Specifying the number of the template that you want to re-register using IN5-7.**
   Input IN5-7 more than 1 msec before Template re-registration signal input.

   How to specify product number to IN5-7

Template No.	IN7	IN6	IN5
0	off	off	off
1	off	off	**ON**
2	off	**ON**	off
	:		
5	**ON**	off	**ON**
6	**ON**	**ON**	off
7	**ON**	**ON**	**ON**

3. **Check the REDY signal ON and then input the template re-registration signal.**

4. **PV200 checks that the template re-registration signal is ON and turns off REDY signal.**

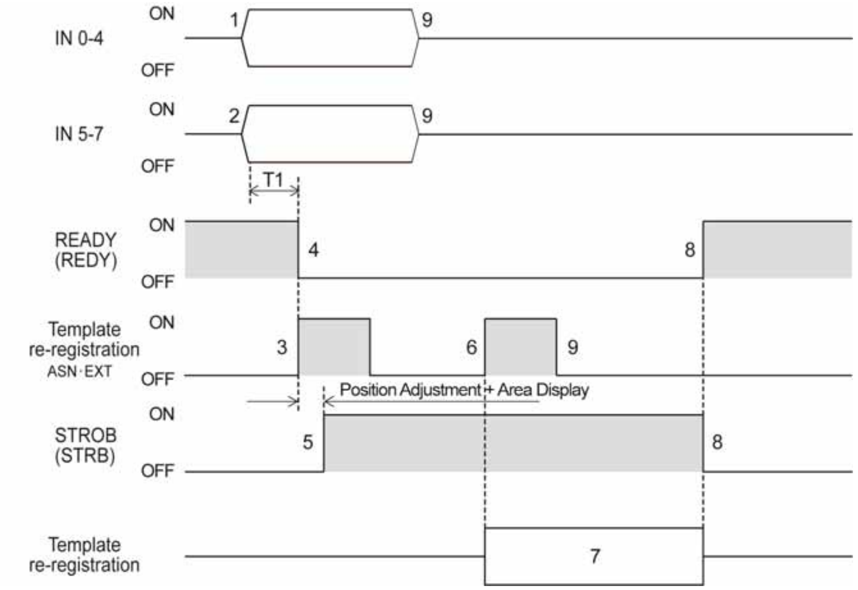
5. **PV200 executes position adjustment and then executes template re-registration.**

6. **After template re-registration completed, REDY signal turns on.**

7. **Turns off the template re-registration signal and IN0-7 signals before inputting a signal, such as STRT, to PV200 the next time.**

“Use the Last Image” > "Adjusted Position"

When Area Display is “Yes”



T1>/=1msec

1. **Specifying the number of the checker that you want to re-register using IN0-4.**
   Input IN0-4 more than 1 msec before Template re-registration signal input.

How to specify product number to IN0-4

Checker No.	IN4	IN3	IN2	IN1	IN0
0	off	off	off	off	off
1	off	off	off	off	**ON**
2	off	off	off	**ON**	off
	:				
29	**ON**	**ON**	**ON**	off	**ON**
30	**ON**	**ON**	**ON**	**ON**	off
31	**ON**	**ON**	**ON**	**ON**	**ON**

2. **Specifying the number of the template that you want to re-register using IN5-7.**
   Input IN5-7 more than 1 msec before Template re-registration signal input.

How to specify product number to IN5-7

Template No.	IN7	IN6	IN5
0	off	off	off
1	off	off	**ON**
2	off	**ON**	off
	:		
5	**ON**	off	**ON**
6	**ON**	**ON**	off
7	**ON**	**ON**	**ON**

3. **Check the REDY signal ON and then input the template re-registration signal.**

4. **PV200 checks that the template re-registration signal is ON and turns off REDY signal.**

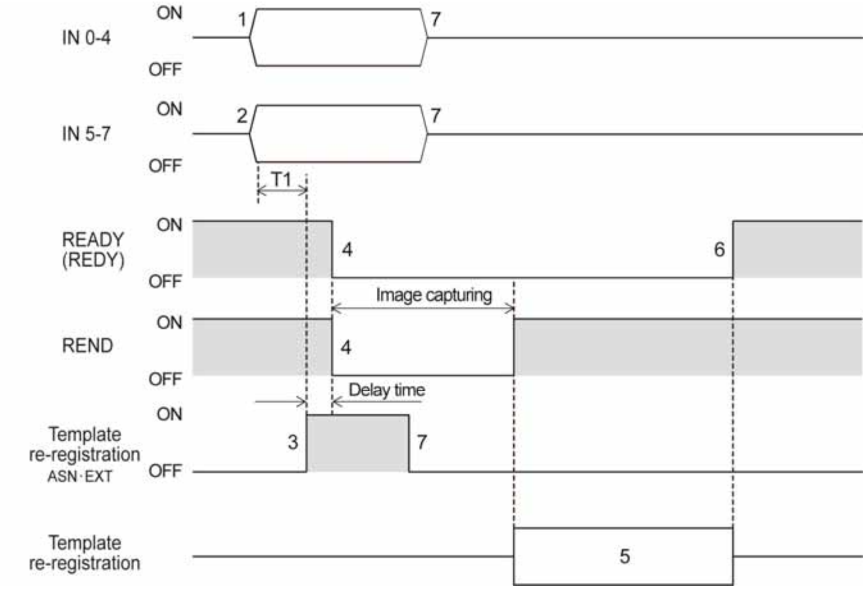
5. **PV200 executes position adjustment and area display and then turns on STRB signal.**

6. **Check the STRB signal ON and then input the template re-registration signal with the external device.**

7. **PV200 executes template re-registration.**
8. **After template re-registration completed, STRB signal turns off and REDY signal turns on.**
9. **Turns off the template re-registration signal and IN0-7 signals before inputting a signal, such as STRT, to PV200 the next time.**

“Capture New Image” > "Set Position"

When Area Display is "No"



T1>/=1msec

1. **Specifying the number of the checker that you want to re-register using IN0-4.**
   Input IN0-4 more than 1 msec before Template re-registration signal input.

   How to specify product number to IN0-4

Checker No.	IN4	IN3	IN2	IN1	IN0
0	off	off	off	off	off
1	off	off	off	off	**ON**
	:				
30	**ON**	**ON**	**ON**	**ON**	off
31	**ON**	**ON**	**ON**	**ON**	**ON**

2. **Specifying the number of the template that you want to re-register using IN5-7.**
   Input IN5-7 more than 1 msec before Template re-registration signal input.

   How to specify product number to IN5-7

Template No.	IN7	IN6	IN5
0	off	off	off
1	off	off	**ON**
	:		
6	**ON**	**ON**	off
7	**ON**	**ON**	**ON**

3. **Check the REDY signal ON and then input the template re-registration signal.**

4. **PV200 checks that the template re-registration signal is on, displays live image, and turns off REDY and REND signals. Then it starts capturing an image. REND signal turns on automatically after capturing an image is completed.**

   ▶ Note
   The delay time mentioned on the right may occur from the input of template re-registration signal until the start of image capture (REND signal is OFF) when displaying a live image.

   4-Mega Camera:
   Max. 63 msec + Shutter speed
   2-Mega Camera:
   Max. 40 msec + Shutter speed
   0.3-Mega Camera:
   Max. 9 msec + Shutter speed

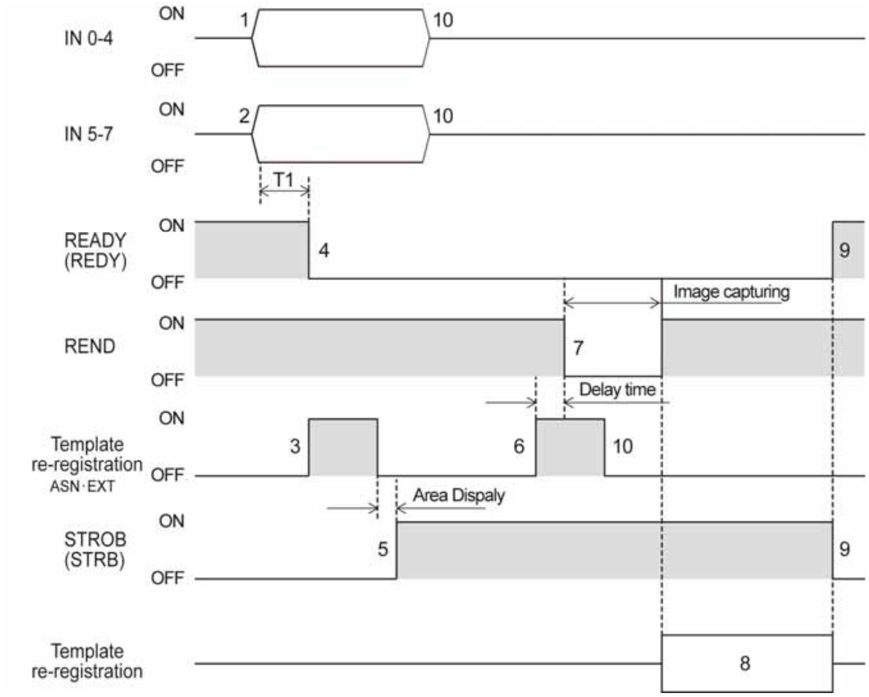
5. **PV200 executes template re-registration.**

6. **After template re-registration completed, REDY signal turns on.**

7. **Turns off the template re-registration signal and IN0-7 signals before inputting a signal, such as STRT, to PV200 the next time.**

“Capture New Image” > "Set Position"

When Area Display is “Yes”



T1>/=1msec

1. **Specifying the number of the checker that you want to re-register using IN0-4.**
   Input IN0-4 more than 1 msec before Template re-registration signal input.

How to specify product number to IN0-4

Checker No.	IN4	IN3	IN2	IN1	IN0
0	off	off	off	off	off
1	off	off	off	off	**ON**
2	off	off	off	**ON**	off
	:				
29	**ON**	**ON**	**ON**	off	**ON**
30	**ON**	**ON**	**ON**	**ON**	off
31	**ON**	**ON**	**ON**	**ON**	**ON**

2. **Specifying the number of the template that you want to re-register using IN5-7.**
   Input IN5-7 more than 1 msec before Template re-registration signal input.

How to specify product number to IN5-7

Template No.	IN7	IN6	IN5
0	off	off	off
1	off	off	**ON**
2	off	**ON**	off
	:		
5	**ON**	off	**ON**
6	**ON**	**ON**	off
7	**ON**	**ON**	**ON**

3. **Check the REDY signal ON and then input the template re-registration signal.**

4. **PV200 checks that the template re-registration signal is ON and turns off REDY signal.**

5. **PV200 executes area display and then turns on STRB signal.**

6. **Check the STRB signal ON and then input the template re-registration signal with the external device.**

7. **PV200 turns off REND signal and starts capturing an image. REND signal turns on automatically after capturing an image is completed.**

▶ Note

The delay time mentioned on the right may occur from the input of template re-registration signal until the start of image capture (REND signal is OFF) when displaying a live image.

4-Mega Camera:
Max. 63 msec + Shutter speed
2-Mega Camera:
Max. 40 msec + Shutter speed
0.3-Mega Camera:
Max. 9 msec + Shutter speed

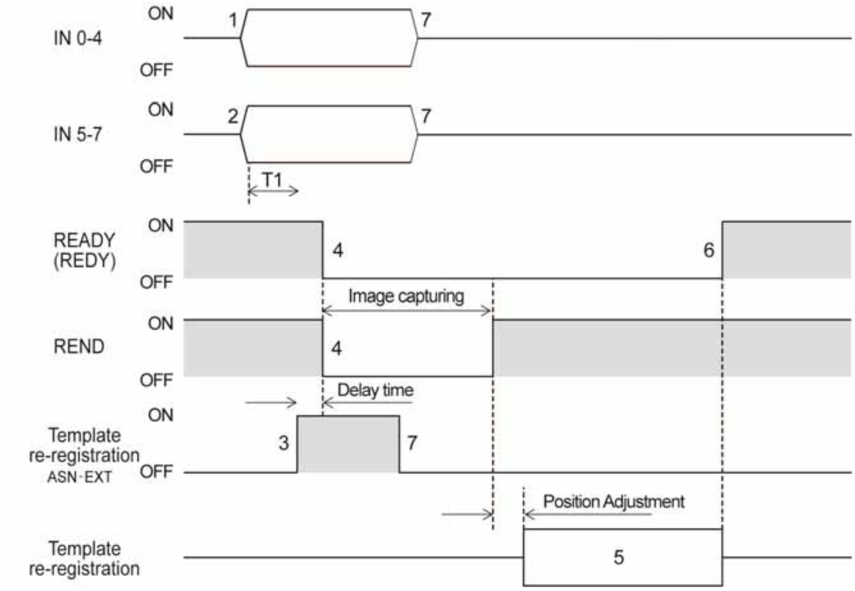
8. **PV200 executes template re-registration.**

9. **After template re-registration completed, STRB signal turns off and REDY signal turns on.**

10. **Turns off the template re-registration signal and IN0-7 signals before inputting a signal, such as STRT, to PV200 the next time.**

“Capture New Image” > "Adjusted Position"

When Area Display is "No"



T1>/=1msec

1. **Specifying the number of the checker that you want to re-register using IN0-4.**
   Input IN0-4 more than 1 msec before Template re-registration signal input.

   How to specify product number to IN0-4

Checker No.	IN4	IN3	IN2	IN1	IN0
0	off	off	off	off	off
1	off	off	off	off	**ON**
	:				
30	**ON**	**ON**	**ON**	**ON**	off
31	**ON**	**ON**	**ON**	**ON**	**ON**

2. **Specifying the number of the template that you want to re-register using IN5-7.**
   Input IN5-7 more than 1 msec before Template re-registration signal input.

   How to specify product number to IN5-7

Template No.	IN7	IN6	IN5
0	off	off	off
1	off	off	**ON**
	:		
6	**ON**	**ON**	off
7	**ON**	**ON**	**ON**

3. **Check the REDY signal ON and then input the template re-registration signal.**

4. **PV200 checks that the template re-registration signal is on, and turns off REDY and REND signals. Then it starts capturing an image. REND signal turns on automatically after capturing an image is completed.**

   ▶ Note
   The delay time mentioned on the right may occur from the input of template re-registration signal until the start of image capture (REND signal is OFF) when displaying a live image.

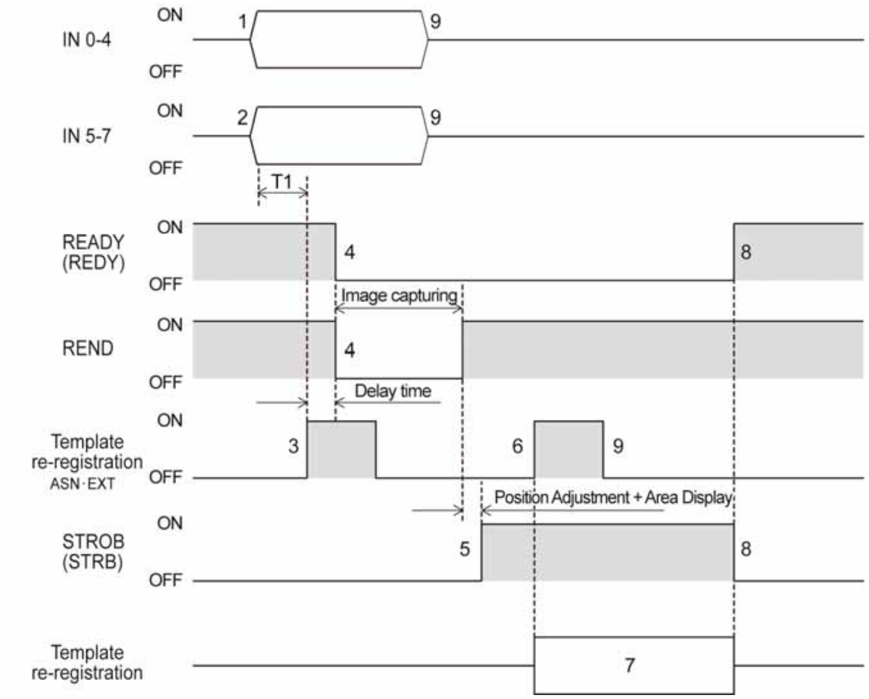
   4-Mega Camera:
   Max. 63 msec + Shutter speed
   2-Mega Camera:
   Max. 40 msec + Shutter speed
   0.3-Mega Camera:
   Max. 9 msec + Shutter speed

5. **PV200 executes template re-registration after executing position adjustment.**

6. **After template re-registration completed, REDY signal turns on.**
7. **Turns off the template re-registration signal and IN0-7 signals before inputting a signal, such as STRT, to PV200 the next time.**

“Capture New Image” > "Adjusted Position"

When Area Display is “Yes”



T1>/=1msec

1. **Specifying the number of the checker that you want to re-register using IN0-4.**
   Input IN0-4 more than 1 msec before Template re-registration signal input.

How to specify product number to IN0-4

Checker No.	IN4	IN3	IN2	IN1	IN0
0	off	off	off	off	off
1	off	off	off	off	**ON**
2	off	off	off	**ON**	off
	:				
29	**ON**	**ON**	**ON**	off	**ON**
30	**ON**	**ON**	**ON**	**ON**	off
31	**ON**	**ON**	**ON**	**ON**	**ON**

2. **Specifying the number of the template that you want to re-register using IN5-7.**
   Input IN5-7 more than 1 msec before Template re-registration signal input.

How to specify product number to IN5-7

Template No.	IN7	IN6	IN5
0	off	off	off
1	off	off	**ON**
2	off	**ON**	off
	:		
5	**ON**	off	**ON**
6	**ON**	**ON**	off
7	**ON**	**ON**	**ON**

3. **Check the REDY signal ON and then input the template re-registration signal.**

4. **PV200 turns off REDY and REND signals and starts capturing an image. REND signal turns on automatically after capturing an image is completed.**

   ▶ Note

   The delay time mentioned on the right may occur from the input of template re-registration signal until the start of image capture (REND signal is OFF) when displaying a live image.

   4-Mega Camera:
   Max. 63 msec + Shutter speed
   2-Mega Camera:
   Max. 40 msec + Shutter speed
   0.3-Mega Camera:
   Max. 9 msec + Shutter speed

5. **PV200 executes position adjustment and area display and then turns on STRB signal.**

6. **Check the STRB signal ON and then input the template re-registration signal with the external device.**

7. **PV200 executes template re-registration.**

8. **After template re-registration completed, STRB signal turns off and REDY signal turns on.**

9. **Turns off the template re-registration signal and IN0-7 signals before inputting a signal, such as STRT, to PV200 the next time.**

Operation of Accepting External Commands When "Area Display" is “Yes”

To perform template re-registration with the setting that "Area Display" is “Yes”, you need to input the template re-registration signal twice.
The table below shows the operations of external commands in the waiting state for the second template input.

Connection method	Operation of command		Waiting state	Processing
Serial	**Execute inspection**	%S	Continue	Error
	Reinspect	%R	Continue	Error
	Switch Type	%X	Continue	Error
	Save Data in PV	%MW	Continue	Error
	Save Data in SD	%CW	Continue	Error
	Read Data from PV	%MR	Continue	Error
	Read Data from SD	%CR	Continue	Error
	Abort Save/read Setting Data	%CD	Continue	Error
	Save Image Memory in SD	%SS	Continue	Error
	Clear Image Memory	%SR	Continue	Error
	Print Screen	%PS	Continue	Error
	Reset Statistics	%Q	Continue	Error
	Switch Run/Stop	%RM	Continue	Error
	Reset Error	%E	Continue	Error
	Abort Inspection/Process	%CC	Cancel	Accept
	Key emulating	%K	Continue	Ignore
	Keypad operation (Command prohibiting/permitting keypad operation)	%BS	Continue	Error
	Keypad operation (Command checking the status of keypad operation)	%BC	Continue	Error
	Switch Layout	%I	Continue	Error
	Template Setting	%A	Complete	Accept
	Parameter (Read)	%PR	Continue	Error
	Parameter (Change)	%PS	Continue	Error
	Wrong command	(Any characters)	Continue	Error

Waiting state
- Continue: Waiting state continues.
- Cancel: Waiting for the second template re-registration signal is canceled
- Complete: Template re-registration processing is executed.

Processing
- Error: Error is output.
- Accept: Template re-registration processing is executed.
- Ignore: No processing is performed.

Connection method	Operation of command		Waiting state	Processing
Parallel	**Execute inspection**	STRT	Continue	Ignore
	Switch Type	ASN・EXT	Continue	Ignore
	Switch Layout	ASN・EXT	Continue	Ignore
	ACK	ASN・EXT	Continue	Ignore
	Template Setting	ASN・EXT	Complete	Accept
	Switch Run/Stop	ASN・EXT	Continue	Ignore
	Save Data in PV	ASN・EXT	Continue	Ignore
	Save Data in SD	ASN・EXT	Continue	Ignore
	Read Data from PV	ASN・EXT	Continue	Ignore
	Read Data from SD	ASN・EXT	Continue	Ignore
	Reinspect	ASN・EXT	Continue	Ignore
	Reset Statistics	ASN・EXT	Continue	Ignore
	Reset Error	ASN・EXT	Continue	Ignore
	Save Image Memory in SD	ASN・EXT	Continue	Ignore
	Output Latest Image	ASN・EXT	Continue	Ignore
	Clear Image Memory	ASN・EXT	Continue	Ignore
	Print Screen	ASN・EXT	Continue	Ignore
	Abort Inspection/Process	ASN・EXT	Cancel	Accept
	Abort Save/read Setting Data	ASN・EXT	Continue	Ignore
	Input Data	IN0 - IN7	Continue	Ignore

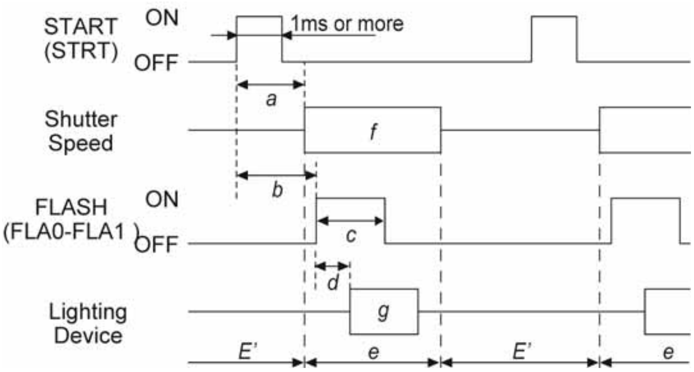
Waiting state
Continue: Waiting state continues.
Cancel: Waiting for the second template re-registration signal is canceled
Complete: Template re-registration processing is executed.

Processing
Error: Error is output.
Accept: Template re-registration processing is executed.
Ignore: No processing is performed.

8.3.5 FLASH Output Timing

Note

When you turn on the light by inputting FLASH signal sent from PV200, the light continuously flashes while display image of PV200 is set to "Live". This is because the Flash signal is output continuously along with the display timing of the live image. It is advisable to display "Memory" image when you use the light using Flash signal.



a	**Image capture response**	Response time for STRT signal to the start of image capturing. STRT signal response time (1 ms or less) + Capture delay *1) (0 to 999.9 ms) = 1000.9 ms (Max)
b	**FLASH signal response time**	Response time for STRT signal to the start of FLASH signal output *2) *3). STRT signal response time (1 ms or less) + FLASH signal delay *1) (0 to 999.9 ms) = 1000.9 ms (Max)
c	**FLASH span *1)**	Set the value with PV200 in accordance with a connecting lighting. (0.2 - 999.9 ms *4))
d	**Lighting response time**	Response time for FLASH signal of a lighting *3). Set the value with a lighting. (It varies depending on the delay time setting of a lighting.)
e	**Lighting range**	Lighting tolerance time between light emission start and the end. If it lights out of the range (E'), brightness of captured images vary every inspection.
f	**Shutter speed *1)**	Set the value with PV200. 0.03 to 1000.00 ms (30 μs to 1000 ms)
g	**Lighting time**	Set the value with a lighting. The time from the emission start to the end of lighting must be less than "Lighting range" (e).

- *1)
  Set it for each "Camera No. to Set" of Types.
- *2)
  Depending on the internal circuit of a connecting device, the response time could be longer than the maximum time (1000.9 ms). Check on the system you actually use.
- *3) For your imformation
  When using our digital power sourse for LED lighting (ANB86001/ANB86003),
  - Setting of "Capture delay" in PV200 to "0 ms" makes "b" = 1 ms or less
  - Setting of "Llight Delay Time" of the digital power sourse to "10 μs" makes "d" = 100 μs or less
- *4)
  In PNP-output-type product (PhotoMos output type, the end of the product number is "P"), actual signal span against the set Falsh span is as listed below due to the feature of PhotoMos relay. The signal span changes depending on the setting of "Flash Polarity".
  When FLASH polarity is set to "ON at Low": [Output signal span] = [set signal span] - [approx. 120μs(0.12ms)]
  When FLASH polarity is set to "ON at High": [Output signal span] = [set signal span] + [approx. 40μs]

Example)

Set Signal Span		Output Signal Span	
		[FLASH Polarity] = ON	[FLASH Polarity] = OFF
Example 1	0.2 ms (200μs)	0.08 ms (80μs)	0.24 ms (240μs)
Example 2	10 ms	9.88 ms	10.04 ms

Chapter 9

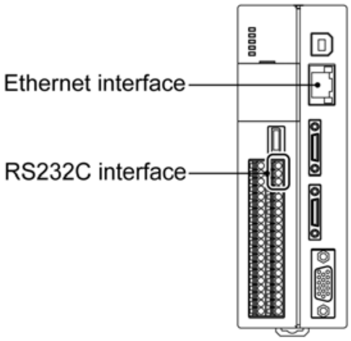
Control with Communication Port

9.1 Communication Port and Protocol

PV200 is provided with the following communication ports.

- COM port: RS-232C interface
- Ethernet port: Ethernet interface

There are two types of protocols for each communication port, "General Communication " and "PLC Communication". The communication details differ depending on the protocols. Use one of them according to your purpose.



9.1.1 RS-232C Interface

Using COM port, PV200 communicates with the external device through RS-232C. Outputting inspection result data and sending/receiving control commands can be performed.

Make the settings for RS232C interface from the following items.

Setting of communication condition	“ENVIRONMENT” > “Input/Output” > “Serial”	▶page 340
Setting of serial output	“ENVIRONMENT” > “Input/Output” > “General Output” > "Serial" column	▶page 279
Setting of PLC communication	“ENVIRONMENT” > “Input/Output” > “PLC Communication”	▶page 426
Setting when selecting "PLC Communication" - "Command Read Type" - "Parallel Input"	“ENVIRONMENT” > “Input/Output” > “Parallel I/O” > "ASSIGN0-1/EXTRA0-2" > Read PLC Communication Command	▶page 339 page 366

▶ Note

For PLC communication, either RS-232C interface or Ethernet interface must be selected.

Communication Specification of RS-232C

Item		Specifications
Connector		D-sub9 pin
Communication method		Full duplex
Synchronous method		Asynchronous
Baud rate [*1)]		1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps (Factory default: 9600)
Transmission code		ASCII
Transmission format	Bit length	7-bit, 8-bit (Factory default: 8-bit)
	Stop bit	1-bit, 2-bit (Factory default: 1-bit)
	Parity check	None/Odd/Even (Factory default: Odd)
	Flow control	None/Soft Flow (Factory default: None)
	Delimiter	CR

*1) When Baud Rate is "115200 bps", the communication may not be carried out stably in accordance with the device to communicate with. In the case, set Baud Rate to "57600 bps" or lower.

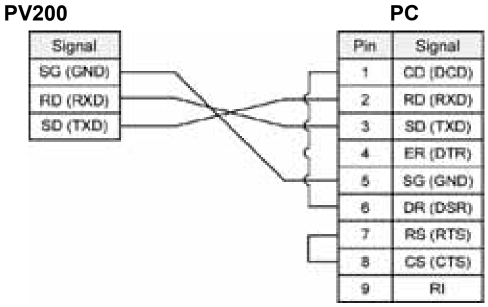
▼Refer to▼

For information how to set communication speed and transmission format, refer to Chapter 6.3.2 Changing Communication Condition of COM port (Serial), page 339.

Connecting with a PC or a PLC

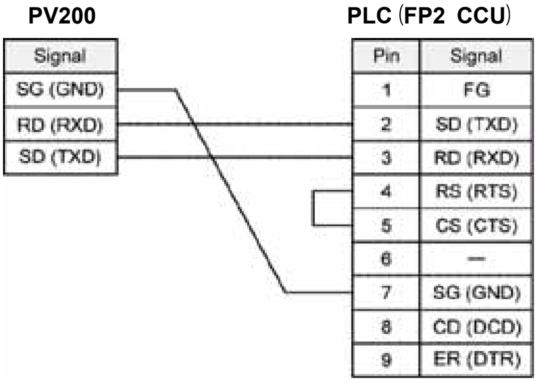
Connecting with a PC

The arrangement of the cables is shown on the right.

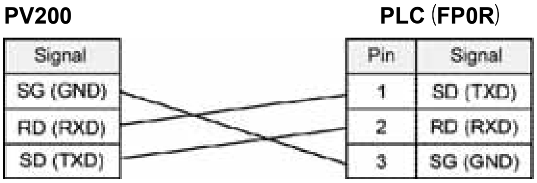


Connections with Panasonic PLC

FP2 CCU



FP0



9.1.2 Ethernet Interface

Ethernet communication is performed with an external device. Outputting inspection result data and sending/receiving Control commands can be performed. PV200 can communicate with the designated setting software PVWIN200. By using "Image Receiver for PV", image data can be also output.

Make the settings for Ethernet interface from the following items.

Setting of network	"TOOL" > "General" > "Network"	▶page 347
Setting of Ethernet output	“ENVIRONMENT” > “Input/Output” > “General Output” > "Ethernet" column	▶page 279
Setting of PLC communication	“ENVIRONMENT” > “Input/Output” > “PLC Communication”	▶page 426
Setting when selecting "PLC Communication" - "Command Read Type" - "Parallel Input”	“ENVIRONMENT” > “Input/Output” > “Parallel I/O” > "ASSIGN0-1/EXTRA0-2" > Read PLC Communication Command	▶page 339 page 366
Setting software "PVWIN200"	All the settings except the network setting are set with PVWIN200.	▶page 482
Image output	“ENVIRONMENT” > “Input/Output” > “Image Output”	▶page 284
Print screen	“ENVIRONMENT” > “Input/Output” > “Print Screen”	▶page 52

▶ Note

- Note that incorrect setting of the connection to the existing LAN might cause malfunction in the devices on the network. Consult your network administrator before connecting.
- One PV200 cannot be operated by multiple PCs on the network.
- Depending on the network condition, delay might be caused in the communication. It is advisable to use I/O interface or RS-232C interface for the operation that requires speedy response such as inspection trigger input.
- For PLC communication, either RS-232C interface or Ethernet interface must be selected.

Communication Specification of Ethernet

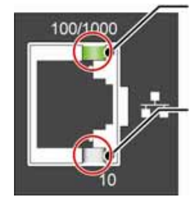
Item	Specifications
Connector	RJ-45
Media	10BASE-T / 100BASE-TX / 1000BASE-T
Protocol	General Communication: TCP / IP PLC Communication: UDP / IP

▶ Note

According to the network adapter of your PC, 1000BASE-T communication may not be available.
When you use Ethernet communication with 1000BASE-T, please check the maximum frame size (which is the data size that can be sent or received in one communication) available in the network environment. In some cases, the network adapter complying with 1000BASE-T also requires a setting change. For details including how to set, please contact a manufacturer of network adapters.

About Baud Rate

PV200 automatically adjusts the baud rate according to the speed of the device to communicate. (Auto negotiation)
You can know the current baud rate by the position and color of LED of Ethernet port that lights when communicating.

Ethernet Port	LED	Color	Baud Rate
	Upper	Green	100 megabits
		Orange	1000 megabits (1 gigabit)
	Lower	Yellow	10 megabits

About Port Number

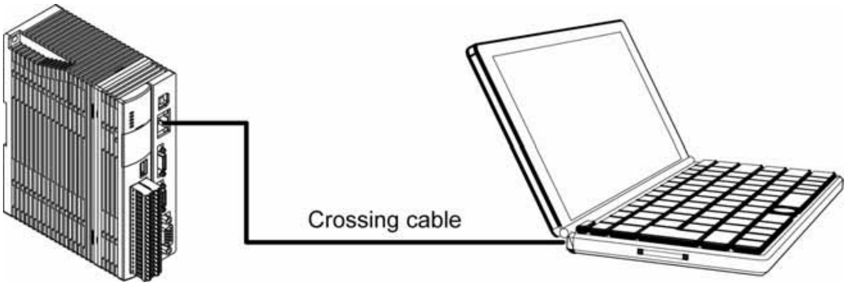
Port number differs depending on protocol and communication data.

General Communication -Data Output:	8601
General Communication -Command send/ receive:	8604
PLC Communication -Data Output: Command send/ receive:	1 – 65534 (Except 8600 – 8699, 9090)
Image output:	8602

Connecting PV200 with PC

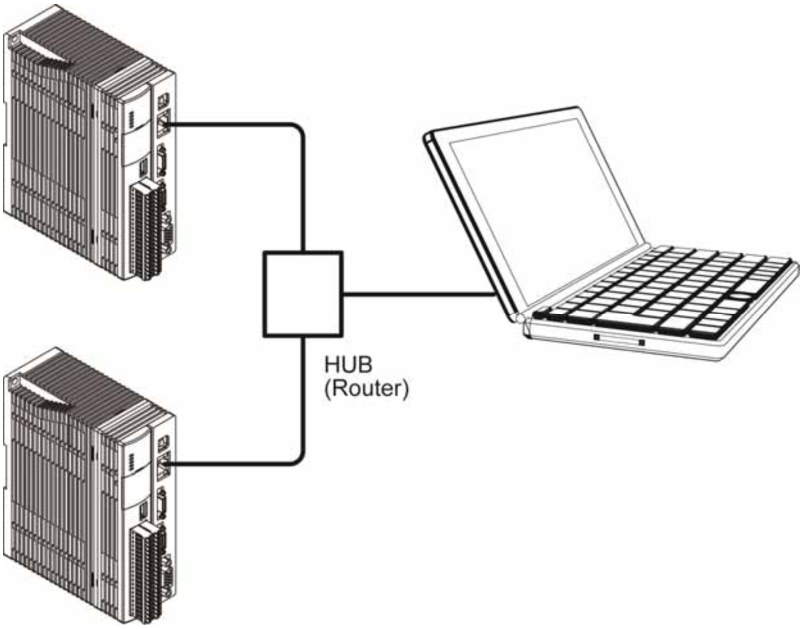
Communicating between a PV200 and a PC

Connect them with a commercially available crossing cable. (STP crossing cable of category 5e or more is recommended.)



Communicating between a PV200 and Multiple PCs

Connect them with a commercially available straight cable (STP straight cable of category 5e or more is recommended.) through a hub or a router, which supports 1000BASE-T, 100BASE-TX, and 10BASE-T.



▶ Note

Do not use the same IP addresses for the PV200 and the PC on the network.

9.1.3 Protocol

The following two protocols are available for PV200.

General Communication:	This method communicates with external devices according to the protocol specified in PV200. As data is sent and received using ASCII strings, there is no restriction on external devices, however, a communication program for PV200 should be created in the external devices. Using this method enables to output inspection results, control PV200, read and change the setting values of PV200.
PLC COMMUNICATION: (Available from Ver1.2)	This method communicates with a PLC according to the protocol of the destination PLC. Although usable PLC units are limited, communication can be easily performed by reading or writing specified registers. Inspection results are written in a specified register of PLC. Also, PV200 can be controlled or the setting values can be read and changed by writing commands into another specified register. Unlike General communication, only integers can be read and written. Two methods are available for the timing of reading commands, "Polling" and "Parallel Input". "Polling" checks whether commands are written in the register of PLC or not in a specified “Polling Time”. The response speed is slower than that of "Parallel Input". The time such as the time of inspection or image output gets longer because the polling process is performed even during the inspection.

▶ Note

For PLC communication, either RS-232C interface or Ethernet interface must be selected.

The pattern 1 in the table below shows the condition when PLC communication is selected for RS-232C interface. In this case, PLC communication cannot be used for Ethernet interface. Although the result output of RS-232C interface is limited to PLC communication, the control command can be also accepted through General communication.

The pattern 2 in the table below shows the condition when PLC communication is selected for Ethernet interface. In this case, PLC communication cannot be used for RS-232C interface. Even when PLC communication is selected for Ethernet interface, General communication can be used for both result output and control command. Note that, however, the output port is different from that of PLC communication.

	RS-232C Interface				**Ethernet Interface**			
	General Communication		**PLC COMMUNICATION**		**General Communication**		**PLC COMMUNICATION**	
	Result output	Control command	Result output	Control command	Result output	Control command	Result output	Control command
Pattern 1	N/A	A	A	A	A	A	N/A	N/A
Pattern 2	A	A	N/A	N/A	A	A	A	A

A: Available. It is also OK not to use.

N/A: Not available

9.2 General Communication

9.2.1 List of Commands for Genral Communication

The commands described in this chapter are the common commands for the ports to control PV200 with RS-232C interface and Ethernet interface through general communication. (Other commands are provided for the control through PLC communication. Refer to page 438.)

▶ Note

Port number of Ethernet interface to send/ receive commands for PV200 is “8604”.

List of Commands

The commands and the modes permitting the commands are listed below.

			Command Permission				
			RUN Menu		SETUP Menu	Parallel Processing	Continuous Inspection
		Command	RUN	STOP	STOP		
Inspection start	Common Trigger	%S	Yes			Yes	Yes
Stop repeating inspection		%S	Yes			Yes	Yes
Stop Detect trigger execution		%S	Yes				Yes
Start reinspection (to inspect on the current memory image without capturing a new image)		%R	Yes			Yes	
Switch product type		%X	Yes			Yes	Yes
Save the setting data	Storage space in PV200	%MW	Yes			Yes	
	SD memory card	%CW	Yes			Yes	
Read the setting data	Storage space in PV200	%MR	Yes			Yes	
	SD memory card	%CR	Yes			Yes	
Abort save/read setting data (Cancel)		%CD	Yes			Yes	
Image memory	Save (in a SD card)	%SS	Yes			Yes	
	Clear	%SR	Yes			Yes	Yes
Print screen		%PS	Yes			Yes	Yes
Reset statistics		%Q	Yes			Yes	Yes
Switch between RUN/STOP		%RM	Yes	Yes		Yes	Yes
Reset error signal		%E	Yes	Yes	Yes	Yes	Yes
Key emulating		%K	Yes	Yes	Yes	Yes	Yes
Keypad Operation	Invalid/Valid	%BS	Yes	Yes		Yes	Yes
	Confirm Status	%BC	Yes	Yes	Yes	Yes	Yes
Cancel Inspection/ Process		%CC	Yes	Yes	Yes	Yes	Yes
Switch layout		%I	Yes			Yes	Yes
Set a template		%A	Yes				
Parameter	Read	%PR	Yes	*1	*1	Yes	Yes
	Read pairs (Maximum/minimum values)	%PRP	Yes			Yes	Yes
	Change	%PW	Yes			Yes	Yes
	Change pairs (Maximum/minimum values)	%PWP	Yes			Yes	Yes

*1 Only operation status (parameter: SYS_RUN) and screen status (parameter: SYS_EDIT) can be read.

9.2.2 Details of Commands

"SEND" described in this chapter indicates the commands given from external devices to PV200. On the other hand, "Receive" indicates the responses for the sent commands from PV200 to external devices.

About Block Check Code

All command messages are added with a block check code, which checks an error using horizontal parity to improve reliability of transmission data. This manual describes a block check code as "BBC".

As a block check code of PV200, a code that is given by removing a terminal code from Exclusive OR (8-bit) of a command message and converting it into ASCII code (two letters) is used.

If you do not employ block check, add it to "**" (2AH2AH) instead of a block check code.

Example) When reading execution time

Command message

%	**P**	**R**		**S**	**Y**	**S**	**_**	**T**	**I**	**M**	**E**	**1**
25H	**50H**	**52H**	**20H**	**53H**	**59H**	**53H**	**5FH**	**54H**	**49H**	**4DH**	**45H**	**31H**

Obtain Exclusive OR

25H

Command message including BBC

%	**P**	**R**		**S**	**Y**	**S**	**_**	**T**	**I**	**M**	**E**	**1**	**2**	**5**	**CR**
													BCC		

About Response at Error

When sending a command message from the external device, an error response message containing 3-digit error code may be returned. This message is returned when the sent command is wrong or PV200 cannot receive the command.

The response differs depending on commands except the following common responses. Refer to the descriptions of each command.

Error Response Message Common to Commands

%	**!**	**1**	**0**	**0**	**BCC(35)**	**CR**

- This message is sent when Block Check Code (BCC) error occurred or an undefined command (unrecognizable command) is received.
- ERROR signal turns on.

%	**!**	**1**	**1**	**0**	**BCC(34)**	**CR**

- Receive buffer overflow of PV200. This might occur when inputting multiple commands in a row from the external device to PV200. If you receive this error response, decrease commands to send to PV200.
- ERROR signal turns on.

Inspection start

When using common trigger in “Execute All” or “Automatic Switch” execution mode

Send

%	S	BCC	CR

BCC = 76 or **

Receive

%	S	$	BCC(52)	CR

Error (ERROR signal = ON)

%	S	!	Error code (3-digit)	BCC	CR

Error code

160	Position adjustment for a detect trigger is unset or a base position is unset when "Camera Trigger" is set to “Detect Trigger (common)”.
200	Operation is stopped.
202	Execution mode is “User-Defined”.
203	No camera is connected. Both two cameras of PV200 are set to "Unused".

When using common trigger in “User-Defined” execution mode

Send

%	S	?	BCC	CR

? = 0 - 9 (Block No. to execute)

Receive

%	S	$	BCC(52)	CR

Error (ERROR signal = ON)

%	S	!	Error code (3-digit)	BCC	CR

Error code

160	Position adjustment for a detect trigger is unset or a base position is unset when "Camera Trigger" is set to “Detect Trigger (common)”.
201	Execution mode is NOT “User-Defined” in PV200.
202	The specified block is invalid (the number which does not/ cannot exist was specified)
203	• No camera is connected. • Both two cameras of PV200 are set to "Unused".

Example: Starts the inspection of block No.2.

Send

%	S	2	*	*	CR

Receive

%	S	$	5	2	CR

Reinspection (Executes inspection without capturing an image)

For “Execute All” or “Automatic Switch” execution mode

Send

%	R	BCC	CR

BCC = 77 or **

Receive

%	R	$	BCC(53)	CR

Error (ERROR signal = ON)

%	R	!	Error code (3-digit)	BCC	CR

Error code

200	Operation is stopped
202	Execution mode is “User-Defined”.
203	There is no image captured.
204	Reinspection cannot be executed because PV200 is inspecting repeatedly

For “User-Defined” execution mode

Send

%	R	?	BCC	CR

? = 0 - 9 (Block No. to execute)

Receive

%	R	$	BCC(53)	CR

Error (ERROR signal = ON)

%	R	!	Error code (3-digit)	BCC	CR

Error code

200	Operation is stopped
201	Execution mode is NOT “User-Defined”.
202	The specified block is invalid. (The number which does not/ cannot exist was specified.)
203	There is no image captured.
204	Reinspection cannot be executed because PV200 is inspecting repeatedly

Example: Starts the inspection of block No.0.

Send

%	R	0	*	*	CR

Receive

%	R	$	5	3	CR

Type Switch

Send

%	X	?	?	?	BCC	CR

??? = 000 - 255 (Product type No.)

Receive

%	X	$	BCC(59)	CR

Error (ERROR signal = ON)

%	X	!	Error code (3-digit)	BCC	CR

Error code

200 Operation is stopped

210
- The specified product number does not exist.
- Other number than 000-255 was specified for a product number.

Saving Setting Data

Saving in the Storage Space in PV200

Send

%	M	W	?	?	BCC	CR

Receive

%	M	W	$	BCC(1B)	CR

Error (ERROR signal = ON)

%	M	W	!	Error code (3-digit)	BCC	CR

Error code

200 Operation is stopped.

Saving in a SD memory card

Send

%	C	W	?	?	BCC	CR

?? = 00 - 99 (Storage area No. of a SD memory card)

Receive

%	C	W	$	BCC(15)	CR

Error (ERROR signal = ON)

%	C	W	!	Error code (3-digit)	BCC	CR

Error code

200 Operation is stopped

212 Other number than 00-99 was specified for a saving area number.

216
- No SD memory card is attached or cannot be accessed.
- Capacity of the SD memory card is used up.
- The SD memory card is write-protected.
- "Write When Cover is Open" is set to "Disable", and the cover is open.

Reading Setting Data

Reading from the Storage Space in PV200

Send

%	M	R	?	?	BCC	CR

Receive

%	M	R	$	BCC(1E)	CR

Error (ERROR signal = ON)

%	M	R	!	Error code (3-digit)	BCC	CR

Error code

200	Operation is stopped
214	• The data file is incompatible. (Data of the later version, etc.) • The number and types of cameras connected to PV200 is different from the Camera setting of the data file. (including the case that the camera is unconnected because the camera cable came off unexpectedly.)

Reading from a SD memory card

Send

%	C	R	?	?	BCC	CR

?? = 00 - 99 (No. of storage area of SD memory card saving the data to read)

Receive

%	C	R	$	BCC(10)	CR

Error (ERROR signal = ON)

%	C	R	!	Error code (3-digit)	BCC	CR

Error code

200	Operation is stopped
212	Other number than 00-99 was specified for a saving area number.
213	• No SD memory card is attached or cannot be accessed. • No data file in the designated area of a SD memory card.
214	• The data file is not data of PV200. • The Data file is incompatible. (Data of the later version, etc.) • The number and types of cameras connected to PV200 is different from the Camera setting of the data file. (including the case that the camera is unconnected because the camera cable came off unexpectedly.)

Abort Save/Read Setting Data

Send

%	C	D	BCC	CR

Receive

%	C	D	$	BCC(06)	CR

Error (ERROR signal = ON)

%	C	D	!	Error code (3-digit)	BCC	CR

Error code

217
- Saving or reading setting data is not executed.
- Aborting failed.

Saving Images Stored in the Save Image Memory of PV into a SD Memory Card

Data is saved into free area of the SD memory card. (A destination number cannot be specified.)

Send

%	S	S	BCC	CR

BCC = 25 or **

Receive

%	S	S	$	BCC(01)	CR

Error (ERROR signal = ON)

%	S	S	!	Error code (3-digit)	BCC	CR

Error code

200 Operation is stopped

260
- No SD memory card is attached or cannot be accessed.
- Capacity of the SD memory card is used up.
- The SD memory card is write-protected.
- No blank folder exists in the destination. (All of 00-99 folders are used.)
- No image is saved in the save image memory.
- "Write When Cover is Open" is set to "Disable", and the cover is open.

Clearing the Image Memory Stored in PV

Execute “SAVE/READ” -> “Clear Image Memory” in SETUP menu.

Send

%	S	R	BCC	CR

BCC = 24 or ＊＊

Receive

%	S	R	$	BCC(00)	CR

Print Screen

It is output into the place specified from “ENVIRONMENT” > “Input/Output” > “Print Screen” -> “Destination”. This command cannot specify the destination.

Send

%	P	S	BCC	CR

BCC = 26 or **

Receive

%	P	S	$	BCC(02)	CR

Error (ERROR signal = ON)

%	P	S	!	Error code (3-digit)	BCC	CR

Error code

200	Operation is stopped
265	• No SD memory card is attached or cannot be accessed. • Capacity of the SD memory card is used up. • The SD memory card is write-protected. • "Write When Cover is Open" is set to "Disable", and the cover is open. • Ethernet communication cannot be established (with connection problems such as cable unconnected or disconnection) • Image Receiver is not activated.

Resetting Statistics Data

Resets statistics data and scan count.

Send

%	Q	BCC	CR

BCC = 74 or **

Receive

%	Q	$	BCC(50)	CR

Error (ERROR signal = ON)

%	Q	!	Error code (3-digit)	BCC	CR

Error code

200	Operation is stopped

Switch between Run/Stop

Send

%	R	M	?	BCC	CR

? = 0 - 1 (0 = switch to RUN, 1 = switch to STOP)

Receive

%	R	M	$	?	BCC	CR

? = 0 – 1 (0 = RUN, 1 = STOP)

Error (ERROR 1 signal = ON)

%	R	M	!	Error code (3-digit)	BCC	CR

Error code

240	• Specification of the parameter is wrong. (A number other than 0 and 1 was specified.)

Example: Switches to Run.

Send

%	R	M	0	*	*	CR

Receive

%	R	M	$	0	2	E	CR

Resetting Error Signal

To turns off ERROR signal.

Send	%	E	BCC	CR		BCC = 60 or **
Receive	%	E	$	BCC(44)	CR	

Keypad Operation (Key Emulation)

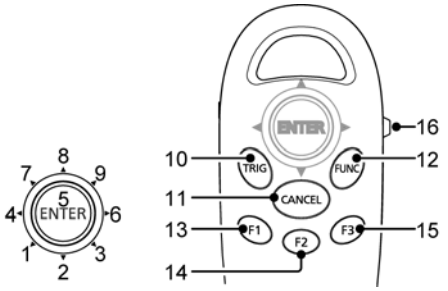
This is a command that performs the same operations of the keypad.

Send	%	K	s	?	?	BCC	CR

s = 0 - 1
(On/off switch of the shift key; 0 = off, 1 = on)

?? = 01 – 16 (See the right figure)

Receive No response



Setting Invalid/Valid of Keypad operation

This is a command for prohibiting/permitting keypad operation in RUN MENU.

When keypad operation has been set to "Invalid", the keypad cannot be used. A message "Keypad is invalid" is shown in the key guide space on the window. Even when setting to "Invalid", key emulate commands can be received.

Send	%	B	S	?	BCC	CR	? = 0-1 (0 = Valid. 1 = Invalid)
Receive	%	B	S	$	BCC(10)	CR	

Error (ERROR signal = **ON**)

%	B	S	!	Error code (3-digit)	BCC	CR

Error Code

270	Not available because SETUP MENU is displayed.
271	Other number than 0.1 and 1 is specified.

Reading Keypad Operation Status

Send	%	B	C	BCC	CR		BCC = 24 or **
Receive	%	B	C	$	?	BCC	CR	? = 0-1 (0 = Valid. 1 = Invalid)

Canceling Inspection/ Processing (Cancel specific operation)

Cancels the following active operations, and restores into the previous status before the operation.

- Cancellation of the operation of a serial command which has been received
- Abort of output in the status waiting for result output after an inspection is complete
- Abort of image saving from Image Memory to a SD memory card
- Cancellation of template re-registration

Send

%	C	C	BCC	CR

BCC = 25 or **

Receive

%	C	C	$	BCC(01)	CR

Layout Switch

Send

%	I	?	?	BCC	CR

?? = 00 – 15 (Layout No.)

Receive

%	I	$	BCC(48)	CR

Error (ERROR signal = ON)

%	I	!	Error code (3-digit)	BCC	CR

Error code

200	Operation is stopped
246	• Other number than 00-15 is specified for layout number. • No layout has been registered in the specified layout number.

Smart Matching Template Setting

Set a template of Smart Matching.

Note

A template that can be set with the command is one of Smart Matching in “Checker” menu. In Smart Matching used in Position Adjustment and Area Size Adjustment, a template cannot be re-registered.

Refer to

For information on the conditions when re-registering templates: page 134

When “Area Display” is set to “No” for Template Setting

Send

%	A	n	n	n	,	?	?	BCC	CR

nnn = 000 - 999 (Checker No.)
?? = 00 – 63 (Template No.)

Receive

%	A	$	BCC(40)	CR

Error (ERROR signal = ON)

%	A	!	Error code (3-digit)	BCC	CR

Error code

200	Operation is stopped
230	• Because PV200 is processing Detect trigger or Continuous Inspection, Template setting cannot be executed. • The command (%A) when "Area Display" is set to “Yes” was sent.
231	• The specified checker number or template number has not be created. • Other number than 000-999 for checker number, or 00-63 for template was specified.
232	Template cannot be set because no image has been captured after PV200 started up when you select “Use the Last Image” for “Template Setting”.
233	• No feature on the image of template registration area. • An error occurs in Position adjustment when you use it. • Template setting area is outside of the captured image (image partially captured when executing partial imaging). (The whole template setting area should be in the range of the captured image.)

Example: Re-registers a template No.1 of checker No.5.

Send	%	A	0	0	5	,	0	1	*	*	CR
Receive	%	A	$	4	0	CR					

When “Area Display” is set to “Yes” for Template Setting

Send1	%	A	n	n	n	,	?	?	BCC	CR

nnn = 000 - 999 (Checker No.)
?? = 00 – 63 (Template No.)

Receive1	%	A	$	BCC(40)	CR
Send2	%	A	BCC	CR	
Receive2	%	A	$	BCC(40)	CR

BCC = 64 or **

Error (ERROR signal = ON)

%	A	!	Error code (3-digit)	BCC	CR

Error code

200 Operation is stopped

230
- Because PV200 is processing Detect trigger or Repeat start, Template setting cannot be executed.
- Because parallel I/O result is being output, Template setting cannot be executed.
- The command for Send 2 (%A) was sent when Send 1 was supposed to.
- The command for Send 1 (%Annn,??) was sent when Send 2 was supposed to.

231
- The specified checker number or template number has not be created.
- Other number than 000-999 for checker number, or 00-63 for template was specified.

232 Template cannot be set because no image has been captured after PV200 started up when you select “Use the Last Image” for “Template Setting”.

233
- No feature on the image of template registration area.
- An error occurs in Position adjustment when you use it.
- Template setting area is outside of the captured image (image partially captured when executing partial imaging). (The whole template setting area should be in the range of the captured image.)

Example: Re-registers a template No.1 of checker No.5.

Send1	%	A	0	0	5	,	0	1	*	*	CR
Receive1	%	A	$	4	0	CR					
Send2	%	A	6	4	CR						
Receive2	%	A	$	4	0	CR					

Read Out Command

This is a command that reads out the settings of PV200 and system value. For the information of readable data, refer to the pages after page 417.

When reading one of data (such as Execution time, Total judgement, Maximum value, or Minimum value)

Send

%	P	R		Parameter	BCC	CR

Receive

%	P	R	$	Parameter	=	Data	BCC	CR

Error (ERROR signal = ON)

%	P	R	!	Error code (3-digit)	BCC	CR

Example: Reads out Execution time 1.

Send

%	P	R		S	Y	S	_	T	I	M	E	1	BCC	CR

Receive

%	P	R	$	S	Y	S	_	T	I	M	E	1	=	5	3	.	2	5	BCC	CR

When reading two of data (such as Maximum value and Minimum value)

Send

%	P	R	P		Parameter	BCC	CR

Receive

%	P	R	P	$	Parameter	=	Data 1	,	Data 2	BCC	CR

Error (ERROR signal = ON)

%	P	R	P	!	Error code (3-digit)	BCC	CR

Example: Reads out the maximum and minimum values of slice level group "A" for camera 0.

Parameter to read out the maximum and minimum values of slice level group. "BLV:PAIR?"

Send

%	P	R	P		B	L	V	:	P	A	I	R	A	BCC	CR

Receive

%	P	R	P	$	B	L	V	:	P	A	I	R	A	=	8	0	,	2	5	5	BCC	CR
															Minimum			Maximum				

Error codes for Read Out command

200	Operation is stopped.
251	Specification of the parameter is wrong. (Undefined parameter is specified.)
252	The specified parameter does not exist. (e.g. You tried to read out the setting value of an uncreated checker.)

Write Command

This is a command that changes the setting value of PV200. Writing is available only when being in RUN mode. For the information of writable data, refer to the next page.

When writing one of data (such as System Register, maximum value, or minimum value)

Send

%	P	W		Parameter	=	Data	BCC	CR

Receive

%	P	W	$	Parameter	BCC	CR

Error (ERROR signal = ON)

%	P	W	!	Error code (3-digit)	BCC	CR

Example: Writes the value “3.14” in System Register 0.

Send

%	P	W		S	Y	S	:	R	E	G	0	=	3	.	1	4	BCC	CR

Receive

%	P	W	$	S	Y	S	:	R	E	G	0	BCC	CR

When writing two of data (such as maximum value and minimum value)

Send

%	P	W	P		Parameter	=	Data 1	,	Data 2	BCC	CR

Data 1, Data 2: Data to be written

Receive

%	P	W	P	$	Parameter	BCC	CR

Error (ERROR signal = ON)

%	P	W	P	!	Error code (3-digit)	BCC	CR

Example: Writes a maximum value of “100” and a minimum value of “50” in Numerical Calculation No.10. CACnnn:LPAIR

Parameter for changing the maximum and minimum values in Numerical Calculation "CACnnn:LPAIR"

Send

%	P	W	P	C	A	C	0	1	0	:	L	P	A	I	R

=	5	0	,	1	0	0	BCC	CR
	Minimum			Maximum				

Receive

%	P	W	P	$	C	A	C	0	1	0	:	L	P	A	I	R	BCC	CR

Error codes for Write command

200 Operation is stopped.

251 Specification of the parameter is wrong. (Undefined parameter is specified.)

252
- The specified parameter does not exist. (e.g. The number of uncreated checker is specified as a parameter.)
- The specified parameter value is out of the settable range. (e.g. Maximum value of slice level is being set to over 256.)
- The specified values led to the status of “Maximum value < Minimum value” when entering them.
- (When specifying the moving distance of marker)
  A part of the circumscribing rectangle of the marker (the intersection point when Shape is Cross line) after move was out of the nine screens where checker area is settable.

254 The number of write commands received by PV200 exceeds the receivable number when executing one inspection.

Details of Read out/write Command Parameter

▶ Note

When writing maximum and minimum values in sets using %PWP command, specify maximum values in Data 1 and minimum values in Data 2. When reading two data in sets using %PRP command, the data is output in the same order.

System values

	Parameter	Read	Write	Lower limit	Upper limit	Details
Inspection time	SYS_TIME1	**Yes**		0.00	99999.00	
Inspection Cycle	SYS_TIME2	**Yes**		0.00	99999.00	
Total Judgement	SYS_RESULT	**Yes**		0	1	0:NG 1: OK
Scan Count	SYS_COUNT	**Yes**		0	2147483647	
Window Status	SYS_EDIT	**Yes**		0	1	0: RUN menu, 1: SETUP menu
Operation Status	SYS_RUN	**Yes**		0	1	0: RUN, 1: STOP
Current Type No.	SYS_TYPE	**Yes**		0	255	
Date	SYS_DATE	**Yes**	**Yes**			YYYY/MM/DD (4-digit of year/ 2-digit of Month/ 2-digit of Day)
Time	SYS_TIME	**Yes**	**Yes**			HH:MM:SS (2-digit of Hour: 2-dgit of Minute: 2-digit of Second)
System Register 0 to System Register 7	SYS:REG0 – SYS:REG7	**Yes**	**Yes**	-9999999.999	9999999.999	Up to 3-digit is available after decimal point.

Checker

The symbol of “nnn” shown in parameters is a checker number (000 - 999).

Line	Parameter	Read	Write	Lower limit	Upper limit
Max. No. of Pixels.	LICnnn:DMAX	**Yes**	**Yes**	0	125938
Min. No. of Pixels.	LICnnn:DMIN	**Yes**	**Yes**	0	125938
Max. and Min. No. of Pixels.	LICnnn:DPAIR	**Yes**	**Yes**	0	125938
Max. No. of Objects	LICnnn:LMAX	**Yes**	**Yes**	0	41979
Min. No. of Objects	LICnnn:LMIN	**Yes**	**Yes**	0	41979
Max. and Min. No. of Objects	LICnnn:LPAIR	**Yes**	**Yes**	0	41979
Binary Window	Parameter	Read	Write	Lower limit	Upper limit
OK Judge. Max.	BWCnnn:MAX	**Yes**	**Yes**	0	4194304
OK Judge. Min.	BWCnnn:MIN	**Yes**	**Yes**	0	4194304
OK Judge. Max.and Min.	BWCnnn:LPAIR	**Yes**	**Yes**	0	4194304
Gray Window	Parameter	Read	Write	Lower limit	Upper limit
OK Judge. Max.	GWCnnn:MAX	**Yes**	**Yes**	0	255
OK Judge. Min.	GWCnnn:MIN	**Yes**	**Yes**	0	255
OK Judge. Max and Min.	GWCnnn:LPAIR	**Yes**	**Yes**	0	255
Binary Edge	Parameter	Read	Write	Lower limit	Upper limit
OK Judge. Max.	BECnnn:MAX	**Yes**	**Yes**	0	256
OK Judge. Min.	BECnnn:MIN	**Yes**	**Yes**	0	256
OK Judge. Max and Min.	BECnnn:LPAIR	**Yes**	**Yes**	0	256
Gray Edge	Parameter	Read	Write	Lower limit	Upper limit
Edge Threshold	GECnnn:LVL	**Yes**	**Yes**	1	255
OK Judge. Max.	GECnnn:MAX	**Yes**	**Yes**	0	256
OK Judge. Min.	GECnnn:MIN	**Yes**	**Yes**	0	256
OK Judge. Max and Min.	GECnnn:LPAIR	**Yes**	**Yes**	0	256

Feature Extraction	Parameter	Read	Write	Lower limit	Upper limit
OK Judge. Max.	FECnnn:MAX	**Yes**	**Yes**	0	10000
OK Judge. Min.	FECnnn:MIN	**Yes**	**Yes**	0	10000
OK Judge. Max and Min.	FECnnn:LPAIR	**Yes**	**Yes**	0	10000
Smart Matching	Parameter	Read	Write	Lower limit	Upper limit
Search Count 1st step	SMCnnn:CNT.1	**Yes**	**Yes**	1	256
Search Count 2nd step	SMCnnn:CNT.2	**Yes**	**Yes**	1	256
Search Count 3rd step	SMCnnn:CNT.3	**Yes**	**Yes**	1	256
Search Count 4th step	SMCnnn:CNT.4	**Yes**	**Yes**	1	256
Search Count 5th step	SMCnnn:CNT.5	**Yes**	**Yes**	1	256
Search Count 6th step	SMCnnn:CNT.6	**Yes**	**Yes**	1	256
Max. OK No. of Subtracted Objects	SMCnnn:DCNTMAX	**Yes**	**Yes**	0	128
Flaw Detection	Parameter	Read	Write	Lower limit	Upper limit
OK Judge. Max.	FWCnnn:MAX	**Yes**	**Yes**	0	512
OK Judge. Min.	FWCnnn:MIN	**Yes**	**Yes**	0	512
OK Judge. Max and Min.	FWCnnn:LPAIR	**Yes**	**Yes**	0	512
Connector (Binary Window)	Parameter	Read	Write	Lower limit	Upper limit
Common Judge. Max.	CBWnnn:CMAX	**Yes**	**Yes**	0	62500
Common Judge. Min.	CBWnnn:CMIN	**Yes**	**Yes**	0	62500
Common Judge. Max. and Min.	CBWnnn:CPAIR	**Yes**	**Yes**	0	62500
Individual Judge. Max. *1)	CBWnnn:MAX.ss	Yes	Yes	0	62500
Individual Judge. Min. *1)	CBWnnn:MIN.ss	Yes	Yes	0	62500
Individual Judge. Max. and Min. *1)	CBWnnn:LPAIR.ss	Yes	Yes	0	62500
Connector (Gray Window)	Parameter	Read	Write	Lower limit	Upper limit
Common Judge. Max.	CGWnnn:CMAX	**Yes**	**Yes**	0	255
Common Judge. Min.	CGWnnn:CMIN	**Yes**	**Yes**	0	255
Common Judge. Max. and Min.	CGWnnn:CPAIR	**Yes**	**Yes**	0	255
Individual Judge. Max. *1)	CGWnnn:MAX.ss	Yes	Yes	0	255
Individual Judge. Min. *1)	CGWnnn:MIN.ss	Yes	Yes	0	255
Individual Judge. Max. and Min. *1)	CGWnnn:LPAIR.ss	Yes	Yes	0	255
Connector (Gray Edge)	Parameter	Read	Write	Lower limit	Upper limit
Max. Judge. Pitch	CGEnnn:PMAX	**Yes**	**Yes**	0	99999999.999
Min. Judge. Pitch	CGEnnn:PMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Judgement Pitch	CGEnnn:PPAIR	**Yes**	**Yes**	0	99999999.999
Max. Distance Difference Judgement	CGEnnn:UMAX	**Yes**	**Yes**	0	99999999.999
Min. Distance Difference Judgement	CGEnnn:UMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Distance Difference Judgement	CGEnnn:UPAIR	**Yes**	**Yes**	0	99999999.999

*1) "ss" in the parameters of Individual Judgement is cell numbers.

Smart Edge (Circle)	Parameter	Read	Write	Lower limit	Upper limit
Max. Measurement *1)	SECnnn:LMAX	**Yes**	**Yes**	0	99999999.999
Min. Measurement *1)	SECnnn:LMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Measurement *1)	SECnnn:LPAIR	**Yes**	**Yes**	0	99999999.999
Max. Standard Deviation	SECnnn:SMAX	**Yes**	**Yes**	0	99999999.999
Min. Standard Deviation	SECnnn:SMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Standard Deviation	SECnnn:SPAIR	**Yes**	**Yes**	0	99999999.999
Max. Circularity	SECnnn:CMAX	**Yes**	**Yes**	0	99999999.999
Min. Circularity	SECnnn:CMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Circularity	SECnnn:CPAIR	**Yes**	**Yes**	0	99999999.999
Max. Unused Edge Count	SECnnn:NMAX	**Yes**	**Yes**	0	3597
Smart Edge (Line)	Parameter	Read	Write	Lower limit	Upper limit
Max. Measurement *2)	SELnnn:LMAX	**Yes**	**Yes**	-99999999.999	99999999.999
Min. Measurement *2)	SELnnn:LMIN	**Yes**	**Yes**	-99999999.999	99999999.999
Max. and Min. Measurement *2)	SELnnn:LPAIR	**Yes**	**Yes**	-99999999.999	99999999.999
Max. Standard Deviation	SELnnn:SMAX	**Yes**	**Yes**	0	99999999.999
Min. Standard Deviation	SELnnn:SMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Standard Deviation	SELnnn:SPAIR	**Yes**	**Yes**	0	99999999.999
Max. Linearity	SELnnn:LIMAX	**Yes**	**Yes**	0	99999999.999
Min. Linearity	SELnnn:LIMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Linearity	SELnnn:LIPAIR	**Yes**	**Yes**	0	99999999.999
Max. Unused Edge Count	SELnnn:NMAX	**Yes**	**Yes**	0	2998
Color Window	Parameter	Read	Write	Lower limit	Upper limit
R Gray Max.	CWCnnn:RMAX	**Yes**	**Yes**	0	255
R Gray Min.	CWCnnn:RMIN	**Yes**	**Yes**	0	255
R Gray Max. and Min.	CWCnnn:RPAIR	**Yes**	**Yes**	0	255
R Gray Ave. Max.	CWCnnn:RAMAX	**Yes**	**Yes**	0	255
R Gray Ave. Min.	CWCnnn:RAMIN	**Yes**	**Yes**	0	255
R Gray Ave. Max. and Min.	CWCnnn:RAPAIR	**Yes**	**Yes**	0	255
R Gray Std. Devi. Max.	CWCnnn:RSMAX	**Yes**	**Yes**	0.000	127.500
R Gray Std. Devi. Min.	CWCnnn:RSMIN	**Yes**	**Yes**	0.000	127.500
R Gray Std. Devi. Max. and Min.	CWCnnn:RSPAIR	**Yes**	**Yes**	0.000	127.500
G Gray Max.	CWCnnn:GMAX	**Yes**	**Yes**	0	255
G Gray Min.	CWCnnn:GMIN	**Yes**	**Yes**	0	255
G Gray Max. and Min.	CWCnnn:GPAIR	**Yes**	**Yes**	0	255
G Gray Ave. Max.	CWCnnn:GAMAX	**Yes**	**Yes**	0	255
G Gray Ave. Min.	CWCnnn:GAMIN	**Yes**	**Yes**	0	255
G Gray Ave. Max. and Min.	CWCnnn:GAPAIR	**Yes**	**Yes**	0	255
G Gray Std. Devi. Max.	CWCnnn:GSMAX	**Yes**	**Yes**	0.000	127.500
G Gray Std. Devi. Min.	CWCnnn:GSMIN	**Yes**	**Yes**	0.000	127.500
G Gray Std. Devi. Max. and Min.	CWCnnn:GSPAIR	**Yes**	**Yes**	0.000	127.500
B Gray Max.	CWCnnn:BMAX	**Yes**	**Yes**	0	255
B Gray Min.	CWCnnn:BMIN	**Yes**	**Yes**	0	255
B Gray Max. and Min.	CWCnnn:BPAIR	**Yes**	**Yes**	0	255
B Gray Ave. Max.	CWCnnn:BAMAX	**Yes**	**Yes**	0	255
B Gray Ave. Min.	CWCnnn:BAMIN	**Yes**	**Yes**	0	255
B Gray Ave. Max. and Min.	CWCnnn:BAPAIR	**Yes**	**Yes**	0	255
B Gray Std. Devi. Max.	CWCnnn:BSMAX	**Yes**	**Yes**	0.000	127.500
B Gray Std. Devi. Min.	CWCnnn:BSMIN	**Yes**	**Yes**	0.000	127.500
B Gray Std. Devi. Max. and Min.	CWCnnn:BSPAIR	**Yes**	**Yes**	0.000	127.500

*1) "Measurement": Radius, Width or Diameter (Determined by the selection of "Detect Mode".)
*2) "Measurement": Deviation, Distance or Width (Determined by the selection of "Detect Mode".)

Geometry Calculation

Geometry Calculation	Parameter	Read	Write	Lower limit	Upper limit
Max. X Coord. (IP X, Center X)	GGCnnn:XMAX	**Yes**	**Yes**	-99999999.999	99999999.999
Min. X Coord. (IP X, Center X)	GGCnnn:XMIN	**Yes**	**Yes**	-99999999.999	99999999.999
Max. and Min. X Coord.(IP X, Center X)	GGCnnn:XPAIR	**Yes**	**Yes**	-99999999.999	99999999.999
Max. Y Coord. (IP Y, Center Y)	GGCnnn:YMAX	**Yes**	**Yes**	-99999999.999	99999999.999
Min. Y Coord. (IP Y, Center Y)	GGCnnn:YMIN	**Yes**	**Yes**	-99999999.999	99999999.999
Max. and Min. Y Coord.(IP Y, Center Y)	GGCnnn:YPAIR	**Yes**	**Yes**	-99999999.999	99999999.999
Max. Standard Deviation	GGCnnn:SMAX	**Yes**	**Yes**	0	99999999.999
Min. Standard Deviation	GGCnnn:SMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Standard Deviation	GGCnnn:SPAIR	**Yes**	**Yes**	0	99999999.999
Max. Angle (Line Angle, Pedal Angle, Major Axis Angle)	GGCnnn:AMAX	**Yes**	**Yes**	-99999999.999	99999999.999
Min. Angle (Line Angle, Pedal Angle, Major Axis Angle)	GGCnnn:AMIN	**Yes**	**Yes**	-99999999.999	99999999.999
Max. and Min. Angle (Line Angle, Pedal Angle, Major Axis Angle)	GGCnnn:APAIR	**Yes**	**Yes**	-99999999.999	99999999.999
Max. Distance	GGCnnn:DMAX	**Yes**	**Yes**	0	99999999.999
Min. Distance	GGCnnn:DMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Distance	GGCnnn:DPAIR	**Yes**	**Yes**	0	99999999.999
Max. Intersecting Angle	GGCnnn:CAMAX	**Yes**	**Yes**	0	360.000
Min. Intersecting Angle	GGCnnn:CAMIN	**Yes**	**Yes**	0	360.000
Max. and Min. Intersecting Angle	GGCnnn:CAPAIR	**Yes**	**Yes**	0	360.000
Max. Radius	GGCnnn:RMAX	**Yes**	**Yes**	0	99999999.999
Min. Radius	GGCnnn:RMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Radius	GGCnnn:RPAIR	**Yes**	**Yes**	0	99999999.999
Max. Major Axis	GGCnnn:LAMAX	**Yes**	**Yes**	0	99999999.999
Min. Major Axis	GGCnnn:LAMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Major Axis	GGCnnn:LAPAIR	**Yes**	**Yes**	0	99999999.999
Max. Minor Axis	GGCnnn:SAMAX	**Yes**	**Yes**	0	99999999.999
Min. Minor Axis	GGCnnn:SAMIN	**Yes**	**Yes**	0	99999999.999
Max. and Min. Minor Axis	GGCnnn:SAPAIR	**Yes**	**Yes**	0	99999999.999

Slice Level

The symbol of “?” shown in parameters is a slice level group (Camera 0: A - Z, Camera 1: Not supported)

	Parameter	Read	Write	Lower limit	Upper limit
Max. Slice Level	BLV:H?	**Yes**	**Yes**	0	255
Min. Slice Level	BLV:L?	**Yes**	**Yes**	0	255
Max. and Min. Slice Level	BLV:PAIR?	**Yes**	**Yes**	0	255

Numerical calculation

The symbol of “nnn” shown in parameters is a numerical calculation number (000 - 999).

	Parameter	Read	Write	Lower limit	Upper limit
Max. Judgement	CACnnn:MAX	**Yes**	**Yes**	-2147483648	2147483647
Min. Judgement	CACnnn:MIN	**Yes**	**Yes**	-2147483648	2147483647
Judge. Max. and Min.	CACnnn:LPAIR	**Yes**	**Yes**	-2147483648	2147483647

Marker

As the marker position should be read/write with a set of X and Y coordinates, use "%PRP" command or "%PWP" command.

Coordinate values to be read is in units of 0.5 pixels, and the moving distance to be written is in pixel. It is not possible to read or write with the values after calibration.

"c" of "MRKcg" in the parameters is camera numbers (0-1), and "g" is marker numbers (0-7).

	Parameter	Read	Write	Lower limit	Upper limit	Details
Central Coordinate (Read))	MRKcg_CXY	**Yes**	---	-2048	4095	Data 1 = X coordi. *1)
				-2048	4095	Data 2 = Y coordi. *1)
Central Coordinate Moving Distance (Write)	MRKcg:MOVE	---	**Yes**	-6143	6143	Data 1 = Distance X *2)
				-6143	6143	Data 2 = Distance Y *2)

*1) The number of digits of the coordinate values of response to the read command is as below.

Example

- Positive value: Max. 6 digits
  (Integar portion: Max. 4 digits, Decimal point: 1 digit, Decimal portion: 1 digit)

4	2	8	.	0

- Negative value: Max. 7 digits
  (Sign: 1 digit, Integar portion: Max. 4 digits, Decimal point: 1 digit, Decimal portion: 1 digit)

—	4	2	8	.	0

*2) Specify values with the following number of digits to write the moving distance.

Example

- Positive value: Max. 4 digits (Integar portion: Max. 4 digits)

1	0

- Negative value: Max. 5 digits (Sign: 1 digit, Integar portion: Max. 4 digits)

—	1	2	0	0

9.3 PLC Communication

9.3.1 Overview and Communication Specifications

This method communicates with a PLC according to the protocol of the destination PLC. Either RS-232C interface or Ethernet interface can be used. (Refer to 9.1.3 Protocol for details.)
The following communications are available with PV200.

・General output

PV200 writes the inspection results (Scan count, Total judgement, Judgement and Numeric calculation), to the specified register of PLC as the beginning. Only integers can be written. The PLC does not need a communication program to receive data. For the information of the settings to use this function, refer to "PLC Communication Common Setting" (page 426) and "PLC Communication (General) Output Setting" (page 427). For the procedure of result output, refer to "9.3.3 Outputting Data through PLC Communication " (page 433).

・Control command (Available from Ver1.2)

Using this function enables to control PV200, read and change the setting values. Only integers can be read and changed. For the information of the settings to use this function, refer to "PLC Communication Common Setting" (page 426) and "PLC Communication Control Command Setting" (page 430). For the timing of sending and receiving commands between PV200 and PLC, refer to "9.3.4 Controlling PV200 through PLC Communication " (page 435).
For the details of the control and commands to be used, refer to "9.3.5 List of Commands for PLC Communication".

PV200 can accept all the general commands described in Chapter 9.2 even when PLC communication is selected.

Usable PLCs for PLC Communication

The following list shows the PLC models available for PLC communication via a RS232C or Ethernet interface.

Manufacturer	Model (series) name	RS232C	Ethernet
Panasonic Electric Works SUNX Co., Ltd.	FP series	Available *1)	Available *2)
	FP2 ET-LAN unit		Available
Mitsubishi Electric Corporation (MELSEC)	A series	Available	
	Q series	Available	Available *3)
	FX series (FX1N)	Available	
	FX-2N series (FX2N, FX3U, FX3UC)	Available	
OMRON Corporation	C series, CV series, CS1 series	Available	
Allen-Bradley	SLC500	Available	
Fuji Electric FA Components & Systems Co., Ltd.	MICREX-SX SPH series	Available	
(Standard) MODBUS RTU		Available	

*1) TOOL port, COM port, FP2-MCU (RS232C communication block), FP2-CCU
*2) Applicable unit: FP-X COM5 communication cassette, FP Web Server 2 unit
*3) Applicable unit: QJ71E71-100 (PLC communication with a PLC unit with a built-in Ethernet port is not possible.)

▶ Note

- When Baud Rate is "115200 bps", the communication via RS232C interface may not be carried out stably in accordance with PLC to communicate with. In the case, set Baud Rate to "57600 bps" or lower.
- PLC communication via Ethernet interface is performed with UDP/IP.

Specifications of PLCs

▶ Note

In accordance with specification of PLCs, some of the registers in "Usable range" of "Usable device" listed below could not be used. Please confirm the specifications of PLC before use.

FP series / FP series (ET-LAN unit) by Panasonic Electric Works SUNX Co., Ltd.

- Protocol: MEWTOCOL
- Usable device

Data output/ Type switch		DT
Data output completion notice	Register*	WR
	Bit	0-15 (0-F)
Control command	Control Register	WR
	Command Input/Output Register	DT

- Sum check: Yes (type: BCC)

Q series / Q series Ethernet unit by Mitsubishi Electric Corporation

- Protocol:
  - RS232C interface: “Format 4”, 4C frame compatible for QnA
  - Ethernet interface: 3E frame compatible for QnA

    However, communication is only available with Ethernet unit QJ71E71-100.
- Usable device

Data output/ Type switch		D
Data output completion notice	Register*	M
	Bit	Invalid
Control command	Control Register	M
	Command Input/Output Register	D

- Make the following setting with PLC.

  When using RS-232C Interface
  - Sum check: Yes (type: BCC)
  - Write at RUN time: "Enable"

  When using Ethernet interface
  - Communication data code: Binary code communication
  - Initial timing setting: Always wait for OPEN
  - Send frame setting: Ethernet(V2.0)
  - Write at RUN time: "Enable"

A series by Mitsubishi Electric Corporation

- Protocol: “Format 4”, 1C frame compatible for A
- Usable device

Data output/ Type switch		D
Data output completion notice	Register*	M
	Bit	Invalid
Control command	Control Register	M
	Command Input/Output Register	D

- Make the following setting with PLC.
  - Sum check: Yes (type: BCC)
  - Modification in RUN mode: Available

FX series by Mitsubishi Electric Corporation

- CPU: FX1N, Communication adapter: FX1N-232-BD
- Protocol: Special protocol for FX1N
  Register for specifying communication format: Store "0" in D8120. (Reboot the PLC after the setting.)
- Usable device

Data output/ Type switch		D
Data output completion notice	Register*	M
	Bit	Invalid
Control command	Control Register	M
	Command Input/Output Register	D

- Sum check: Yes
  With PLC, you cannot select to perform sum check. Automatically “Yes” is selected.

FX-2N series by Mitsubishi Electric Corporation

- CPU: FX2N, FX3U, FX3UC
  Communication adapter: FX2N-232-BD, FX3U-232-BD, FX3U-232-ADP
- Protocol: Special protocol for FX2N
  Register for specifying communication format: Store "0" in D8120. (Reboot the PLC after the setting.)
- Usable device

Data output/ Type switch		D
Data output completion notice	Register*	M
	Bit	Invalid
Control command	Control Register	M
	Command Input/Output Register	D

- Sum check: Yes
  With PLC, you cannot select to perform sum check. Automatically “Yes” is selected.

C, CV, and CS1 series by OMRON Corporation

- Protocol: Host link
- Usable device

Data output/ Type switch		D / DM
Data output completion notice	Register*	CIO / IR
	Bit	0-15 (0-F)
Control command	Control Register	CIO / IR
	Command Input/Output Register	D / DM

- Make the following setting with PLC.
  - Sum check: Yes
  - Station No.: "0"
- Communication is not available when PLC is in "Run" mode. Change to "Monitor" mode to communicate.

SLC series by Allen-Bradley

- Usable device

Data output/ Type switch		N7 (Only integer registers)
Data output completion notice	Register*	N7 (Only integer registers)
	Bit	0-15 (0-F)
Control command	Control Register	N7 (Only integer registers)
	Command Input/Output Register	N7 (Only integer registers)

- Make the following setting with PLC.
  - Duplicate Detect: OFF
  - ACK Timeout (*20 ms): 20
  - Control Line: NO HANDSHAKING
  - Error Detect: CRC

- NAK Retries: 3
- ENQ Retries: 0
- Embedded Responses: AUTO DETECT

MICREX-SX (SPH series) by Fuji Electric FA Components & Systems Co., Ltd.

- Usable device
- Usable device

Data output/ Type switch		%MW3
Data output completion notice	Register*	%MW3
	Bit	0-15 (0-F)
Control command	Control Register	%MW3
	Command Input/Output Register	%MW3

- Sum check: Yes (type: BCC, the calculation method developed by Fuji is used.)

MODBUS RTU

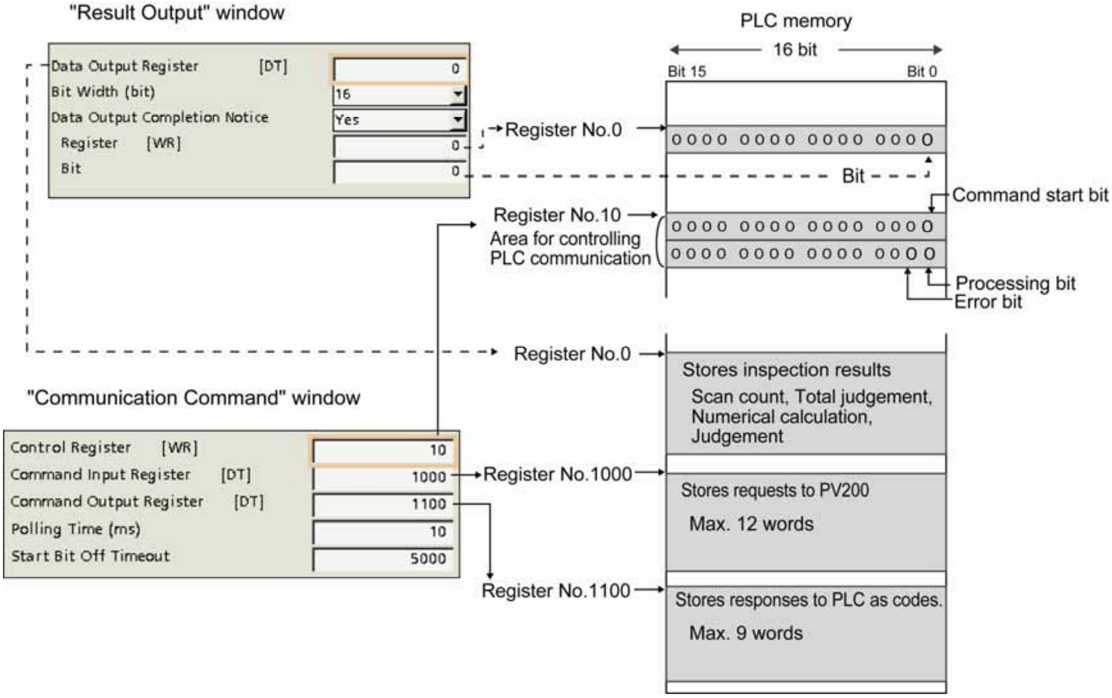
- Usable device

Data output/ Type switch		Holding register
Data output completion notice	Bit	Coil
Control command	Control Register	Coil
	Command Input/Output Register	Holding register

9.3.2 Setting PLC Communication

In PLC communication, commands and results are sent and received using the registers of a PLC to communicate. More than one register area is used for each function. Set register areas as the figure below.

Relation between setting items and PLC registers



Data Output Register	[DT]	0
Bit Width (bit)		16
Data Output Completion Notice		Yes
Register	[WR]	0
Bit		0

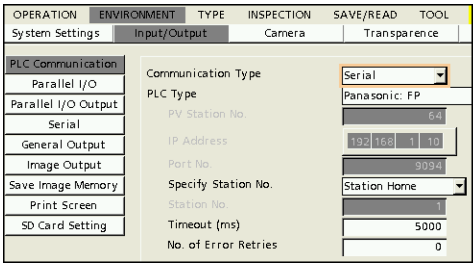
Control Register	[WR]	10
Command Input Register	[DT]	1000
Command Output Register	[DT]	1100
Polling Time (ms)		10
Start Bit Off Timeout		5000

(The function relating to the communication command setting is available from Ver1.2. In the versions older than Ver1.2, the menu configuration of the function relating to the result output is different.

PLC Communication Common Setting

This is the common setting for sending and receiving result output and control commands.

1. **Select "ENVIRONMENT" > "Input/Output" > "PLC Communication" from the menu bar.**



Communication Type	Serial
PLC Type	Panasonic: FP
PV Station No.	64
IP Address	192 168 1 10
Port No.	9094
Specify Station No.	Station Home
Station No.	1
Timeout (ms)	5000
No. of Error Retries	0

2. **Select a communication port in "Communication Type".**
Select "PLC Type".

Serial	Communicates with RS-232C interface. Refer to page 431 for the detailed setting.
Ethernet	Communicates with Ethernet interface. Refer to page 431 for the detailed setting.

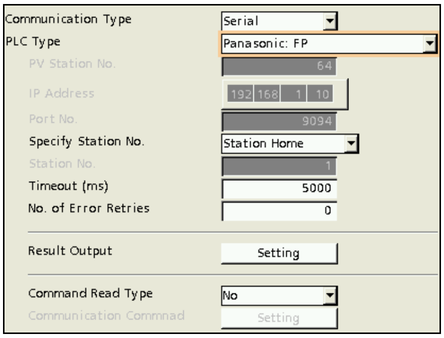
Selectable PLC types differ depending on the communication type.

3. **Set time for “Timeout (ms)”.**

20 – 20000 msec (default: 5000)

Note

When PV200 writes data in the specified address of PLC, it sends and receives commands and response messages in the dedicated protocol between PV200 and PLC. The value set here is Timeout in the message communication in this case.
If PLC sends no response in the time of Timeout, a timeout error occurs.



Communication Type	Serial
PLC Type	Panasonic: FP
PV Station No.	64
IP Address	192 168 1 10
Port No.	9094
Specify Station No.	Station Home
Station No.	1
Timeout (ms)	5000
No. of Error Retries	0
Result Output	Setting
Command Read Type	No
Communication Commnad	Setting

4. **Set "No. of Error Retries".**
0 – 255 (Default: 0)

5. **According to the function to be used, set "Result Output" or "Communication Command".**

PLC Communication (General) Output Setting

1. **Make PLC communication common settings. Refer to page 426.**

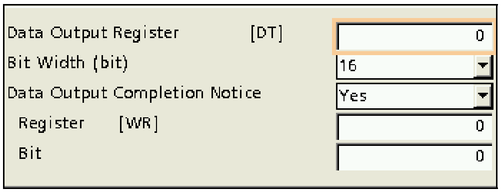
2. **Select “ENVIRONMENT” > “Input/Output” > “PLC Communication” > “Result Output” from the menu bar.**

3. **In “Data Output Register”, specify the first register number of the PLC that PV200 outputs data into.**

0 to 99999 are available.

Note

Not all addresses 0 to 99999 can be used in destination PLC. As the address allowed to be written by the external device (PV200) varies depending on PLC, please make sure the address with the instruction manual of PLC.
The number of data registers differ depending on the number of data to be output and "Bit Width". Be sure to set address number not to destroy the contents of registers used for other applications.



Data Output Register [DT]	0
Bit Width (bit)	16
Data Output Completion Notice	Yes
Register [WR]	0
Bit	0

4. **Select 16-bit or 32-bit to output Scan count and Numerical calculation data in “Bit Width” according to the maximum value of the data to be output.**

When output data exceeds the value which can be output in the selected Bit Width, "0" is output.

5. **To notice to PLC that data output is complete, set “Data Output Completion Notice” to “Yes”.**

Specify an address to make the specified bit to “1” and the bit.

Register: 0 - 99999:	It varies according to the PLC used.
Bit: 0 - 15:	Specifying “15” makes the highest order bit "1".

▶ Note

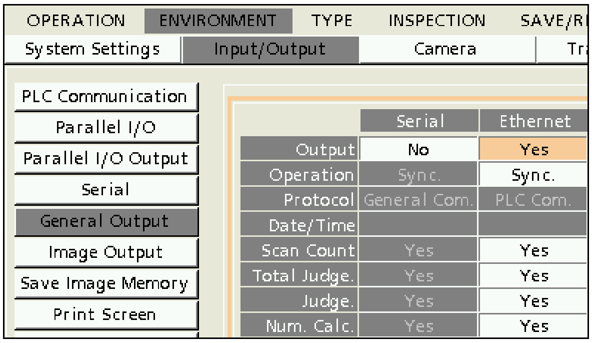
For Mitsubishi PLC, enter interface No. to output register. (Output bit is invalid.)

6. **Select “ENVIRONMENT” > “Input/Output” > “General Output” from the menu bar.**

7. **Set "Output" to "Yes" for the selected communication port, and select "PLC communication" in Protocol.**

When the communication port is Ethernet, select the column of PLC communication in advance. For PLC communication, either “Serial” or “Ethernet” can be selected..

8. **Set “Scan Count”, “Total Judgement”, “Judgement”, and “Numerical Calculation” to “Yes” as necessary.**



	Serial	Ethernet
Output	No	Yes
Operation	Sync.	Sync.
Protocol	General Com.	PLC Com.
Date/Time		
Scan Count	Yes	Yes
Total Judge.	Yes	Yes
Judge.	Yes	Yes
Num. Calc.	Yes	Yes

Example of General Output

Output Condition - Output Data:

- Scan count: 1234 times
- Total Judgement: OK
- Judgement: JDC000=OK, JDC001=unset, JDC002=NG, JDC003 or later=Unset
- Numerical Calculation: CAC000=215.3, CAC001=unset, CAC002=-2184.0, CAC003 or later=Unset

Output Result: Bit Width(bit) = 16 bit, Data Output Register = 500

Data	Register No.	Value (Hex.)	Description	Details
Scan Count	500	04D2	"1234" is stored.	Scan Count
			Bit 15 ←→ Bit 0	
Total Judgement	501	0001	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1	OK
Judgement	502	E01E	1 1 1 0 0 0 0 0 0 0 0 1 1 1 1 0	JDC001, JDC002
Numerical calculation	503	00D7	"215" is stored.	CAC000
	504	F778	"-2184" is stored.	CAC002

Concept:

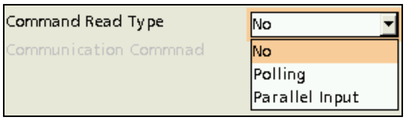
- The number of scans is stored in the start register (data output register).
  When specifying "32-bit" for "Bit Width", the number of scans is stored in the first two registers.
- Four pieces of judgement data are stored per word (16 bits). (Four bits are used for a piece of data.)
  Data is output up to Judgement specified with the largest number. For unset judgement data within the range, "E" is output such as JDC000.
  Also, when the number of output data is "3" which is not multiples of 4 like this example, "E" is stored in each part which cannot make a word.
- Only the data of Numeric Calculation that are set to output are output.
  (In the case where the data of CAC000 or CAC002 is out of the range between -32768 and +32767, "0" is stored in the registers No.503 and 504.)
- Negative numbers are output in the complement number of 2.
- When specifying "32-bit" for "Output data";
  - Four Judgement data are stored per word as the same as when you select "16-bit".
  - Each data of Scan Count and Numerical Calculation uses two words (32-bit). In the case, the data is output from of lower 16-bit to upper 16-bit, and data of lower word (16-bit) is stored in the register of smaller number.

PLC Communication Control Command Setting (Available from Ver1.2)

1. **Make PLC communication common settings. Refer to page 426.**

2. **Select either "Polling" or "Parallel Input" in "Command Read Type" from "ENVIRONMENT" > "Input/Output" > "PLC Communication".**

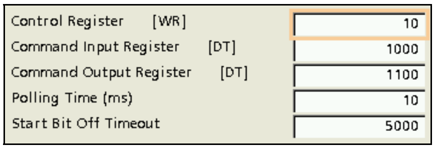
   Select the trigger for PV200 to start reading data from PLC.



Command Read Type: No

No	Not perform command control.
Polling:	Periodically checks whether commands are written in PLC or not, and starts reading the commands once the completion is confirmed. The response speed is slower than that of "Parallel Input". The time such as the time of inspection or image output gets longer because the polling process is performed even during the inspection. Set "Polling Time" and "Start Bit Off Timeout" in step 7.
Parallel Input	Starts reading commands from PLC when the signal is input to PV200 from a parallel input terminal (*). *: Terminal among one of ASSIGN0, 1 and EXTRA 0 to 2 assigned to "PLC Communication Command". (Set in "ENVIRONMENT" > "Input/Output" > "Parallel I/O")

3. **Open the "Communication Command" menu.**



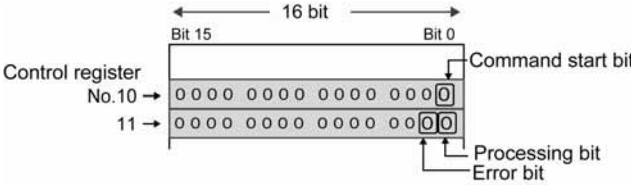
Control Register [WR]	10
Command Input Register [DT]	1000
Command Output Register [DT]	1100
Polling Time (ms)	10
Start Bit Off Timeout	5000

▶ Note

The display of "WR" and "DT" in the menu is different between PLC types.

4. **"Control Register": Specify the start address of the control register to be used for sending and receiving the control command.**

   According to the bit information of the specified control register, it is used as the command start bit, error bit or processing bit.
   For the information of using the control register, refer to "Controlling PV200 through PLC Communication" (page 435).



Example: Control Register = 10

5. **"Command Input Register": Specify the start register number in which PLC writes commands for PV200.**

   There is a command which uses a maximum of twelve words. It is recommended not to use twelve words for other applications.
   Refer to page 440 for the details of commands.

6. **"Command Output Register": Specify the start register number in which PV200 writes responses to PLC.**

   There is a response which uses a maximum of nine words. It is recommended not to use nine words for other applications.
   Refer to page 440 for the details of responses.

7. **When "Polling" was selected in step 2, set "Polling Time (ms)" and "Start Bit Off Timeout (ms)".**

"Polling Time"	The cycle that PV200 monitors the registers of PLC. The shorter the cycle, the faster the response after a command is written by PLC. However, it affects the execution time as PV200 monitors the PLC registers during inspections. The actual polling frequency may be longer than the frequency set here. The actual polling frequency is displayed in the information area of RUN menu. Please check it.
"Start Bit Off Timeout"	The time until PLC turns off the command start bit after PV200 turns on the command processing bit. The error (E0113) occurs when the command start bit does not turn off within the time set here.

When performing PLC communication using RS-232C Interface

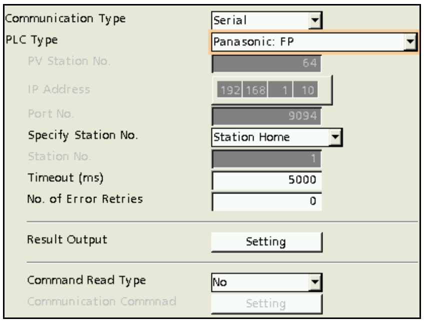
▶ Note For the information of applicable PLC types, refer to page 422.

1. **Make PLC communication common settings.**
   (Refer to page 426.)

2. **Only when selecting "Panasonic: FP" for PLC Type, set "Specify Station No.".**

   Station Home (Default):
   A command which specifies no station number is issued.
   Example) %EE#WDD0001 · · · · ·

   Specify Station No. (Station No.:1 – 99):
   A command for a PLC with the specified station number is issued. Specify the same number of the station number that is set for the PLC to communicate in "Station No.".
   Example) When Station No. is 99 %99#WDD0001 · · · ·



Communication Type: Serial
PLC Type: Panasonic: FP
PV Station No.: 64
IP Address: 192 168 1 10
Port No.: 9094
Specify Station No.: Station Home
Station No.: 1
Timeout (ms): 5000
No. of Error Retries: 0
Command Read Type: No

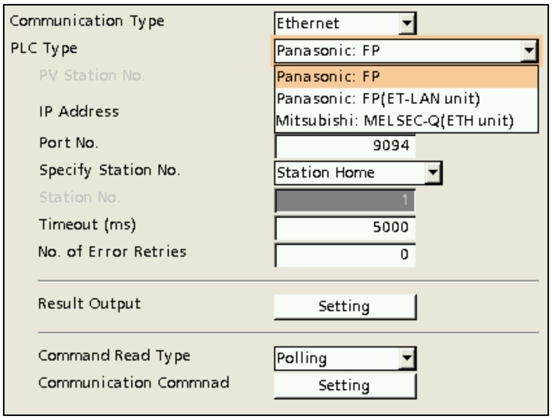
When performing PLC communication using Ethernet interface

▼Refer to▼

Refer to page 347 for details of network settings.

▶ Note

Applicable PLCs are three types. Refer to page 422 for details.


Communication Type: Ethernet
PLC Type: Panasonic: FP

PV Station No.
IP Address
Port No.: 9094
Specify Station No.: Station Home
Station No.: 1
Timeout (ms): 5000
No. of Error Retries: 0

Command Read Type: Polling

1. **Make PLC communication common settings.**
(Refer to page 426.)

2. **Specify the network setting of the selected "PLC Type".**

The network setting consists as listed below.

- PV Station No.
- PLC IP Address
- PLC Port No.
- Specify PLC Station No.
- PLC Station No.

Note

Items to be specified vary depending on the selected PLC type. For the detail, refer to steps 3 to 6..

3. **Specify the PV200 station No. in "PV Station No.".**

Selectable station No.: 1 – 64

Note

Set only when PLC Type is Panasonic: FP (ET-LAN unit)

4. **Assign the IP address to the PLC.**

5. **Specify the port number of the PLC.**

Input the same number as the port number set on the PLC to communicate.
When PLC Type is " Panasonic: FP " or " Panasonic: FP(ET-LAN unit) "
Available port No. on PV200: 1 to 32767 (except 8600 to 8699 and 9090)
Default: 9094

When PLC Type is Mitsubishi: MELSEC-Q (Ethernet unit)
Available port No. on PV200: 1 to 65534 (except 8600 to 8699 and 9090)
Default: 5000

6. **Only when selecting "Panasonic: FP" or "Panasonic: FP(ET-LAN unit)" for PLC Type, set "Specify Station No.".**

Station Home (Default):
A command which specifies no station number is issued.
Example) %EE#WDD0001 · · · · ·

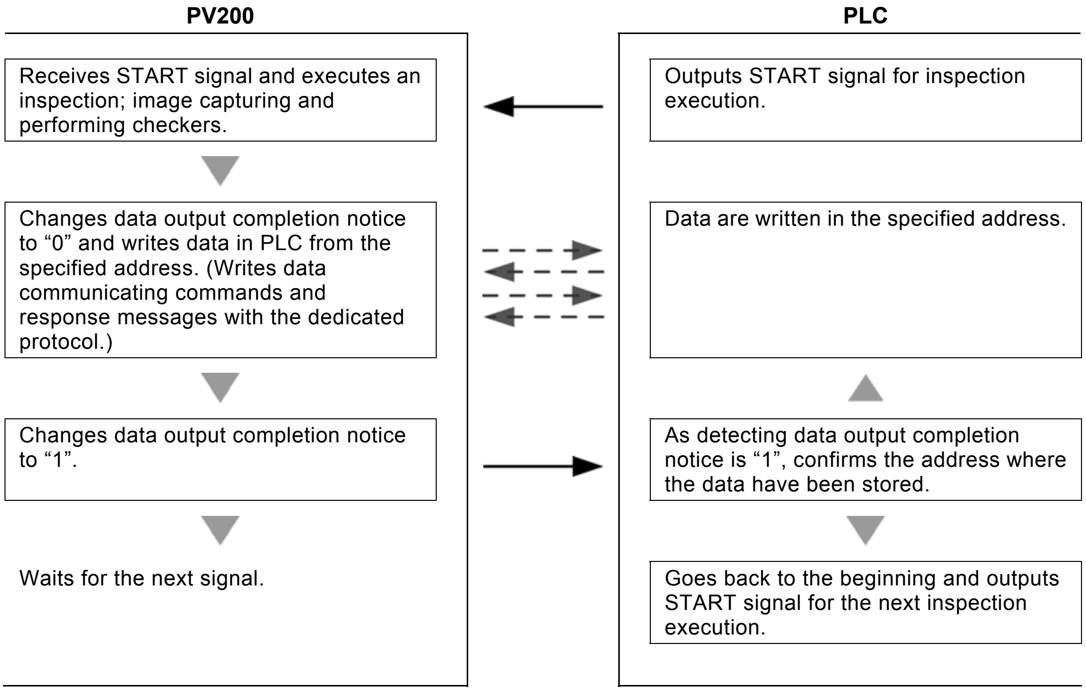
Specify Station No. (Station No.:1 – 99):
A command for a PLC with the specified station number is issued. Specify the same number of the station number that is set for the PLC to communicate in "Station No.".
Example) When Station No. is 99 %99#WDD0001 · · · · ·

When PLC Type is " Panasonic: FP "
Selectable station No.: 1 – 99

When PLC Type is "Panasonic: FP(ET-LAN unit)"
Selectable station No.: 1 – 64
The number specified in the step 3 "PV Station No." cannot be used.

9.3.3 Outputting Data through PLC Communication

Data Output Flaw



Receives START signal and executes an inspection; image capturing and performing checkers.

Changes data output completion notice to “0” and writes data in PLC from the specified address. (Writes data communicating commands and response messages with the dedicated protocol.)

Changes data output completion notice to “1”.

Waits for the next signal.

Outputs START signal for inspection execution.

Data are written in the specified address.

As detecting data output completion notice is “1”, confirms the address where the data have been stored.

Goes back to the beginning and outputs START signal for the next inspection execution.

About Data that can be Output

When PV200 executes inspection, the data set to output are output in the following order.

1. Scan Count
2. Total Judgement
3. Judgement result:
4. Numerical Calculation:

Up to 1000 points combining judgements and numerical calculations.

In the following cases, the data of Judgement and Numeric Calculation are not output to PLC.

- PV sets data to output, but no data exist.
- The setting data exist, but data are set to not to be output.

Output format of Scan count:

Output Data	Differs depending on the setting of Output bit width. • Range (16 bits) between 0 and 32767 • Range (32 bits) between 0 and 2147483647	
Number of Data	1	
Values to be Output	Normal	0 to 2147483647
	Overflow (when exceeding the specified "Bit Width")	0

Output format of Judgement data:

Output Data	A Judgement is output in 4-bit (digit) unit Four data of Judgement per word from PLC are saved starting with LSB. When the outputting data is other than multiples of four, hexadecimal E is output.	
Number of Data	Up to 1000	
Values to be Output	OK	1 in hexadecimal form (0001 in binary form)
	NG	0 in hexadecimal form (0000 in binary form)
	Error	E in hexadecimal form (1110 in binary form)
	Unset	Data are not output. (But if the Judgement data No.s before and after the unset data No. are set to output, E is output in 16-digit form (1110 in binary form).)

Output format of Total Judgement:

Output Data	Regardless of output bit width, it is output in the last bit using one word.	
Number of Data	1	
Values to be Output	OK	1 in hexadecimal form (0001 in binary form)
	NG	0 in hexadecimal form (0000 in binary form)
	Error	E in hexadecimal form (1110 in binary form)
	Unset	E in hexadecimal form (1110 in binary form)

Output format of Scan Count and Numerical Calculation:

The values that can be output are only integers. Actual values with value after decimal point are rounded to whole number and output.

Output Data	Differs depending on the setting of Output bit width. • Range of 16-bit: -32768 to 32767 • Range of 32-bit: -2147483648 to 2147483647	
Number of Data	Numerical Calculation: Up to 1000	
Values to be Output	Normal	Calculation results: -2147483648 to +2147483647
	Overflow (when exceeding the specified "Bit Width")	0 (including the overflowing numeric calculations and the results)
	Error	0
	Unset	Data are not output.

9.3.4 Controlling PV200 through PLC Communication

(Available from Ver1.2)

For controlling PV200 through PLC Communication, PLC sends commands to PV200 and receives the responses.

For the details of the control and commands to be used, refer to "9.3.5 List of Commands for PLC Communication".

PV200 uses the following signals for the timings that PV200 reads commands sent by PLC and PLC receives responses. Refer to the timing charts for the details of the timing of each signal.

Those signals can be read when PV200 is in RUN menu. PV200 cannot be controlled when it is in SETUP menu. (Refer to page 438.)

Timing signal for PV200 to read the command sent by PLC

The timing varies according to the selected "Command Read Type".

Polling	Uses the command start bit of the control register. PLC turns on the command start bit after writing a command.
Parallel Input	PLC turns on the signal of "Read PLC Communication Command" assigned to ASSIGN or EXTRA after writing a command.

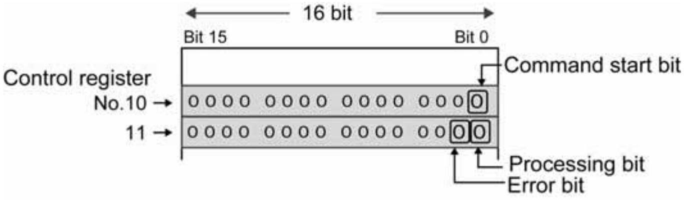
Timing signal for PLC to read the received response

PV200 sets the response completion (COR = the first word of command output register) to 1 after writing responses.

Also, PV200 sets the processing bit of the control register to zero after setting the response completion (COR) to one.

Control register

Example: Control Register = 10



Command start bit:

The zeroth register number specified in "Control Register".
It is used when setting "Command Read Type" to "Polling". It indicates that a command was sent to PV200 from PLC. PLC turns on (sets to 1) after setting the command. PV200 performs polling, and starts reading the command after confirming this bit is on. Also, PLC turns off this bit (sets to zero) when the processing bit is on.

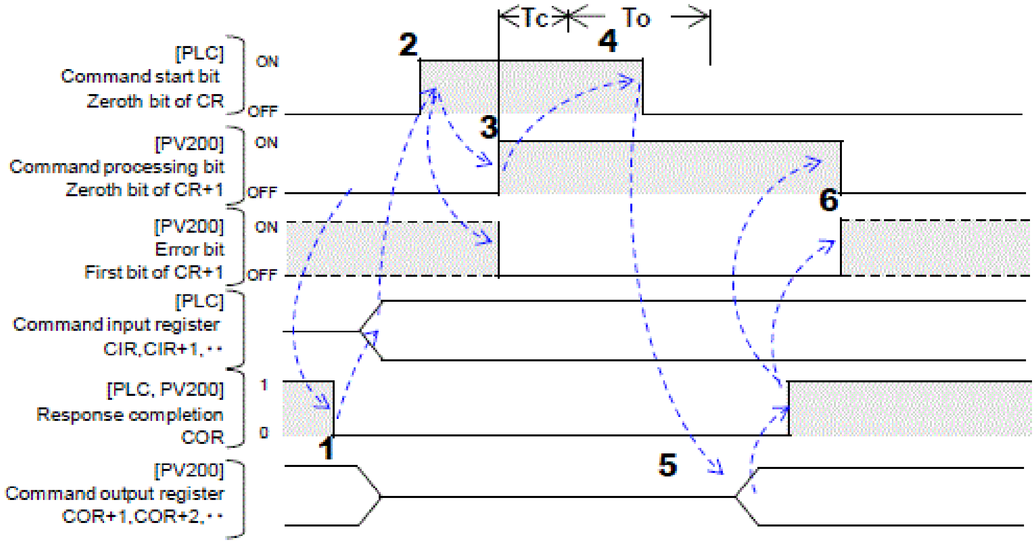
Processing bit:

The zeroth bit of the next register number specified in "Control Register".
PV200 turns on this bit (sets to 1) during the command processing. After the processing, PV200 writes response to the command in the command output register and turns off this bit (sets to zero). Monitoring this bit shows the timing that the next trigger can be used.

Error bit:

The first bit of the next register number specified in "Control Register".
It indicates that an error occurred. When an error occurred, PV200 turns on this bit (sets to 1).
(1) When the response error to the control command occurred
(2) When the "Start Bit Off Timeout" error occurred when using polling

PLC Communication: Control Command Timing Chart (Command Read Type: Polling)


Tc
To
2
4
3
6
1
5
[PLC] Command start bit Zeroth bit of CR
ON
OFF
[PV200] Command processing bit Zeroth bit of CR+1
ON
OFF
[PV200] Error bit First bit of CR+1
ON
OFF
[PLC] Command input register CIR,CIR+1,・・
[PLC, PV200] Response completion COR
1
0
[PV200] Command output register COR+1,COR+2,・・

Tc: Command processing time. It varies depending on the content. For example, the processing time of saving data in a SD card may be over several seconds.
To: Timeout period. An error occurs when the command start bit does not turn off within the time of Tc + To.
CR: PLC address specified in "Control Register".
CIR: PLC address specified in "Command Input Register".
COR: PLC address specified in "Command Output Register".

1. **PLC confirms that the command processing bit is off, and resets the response completion (COR) to zero to clear the previous result output. (Off-state) Then, PLC writes a command in the command input registers (CIR, CIR+1, ...) to give PV200.**

2. **PLC turns on the command start bit.**
   PV200 monitors the command start bit in the specified polling cycle, and starts reading the commands from the command input register (CIR) as the first register once it confirms that the start bit is on.

3. **PV200 turns on the command processing bit. Also, PV200 turns off the error bit regardless of the previous state.**

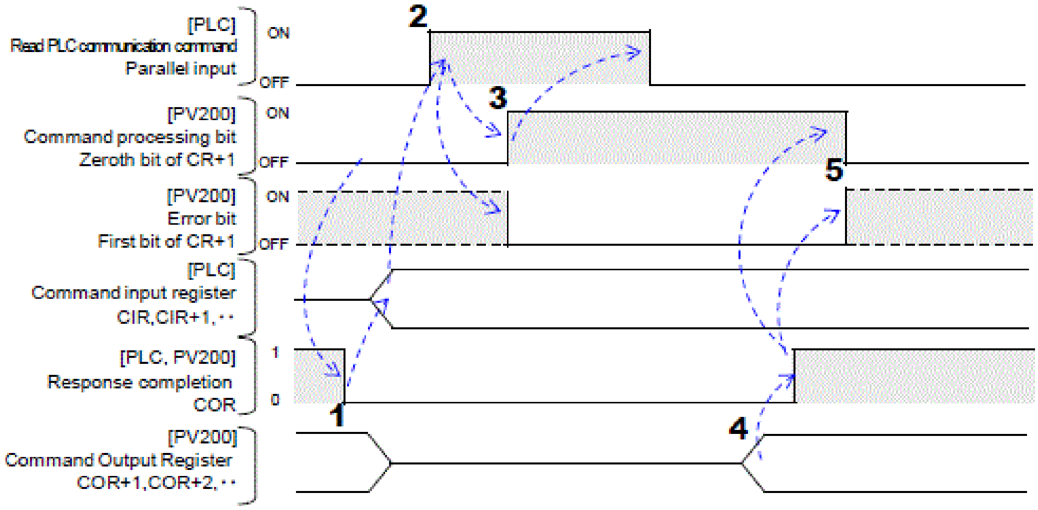
4. **PLC turns off the command start bit within the time of Tc + To after confirming the command processing bit is on.**
   During this process, PV200 confirms that the command start bit is off by polling.

   PV200 responds the error code (113) when the command start bit does not turn off within the time of Tc + To.

5. **PV200 write responses in the command output register, and then sets the response completion (COR) to 1. (On-state)**

6. **PV200 turns off or on the error bit according to the error occurrence, and then turns off the command processing bit.**

PLC Communication: Control Command Timing Chart (Command Read Type: Parallel Input)



CR: PLC address specified in "Control Register".
CIR: PLC address specified in "Command Input Register".
COR: PLC address specified in "Command Output Register".

1. **PLC confirms that the command processing bit is off, and resets the response completion (COR) to zero to clear the previous result output. (Off-state) Then, PLC writes a command in the command input registers (CIR, CIR+1, ...) to give PV200.**

2. **PLC turns on the "Read PLC Communication Command" assigned to the parallel I/O terminal of PV200.**
   PV200 starts reading the commands from the command input register (CIR) as the first register once it confirms this parallel signal is on.

   Assign "Read PLC Communication Command" to one of ASSIGN0-1 and EXTRA0-2 from "ENVIRONMENT" > "Input/Output" > "Parallel" in SETUP menu.

3. **PV200 turns on the command processing bit. Also, PV200 turns off the error bit regardless of the previous state.**
   PLC can turn off the "Read PLC Communication Command" signal after turning on the command processing bit.

4. **PV200 write responses in the command output register, and then sets the response completion (COR) to 1. (On-state)**

5. **PV200 turns off or on the error bit according to the error occurrence, and then turns off the command processing bit.**

9.3.5 List of Commands for PLC Communication

(Available from Ver1.2)

The commands and the modes permitting the commands are listed below.

			Command Permission				
		For details, refer to	RUN Menu		SETUP Menu	Parallel Processing	Continuous Inspection
			RUN	STOP	STOP		
Inspection start	**Common Trigger**	**Page 440**	**Yes**			**Yes**	**Yes**
Start reinspection (to inspect on the current memory image without capturing a new image)		**Page 441**	**Yes**			**Yes**	
Switch product type		**Page 444**	**Yes**			**Yes**	**Yes**
Save the setting data	**Storage space in PV200**	**Page 444**	**Yes**			**Yes**	
	SD memory card	**Page 445**	**Yes**			**Yes**	
Read the setting data	**Storage space in PV200**	**Page 445**	**Yes**			**Yes**	
	SD memory card	**Page 446**	**Yes**			**Yes**	
Abort save/read setting data (Cancel)		**Page 446**	**Yes**			**Yes**	
Image memory	**Save (in a SD card)**	**Page 446**	**Yes**			**Yes**	
	Clear	**Page 447**	**Yes**			**Yes**	**Yes**
Print screen		**Page 447**	**Yes**			**Yes**	**Yes**
Reset statistics		**Page 442**	**Yes**			**Yes**	**Yes**
Start RUN Mode		**Page 442**	**Yes**	**Yes**		**Yes**	**Yes**
Stop RUN Mode		**Page 442**	**Yes**	**Yes**		**Yes**	**Yes**
Reset error signal		**Page 443**	**Yes**	**Yes**		**Yes**	**Yes**
Cancel Inspection/ Process		**Page 449**	**Yes**	**Yes**		**Yes**	**Yes**
Keypad Operation	**Key emulating**	**Page 443**	**Yes**	**Yes**		**Yes**	**Yes**
	Valid	**Page 443**	**Yes**	**Yes**		**Yes**	**Yes**
	Invalid	**Page 443**	**Yes**	**Yes**		**Yes**	**Yes**
	Confirm Status	**Page 444**	**Yes**	**Yes**		**Yes**	**Yes**
Switch layout		**Page 447**	**Yes**			**Yes**	**Yes**
Set a template		**Page 448**	**Yes**			**Yes**	

List of Read/Write Command Parameter

	For details, refer to		Command Permission			Parallel Processing	Continuous Inspection
			RUN Menu		SETUP Menu		
	Read	Write	RUN	STOP	STOP		
Inspection time	Page 450	-	Yes			Yes	Yes
Inspection Cycle	Page 450	-	Yes			Yes	Yes
Total Judgement	Page 450	-	Yes			Yes	Yes
Scan Count	Page 450	-	Yes			Yes	Yes
Operation Status	Page 450	-	Yes	Yes		Yes	Yes
Current Type No.	Page 450	-	Yes			Yes	Yes
System Register 0 to System Register 7	Page 450	Page 465	Yes			Yes	Yes
Date	Page 450	Page 465	Yes			Yes	Yes
Time	Page 450	Page 465	Yes			Yes	Yes
Line	Page 451	Page 465	Yes			Yes	Yes
Binary Window	Page 451	Page 466	Yes			Yes	Yes
Gray Window	Page 452	Page 467	Yes			Yes	Yes
Binary Edge	Page 453	Page 468	Yes			Yes	Yes
Gray Edge	Page 453	Page 468	Yes			Yes	Yes
Feature Extraction	Page 454	Page 469	Yes			Yes	Yes
Smart Matching	Page 455	Page 470	Yes			Yes	Yes
Flaw Detection	Page 455	Page 470	Yes			Yes	Yes
Connector (Binary Window)	Page 456	Page 471	Yes			Yes	Yes
Connector (Gray Window)	Page 457	Page 472	Yes			Yes	Yes
Connector (Gray Edge)	Page 458	Page 473	Yes			Yes	Yes
Smart Edge (Circle)	Page 459	Page 474	Yes			Yes	Yes
Smart Edge (Line)	Page 460	Page 475	Yes			Yes	Yes
Color Window	Page 461	Page 476	Yes			Yes	Yes
Geometry Calculation	Page 462	Page 477	Yes			Yes	Yes
Numerical calculation	Page 463	Page 478	Yes			Yes	Yes
Marker	Page 464	Page 479	Yes			Yes	Yes
Slice Level	Page 464	Page 480	Yes			Yes	Yes

9.3.6 Descriptions of PLC Communication Commands

(Available from Ver1.2)

The "Command" in the tables means commands to be issued (sent) to PV200 from PLC. CIR is written at the beginning. The "Response" means the responses to PLC from PV200 to the sent commands. COR is written at the beginning.

The CIR and COR in the tables mean the following contents.

CIR:	Address specified in "Command Input Register". A request to PV200 is written with this address at the beginning.	（Refer to page 426）
COR:	Address specified in "Command Output Register".A response is written by PV200 with this address at the beginning.	（Refer to page 426）

The common error codes in PLC communication are as follows.For the details of the error codes peculiar to each command, refer to the description of each command.

Error code

100	An undefined command was sent.
111	• PLC response timeout • Register number error • Format error of a response from PLC
113	Command Start Bit Off Timeout
114	When "Parallel Input" has not been selected for "Command Read Type", the "Read PLC Communication Command" signal was input.

For Read and Write commands

200	Operation is stopped. (However,except Read of "Operation Status")
252	• The specified parameter does not exist. (e.g. The number of uncreated checker is specified as a parameter.) • The specified parameter value is out of the settable range. (e.g. Maximum value of slice level is being set to over 256.) • The specified values led to the status of “Maximum value < Minimum value” when entering them. • When specifying the moving distance of the marker, a part of the circumscribing rectangle of the marker (the intersection point when Shape is Cross line) after move was out of the nine screens where checker area is settable.

Inspection start

When using common trigger in “Execute All” or “Automatic Switch” execution mode

Command	
CIR	**0200 h**
CIR +1	**0110 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Error code

160	Position adjustment for a detect trigger is unset or a base position is unset when "Camera Trigger" is set to “Detect Trigger (common)”.
200	Operation is stopped.
202	Execution mode is “User-Defined”.
203	• No camera is connected. • Both two cameras of PV200 are set to "Unused".
211	Type switch was executed by an external command while executing detect trigger.

When using common trigger in “User-Defined” execution mode

Command	
CIR	**0200 h**
CIR +1	**0120 h**
CIR +2	**4**
CIR +3 , CIR +4	Block No. to execute

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Block No. to execute = 0 - 9

Error code

160	Position adjustment for a detect trigger is unset or a base position is unset when "Camera Trigger" is set to “Detect Trigger (common)”.
201	Execution mode is NOT “User-Defined” in PV200.
202	The specified block is invalid (the number which does not/ cannot exist was specified)
203	• No camera is connected. • Both two cameras of PV200 are set to "Unused".

Reinspection
(Executes inspection without capturing an image)

For “Execute All” or “Automatic Switch” execution mode

Command	
CIR	**0200 h**
CIR +1	**0210 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Error code

200	Operation is stopped
202	Execution mode is “User-Defined”.
203	There is no image captured.
204	Reinspection cannot be executed because PV200 is inspecting repeatedly

For “User-Defined” execution mode

Command	
CIR	**0200 h**
CIR +1	**0220 h**
CIR +2	**4**
CIR +3 , CIR +4	Block No. to execute

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Block No. to execute = 0 - 9

Error code

200	Operation is stopped
201	Execution mode is NOT “User-Defined”.
202	The specified block is invalid. (The number which does not/ cannot exist was specified.)
203	There is no image captured.
204	Reinspection cannot be executed because PV200 is inspecting repeatedly

Resetting Statistics Data

Resets statistics data and scan count.

Command	
CIR	**0200 h**
CIR +1	**0600 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Error code

200	Operation is stopped

Start RUN Mode

Command	
CIR	**0300 h**
CIR +1	**0000 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

STOP Run Mode

Command	
CIR	**0300 h**
CIR +1	**0100 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Resetting Error Signal

To turns off ERROR signal.

Command	
CIR	**0400 h**
CIR +1	**0000 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

Keypad Operation (Key Emulation)

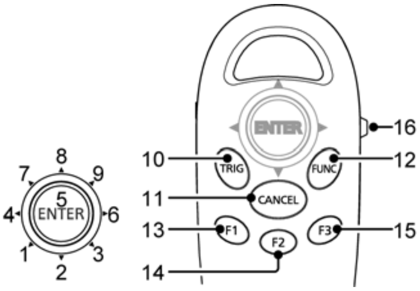
This is a command that performs the same operations of the keypad.

Command	
CIR	**0500 h**
CIR +1	**0100 h**
CIR +2	**8**
CIR +3 , CIR +4	**shift key**
CIR +5 , CIR +6	**Key No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

On/off switch of the shift key; 0 = off, 1 = on

Key No.=1-16 (See the right figure)



Setting Valid of Keypad operation

This is a command for permitting keypad operation in RUN MENU.

Cancel "Keypad is invalid" that is the setting to disable the keypad operation.

Command	
CIR	**0500 h**
CIR +1	**0200 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

Setting Invalid of Keypad operation

This is a command for prohibiting keypad operation in RUN MENU.

When keypad operation has been set to "Invalid", the keypad cannot be used. A message "Keypad is invalid" is shown in the key guide space on the window. Even when setting to "Invalid", key emulate commands can be received.

Command	
CIR	**0500 h**
CIR +1	**0300 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Reading Keypad Operation Status

Command	
CIR	**0500 h**
CIR +1	**0400 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0**
COR +2	**4**
COR +3 , COR +4	**Status**

Status: 0=Valid, 1=Invalid

COR	**Response completion=1**
COR +1	**Error code**
COR +2	**0**

Type Switch

Command	
CIR	**0100 h**
CIR +1	**0100 h**
CIR +2	**4**
CIR +3 , CIR +4	**Type No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Type No. = 0-255

Error code

200	Operation is stopped
210	• The specified product number does not exist. • Other number than 000-255 was specified for a product number.

Saving Setting Data

Saving in the Storage Space in PV200

Command	
CIR	**0600 h**
CIR +1	**0111 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Error code

200 Operation is stopped.

205 READY signal is off for more than one seconds during operations such as detect trigger or continuous inspection.

Saving in a SD memory card

Command	
CIR	**0600 h**
CIR +1	**0112 h**
CIR +2	**4**
CIR +3 , CIR +4	Storage area No.

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

Storage area No. = 0 – 99

Error code

200 Operation is stopped

205 READY signal is off for more than one seconds during operations such as detect trigger or continuous inspection.

212 Other number than 00-99 was specified for a saving area number.

216
- No SD memory card is attached or cannot be accessed.
- Capacity of the SD memory card is used up.
- The SD memory card is write-protected.
- The file with the specified storage number already exists, and the property of the file is "Read-only".
- ”Write When Cover is Open” is set to “Disable”, and the cover is open.

Reading Setting Data

Reading from the Storage Space in PV200

Command	
CIR	**0600 h**
CIR +1	**0211 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

Error code

200 Operation is stopped

205 READY signal is off for more than one seconds during operations such as detect trigger or continuous inspection.

214
- The data file is incompatible. (Data of the later version, etc.)
- The number and types of cameras connected to PV200 is different from the Camera setting of the data file.
  (including the case that the camera is unconnected because the camera cable came off unexpectedly.)

Reading from a SD memory card

Command	
CIR	**0600 h**
CIR +1	**0212 h**
CIR +2	**4**
CIR +3 , CIR +4	**Reading area No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Reading Area No. = 0-99

Error code

200	Operation is stopped
205	READY signal is off for more than one seconds during operations such as detect trigger or continuous inspection.
212	Other number than 00-99 was specified for a reading area number.
213	• No SD memory card is attached or cannot be accessed. • No data file in the designated area of a SD memory card.
214	• The data file is not data of PV200. • The Data file is incompatible. (Data of the later version, etc.) • The number and types of cameras connected to PV200 is different from the Camera setting of the data file. (including the case that the camera is unconnected because the camera cable came off unexpectedly.)

Abort Save/Read Setting Data

Command	
CIR	**0600 h**
CIR +1	**0410 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Error code

217	• Saving or reading setting data is not executed. • Aborting failed.

Saving Images Stored in the Save Image Memory of PV into a SD Memory Card

Data is saved into free area of the SD memory card. (A destination number cannot be specified.)

Command	
CIR	**0600 h**
CIR +1	**0122 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

Error code

200 Operation is stopped.

260
- No SD memory card is attached or cannot be accessed.
- Capacity of the SD memory card is used up.
- The SD memory card is write-protected.
- No blank folder exists in the destination. (All of 00-99 folders are used.)
- No image is saved in the save image memory.
- “Write When Cover is Open” is set to “Disable”, and the cover is open.

Clearing the Image Memory Stored in PV

Execute “SAVE/READ” -> “Clear Image Memory” in SETUP menu.

Command		Response	
CIR	**0600 h**	COR	**Response completion=1**
CIR +1	**0320 h**	COR +1	**Normal end=0** **or Error code**
CIR +2	**0**		
		COR +2	**0**

Print Screen

It is output into the place specified from “ENVIRONMENT” > “Input/Output” -> “Print Screen” -> “Destination”. This command cannot specify the destination.

Command		Response	
CIR	**0600 h**	COR	**Response completion=1**
CIR +1	**0130 h**	COR +1	**Normal end=0** **or Error code**
CIR +2	**0**		
		COR +2	**0**

Error code

200 Operation is stopped。

265
- No SD memory card is attached or cannot be accessed.
- Capacity of the SD memory card is used up.
- The SD memory card is write-protected.
- ”Write When Cover is Open” is set to “Disable”, and the cover is open.
- Ethernet communication cannot be established (with connection problems such as cable unconnected or disconnection)
- Image Receiver is not activated.

Layout Switch

Command		Response	
CIR	**0700 h**	COR	**Response completion=1**
CIR +1	**0000 h**	COR +1	**Normal end=0** **or Error code**
CIR +2	**4**		
CIR +3 , CIR +4	**Layout No.**	COR +2	**0**

Layout No. = 0-15

Error code

200	Operation is stopped.
246	• Other number than 00-15 is specified for layout number. • No layout has been registered in the specified layout number

Smart Matching Template Setting

Set a template of Smart Matching. When "Area Display" is "Yes", follow two instructions in order.

Note

A template that can be set with the command is one of Smart Matching in “Checker” menu. In Smart Matching used in Position Adjustment and Area Size Adjustment, a template cannot be re-registered.

参照

For information on the conditions when re-registering templates: page 134

When “Area Display” is set to “No” for Template Setting
The first command to be sent when "Area Display" is "Yes"

Command		Response	
CIR	**0800 h**	COR	**Response completion=1**
CIR +1	**0100 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**8**		
CIR +3 , CIR +4	**Checker No.**	COR +2	**0**
CIR +5 , CIR +6	**Template No.**		

Checker No. = 0 – 999

Template No.=0-63

Error code

200	Operation is stopped.
230	• Because PV200 is processing Detect trigger or Continuous Inspection, Template setting cannot be executed. • Command was sent in the second operation when "Area Display" is "Yes".
231	• The specified checker number or template number has not be created. • Other number than 000-999 for checker number, or 00-63 for template was specified.
232	Template cannot be set because no image has been captured after PV200 started up when you select “Use the Last Image” for “Template Setting”.
233	• No feature on the image of template registration area. • An error occurs in Position adjustment when you use it. • Template setting area is outside of the captured image (image partially captured when executing partial imaging). (The whole template setting area should be in the range of the captured image.)

When “Area Display” is set to “Yes” for Template Setting The second command to be sent when "Area Display" is "Yes"

Command	
CIR	**0800 h**
CIR +1	**0200 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

Error code

200	Operation is stopped.
230	• Because PV200 is processing Detect trigger or Repeat start, Template setting cannot be executed. • Because parallel I/O result is being output, Template setting cannot be executed • Command was sent without the first command transmission when "Display Area" is "Yes".
232	Template cannot be set because no image has been captured after PV200 started up when you select “Use the Last Image” for “Template Setting”.
233	• No feature on the image of template registration area. • An error occurs in Position adjustment when you use it. • Template setting area is outside of the captured image (image partially captured when executing partial imaging). (The whole template setting area should be in the range of the captured image.)

Canceling Inspection/ Processing (Cancel specific operation)

Cancels the following active operations, and restores into the previous status before the operation.

- Cancellation of the operation of a serial command which has been received
- Abort of output in the status waiting for result output after an inspection is complete
- Abort of image saving from Image Memory to a SD memory card
- Cancellation of template re-registration

Command	
CIR	**0900 h**
CIR +1	**0000 h**
CIR +2	**0**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

Read Command Parameters

System values (Read) 1

Command	
CIR	**0A01 h**
CIR +1	**0000 h**
CIR +2	**0**
CIR +3	**Code**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

	Code	Lower limit	Upper limit	Details
Inspection time	6400 h	0	100000	Value is rounded to the whole number, and the integer portion is read.
Inspection Cycle	6401 h	0	100000	
Total Judgement	6402 h	0	1	0:NG 1: OK
Scan Count	6403 h	0	2147483647	
Operation Status	6405 h	0	1	0: RUN 1: STOP
Current Type No.	6406 h	0	255	
System Register 0	6480 h	-10000000	10000000	Value is rounded to the whole number, and the integer portion is read.
System Register1	6481 h	-10000000	10000000	
System Register2	6482 h	-10000000	10000000	
System Register3	6483 h	-10000000	10000000	
System Register4	6484 h	-10000000	10000000	
System Register5	6485 h	-10000000	10000000	
System Register6	6486 h	-10000000	10000000	
System Register7	6487 h	-10000000	10000000	

System values (Read) 2

Command	
CIR	**0A01 h**
CIR +1	**0000 h**
CIR +2	**2**
CIR +3	**Code**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**12**
COR +3 , COR +4	**Result 1**
COR +5 , COR +6	**Result 2**
COR +7 , COR +8	**Result 3**

	Code	Result 1	Result 2	Result 3
Date	6407 h	Year	Month	Day
Time	6408 h	Hour	Minute	Second

Line (Read) 1

Command	
CIR	**0A02 h**
CIR +1	**0100 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
No. of Pixels	Maximum	0100 h	0	125938
	Minimum	0101 h		
No. of Objects	Maximum	0103 h	0	41979
	Minimum	0104 h		

Line (Read) 2

Command	
CIR	**0A02 h**
CIR +1	**0100 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
No. of Pixels	Max. and Min.	0102 h	0	125938
No. of Objects	Max. and Min.	0105 h	0	41979

Binary Window (Read) 1

Command	
CIR	**0A02 h**
CIR +1	**0200 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
OK JUDGE.	Maximum	0200 h	0	4194304
	Minimum	0201 h		

Binary Window (Read) 2

Command	
CIR	**0A02 h**
CIR +1	**0200 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0202 h	0	4194304

Gray Window (Read) 1

Command	
CIR	**0A02 h**
CIR +1	**0300 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
OK JUDGE.	Maximum	0300 h	0	255
	Minimum	0301 h		

Gray Window (Read) 2

Command	
CIR	**0A02 h**
CIR +1	**0300 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0302 h	0	255

Binary Edge (Read) 1

Command	
CIR	**0A02 h**
CIR +1	**0400 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
OK JUDGE.	Maximum	0400 h	0	256
	Minimum	0401 h		

Binary Edge (Read) 2

Command	
CIR	**0A02 h**
CIR +1	**0400 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0402 h	0	256

Gray Edge (Read) 1

Command	
CIR	**0A02 h**
CIR +1	**0500 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
Edge Threshold		0500 h	1	255
OK JUDGE.	Maximum	0501 h	0	256
	Minimum	0502 h		

Gray Edge (Read) 2

Command	
CIR	**0A02 h**
CIR +1	**0500 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0503 h	0	256

Feature Extraction (Read) 1

Command	
CIR	**0A02 h**
CIR +1	**0600 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
OK JUDGE.	Maximum	0600 h	0	10000
	Minimum	0601 h		

Feature Extraction (Read) 2

Command	
CIR	**0A02 h**
CIR +1	**0600 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0602 h	0	10000

Smart Matching (Read)

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0700 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**6**		
CIR +3	**Code**	COR +2	**4**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
Search Count	1st step	0700 h	1	256
	2nd step	0701 h	1	256
	3rd step	0702 h	1	256
	4th step	0703 h	1	256
	5th step	0704 h	1	256
	6th step	0705 h	1	256
No. of Subtracted Objects		0706 h	0	128

Flaw Detection (Read) 1

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0800 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**6**		
CIR +3	**Code**	COR +2	**4**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
OK JUDGE.	Maximum	0800 h	0	512
	Minimum	0801 h		

Flaw Detection (Read) 2

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0800 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**6**		
CIR +3	**Code**	COR +2	**8**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result 1 (Min.)**
		COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0802 h	0	10000

Connector Binary Window (Read) 1

Command	
CIR	**0A02 h**
CIR +1	**0900 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
Common Judge.	Maximum	0900 h	0	62500
	Minimum	0901 h		

Connector Binary Window (Read) 2

Command	
CIR	**0A02 h**
CIR +1	**0900 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0902 h	0	62500

Connector Binary Window (Read) 3

Command	
CIR	**0A02 h**
CIR +1	**0900 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Cell No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
Individual Judge.	Maximum	0903 h	0	62500
	Minimum	0904 h		

Connector Binary Window (Read) 4

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0900 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**10**		
CIR +3	**Code**	COR +2	**8**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result 1 (Min.)**
CIR +6 , CIR +7	**Cell No.**	COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
Individual Judge.	Max. and Min.	0905 h	0	62500

Connector Gray Window (Read) 1

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0A00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**6**		
CIR +3	**Code**	COR +2	**4**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
Common Judge.	Maximum	0A00 h	0	255
	Minimum	0A01 h		

Connector Gray Window (Read) 2

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0A00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**6**		
CIR +3	**Code**	COR +2	**8**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result 1 (Min.)**
		COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0A02 h	0	255

Connector Gray Window (Read) 3

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0A00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**10**		
CIR +3	**Code**	COR +2	**4**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result**
CIR +6 , CIR +7	**Cell No.**		

		Code	Lower limit	Upper limit
Individual Judge.	Maximum	0A03 h	0	255
	Minimum	0A04 h		

Connector Gray Window (Read) 4

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0A00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**10**		
CIR +3	**Code**	COR +2	**8**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result 1 (Min.)**
CIR +6 , CIR +7	**Cell No.**	COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
Individual Judge.	Max. and Min.	0A05 h	0	255

Connector Gray Edge (Read) 1

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0B00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**6**		
CIR +3	**Code**	COR +2	**4**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
Judge. Pitch	Maximum	0B00 h	0	100000000
	Minimum	0B01 h		
Distance Difference Judge.	Maximum	0B03 h	0	100000000
	Minimum	0B04 h		

* Value is rounded to the whole number, and the integer portion is read.

Connector Gray Edge (Read) 2

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0B00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**6**		
CIR +3	**Code**	COR +2	**8**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result 1 (Min.)**
		COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
Judge. Pitch	Max. and Min.	0B02 h	0	100000000
Distance Difference Judge.	Max. and Min.	0B05 h	0	100000000

* Value is rounded to the whole number, and the integer portion is read.

Smart Edge Circle (Read) 1

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0C00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**6**		
CIR +3	**Code**	COR +2	**4**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
Measurement	Maximum	0C00 h	0	100000000
	Minimum	0C01 h		
Standard Deviation	Maximum	0C03 h	0	100000000
	Minimum	0C04 h		
Circularity	Maximum	0C06 h	0	100000000
	Minimum	0C07 h		
Unused Edge Count	Maximum	0C09 h	0	3597

* Value is rounded to the whole number, and the integer portion is read.

Smart Edge Circle (Read) 2

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0C00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**6**		
CIR +3	**Code**	COR +2	**8**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result 1 (Min.)**
		COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
Measurement	Max. and Min.	0C02 h	0	100000000

Standard Deviation	Max. and Min.	0C05 h	0	100000000
Circularity	Max. and Min.	0C08 h	0	100000000

* Value is rounded to the whole number, and the integer portion is read.

Smart Edge Line (Read) 1

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0D00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**6**		
CIR +3	**Code**	COR +2	**4**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
Measurement	Maximum	0D00 h	0	100000000
	Minimum	0D01 h		
Standard Deviation	Maximum	0D03 h	0	100000000
	Minimum	0D04 h		
Linearity	Maximum	0D06 h	0	100000000
	Minimum	0D07 h		
Unused Edge Count	Maximum	0D09 h	0	2998

* Value is rounded to the whole number, and the integer portion is read.

Smart Edge Line (Read) 2

Command		Response	
CIR	**0A02 h**	COR	**Response completion=1**
CIR +1	**0D00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**6**		
CIR +3	**Code**	COR +2	**8**
CIR +4 , CIR +5	**Checker No.**	COR +3 , COR +4	**Result 1 (Min.)**
		COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
Measurement	Max. and Min.	0D02 h	0	100000000
Standard Deviation	Max. and Min.	0D05 h	0	100000000
Linearity	Max. and Min.	0D08 h	0	100000000

* Value is rounded to the whole number, and the integer portion is read.

Color Window (Read) 1

Command	
CIR	**0A02 h**
CIR +1	**0E00 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
RGray	Maximum	0E00 h	0	255
	Minimum	0E01 h		
RGray Ave.	Maximum	0E03 h	0	255
	Minimum	0E04 h		
RGray Std. Devi.	Maximum	0E06 h	0	128
	Minimum	0E07 h		
GGray	Maximum	0E09 h	0	255
	Minimum	0E0A h		
GGray Ave.	Maximum	0E0C h	0	255
	Minimum	0E0D h		
GGray Std. Devi.	Maximum	0E0F h	0	128
	Minimum	0E10 h		
BGray	Maximum	0E12 h	0	255
	Minimum	0E13 h		
BGray Ave.	Maximum	0E15 h	0	255
	Minimum	0E16 h		
BGray Std. Devi.	Maximum	0E18 h	0	128
	Minimum	0E19 h		

* Value is rounded to the whole number, and the integer portion is read.

Color Window (Read) 2

Command	
CIR	**0A02 h**
CIR +1	**0E00 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
RGray	Max. and Min.	0E02 h	0	255
R Gray Ave.	Max. and Min.	0E05 h	0	255
R Gray Std. Devi.	Max. and Min.	0E08 h	0	127
GGray	Max. and Min.	0E0B h	0	255
GGray Ave.	Max. and Min.	0E0E h	0	255

GGray Std. Devi.	Max. and Min.	0E11 h	0	127
BGray	Max. and Min.	0E14 h	0	255
BGray Ave.	Max. and Min.	0E17 h	0	255
BGray Std. Devi.	Max. and Min.	0E1A h	0	127

* Value is rounded to the whole number, and the integer portion is read.

Geometry Calculation (Read) 1

Command	
CIR	**0A03 h**
CIR +1	**0000 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Geometry Calculation No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
X COORD. (IP X, Center X)	Maximum	6500 h	-100000000	100000000
	Minimum	6501 h		
Y COORD. (IP Y, Center Y)	Maximum	6503 h	-100000000	100000000
	Minimum	6504 h		
Standard Deviation	Maximum	6506 h	0	100000000
	Minimum	6507 h		
Angle	Maximum	6509 h	-100000000	100000000
	Minimum	650A h		
Distance	Maximum	650C h	0	100000000
	Minimum	650D h		
Intersecting Angle	Maximum	650F h	0	360
	Minimum	6510 h		
Radius	Maximum	6512 h	0	100000000
	Minimum	6513 h		
Major Axis	Maximum	6515 h	0	100000000
	Minimum	6516 h		
Minor Axis	Maximum	6518 h	0	100000000
	Minimum	6519 h		

* Value is rounded to the whole number, and the integer portion is read.

Geometry Calculation (Read) 2

Command	
CIR	**0A03 h**
CIR +1	**0000 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Geometry Calculation No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
X COORD.	Max. and Min.	6502 h	-100000000	100000000
Y COORD.	Max. and Min.	6505 h	-100000000	100000000
Standard Deviation	Max. and Min.	6508 h	0	100000000
Angle	Max. and Min.	650B h	-100000000	100000000
Distance	Max. and Min.	650E h	0	100000000
Intersecting Angle	Max. and Min.	6511 h	0	360
Radius	Max. and Min.	6514 h	0	100000000
Major Axis	Max. and Min.	6517 h	0	100000000
Minor Axis	Max. and Min.	651A h	0	100000000

* Value is rounded to the whole number, and the integer portion is read.

Numerical Calculation (Read) 1

Command	
CIR	**0A04 h**
CIR +1	**0000 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Numerical calculation No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
Judgement	Max. and Min.	6600 h	-100000000	100000000
	Max. and Min.	6601 h		

* Value is rounded to the whole number, and the integer portion is read.

Numerical Calculation (Read) 2

Command	
CIR	**0A04 h**
CIR +1	**0000 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Numerical calculation No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
Judgement	Max. and Min.	6602 h	-100000000	100000000

* Value is rounded to the whole number, and the integer portion is read.

Marker (Read)

Command	
CIR	**0A05**
CIR +1	**0000 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Camera No.**
CIR +6 , CIR +7	**Marker No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
Central Coordinate	XY set	6700 h	-2048	4095

* Value is rounded to the whole number, and the integer portion is read.

* Witten values are in pixel units before calibration.

Slice Level (Read) 1

Command	
CIR	**0A06 h**
CIR +1	**0000 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Camera No.**
CIR +6 , CIR +7	**Slice Level Group No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**4**
COR +3 , COR +4	**Result**

		Code	Lower limit	Upper limit
Slice Level	Maximum	6800 h	0	255
	Minimum	6801 h		

Slice Level (Read) 2

Command	
CIR	**0A06 h**
CIR +1	**0000 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Camera No.**
CIR +6 , CIR +7	**Slice Level Group No.**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**8**
COR +3 , COR +4	**Result 1 (Min.)**
COR +5 , COR +6	**Result 2 (Max.)**

		Code	Lower limit	Upper limit
Slice Level	Max. and Min.	6802 h	0	255

Write Command Parameters

System values (Write) 1

Command	
CIR	**0A11 h**
CIR +1	**0000 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Data 1**
CIR +6 , CIR +7	**Data 2**
CIR +8 , CIR +9	**Data 3**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

	Code	Data 1	Data 2	Data 3
Date	6407 h	Year	Month	Day
Time	6408 h	Hour	Minute	Second

System values (Write) 2

Command	
CIR	**0A11 h**
CIR +1	**0000 h**
CIR +2	**6**
CIR +3	**Code**
CIR +4 , CIR +5	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

	Code	Lower limit	Upper limit	Details
System Register 0	6480 h	-9999999	9999999	Only integers can be written.
System Register1	6481 h	-9999999	9999999	
System Register2	6482 h	-9999999	9999999	
System Register3	6483 h	-9999999	9999999	
System Register4	6484 h	-9999999	9999999	
System Register5	6485 h	-9999999	9999999	
System Register6	6486 h	-9999999	9999999	
System Register7	6487 h	-9999999	9999999	

Line (Write) 1

Command	
CIR	**0A12 h**
CIR +1	**0100**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
No. of Pixels	Maximum	0100 h	0	125938
	Minimum	0101 h		
No. of Objects	Maximum	0103 h	0	41979
	Minimum	0104 h		

Line (Write) 2

Command	
CIR	**0A12 h**
CIR +1	**0100 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
No. of Pixels	Max. and Min.	0102 h	0	125938
No. of Objects	Max. and Min.	0105 h	0	41979

Binary Window (Write) 1

Command	
CIR	**0A12 h**
CIR +1	**0200**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
OK JUDGE.	Maximum	0200 h	0	4194304
	Minimum	0201 h		

Binary Window (Write) 2

Command	
CIR	**0A12 h**
CIR +1	**0200**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0202 h	0	4194304

Gray Window (Write) 1

Command	
CIR	**0A12 h**
CIR +1	**0300 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
OK JUDGE.	Maximum	0300 h	0	255
	Minimum	0301 h		

Gray Window (Write) 2

Command	
CIR	**0A12 h**
CIR +1	**0300 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0302 h	0	255

Binary Edge (Write) 1

Command		Response	
CIR	**0A12 h**	COR	**Response completion=1**
CIR +1	**0400 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**10**		
CIR +3	**Code**	COR +2	**0**
CIR +4 , CIR +5	**Checker No.**		
CIR +6 , CIR +7	**Data**		

		Code	Lower limit	Upper limit
OK JUDGE.	Maximum	0400 h	0	256
	Minimum	0401 h		

Binary Edge (Write) 2

Command		Response	
CIR	**0A12 h**	COR	**Response completion=1**
CIR +1	**0400 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**14**		
CIR +3	**Code**	COR +2	**0**
CIR +4 , CIR +5	**Checker No.**		
CIR +6 , CIR +7	**Data 1 (Min.)**		
CIR +8 , CIR +9	**Data 2 (Max.)**		

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0402 h	0	256

Gray Edge (Write) 1

Command		Response	
CIR	**0A12 h**	COR	**Response completion=1**
CIR +1	**0500 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**10**		
CIR +3	**Code**	COR +2	**0**
CIR +4 , CIR +5	**Checker No.**		
CIR +6 , CIR +7	**Data**		

		Code	Lower limit	Upper limit
Edge Threshold		0500 h	1	255
OK JUDGE.	Maximum	0501 h	0	256
	Minimum	0502 h		

Gray Edge (Write) 2

Command	
CIR	**0A12 h**
CIR +1	**0500 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0503 h	0	256

Feature Extraction (Write) 1

Command	
CIR	**0A12 h**
CIR +1	**0600 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
OK JUDGE.	Maximum	0600 h	0	10000
	Minimum	0601 h		

Feature Extraction (Write) 2

Command	
CIR	**0A12 h**
CIR +1	**0600 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0602 h	0	10000

Smart Matching (Write)

Command	
CIR	**0A12 h**
CIR +1	**0700 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Search Count	1st step	0700 h	1	256
	2nd step	0701 h	1	256
	3rd step	0702 h	1	256
	4th step	0703 h	1	256
	5th step	0704 h	1	256
	6th step	0705 h	1	256
No. of Subtracted Objects		0706 h	0	128

Flaw Detection (Write) 1

Command	
CIR	**0A12 h**
CIR +1	**0800 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
OK JUDGE.	Maximum	0800 h	0	512
	Minimum	0801 h		

Flaw Detection (Write) 2

Command	
CIR	**0A12 h**
CIR +1	**0800 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
OK JUDGE.	Max. and Min.	0802 h	0	512

Connector Binary Window (Write) 1

Command	
CIR	**0A12 h**
CIR +1	**0900 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Common Judge.	Maximum	0900 h	0	62500
	Minimum	0901 h		

Connector Binary Window (Write) 2

Command	
CIR	**0A12 h**
CIR +1	**0900 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Common Judge.	Max. and Min.	0902 h	0	62500

Connector Binary Window (Write) 3

Command	
CIR	**0A12 h**
CIR +1	**0900 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Cell No.**
CIR +8 , CIR +9	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Individual Judge.	Maximum	0903 h	0	62500
	Minimum	0904 h		

Connector Binary Window (Write) 4

Command	
CIR	**0A12 h**
CIR +1	**0900 h**
CIR +2	**18**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Cell No.**
CIR +8 , CIR +9	**Data 1 (Min.)**
CIR +10 , CIR +11	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Common Judge.	Max. and Min.	0905 h	0	62500

Connector Gray Window (Write) 1

Command	
CIR	**0A12 h**
CIR +1	**0A00 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Common Judge.	Maximum	0A00 h	0	255
	Minimum	0A01 h		

Connector Gray Window (Write) 2

Command	
CIR	**0A12 h**
CIR +1	**0A00 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Common Judge.	Max. and Min.	0A02 h	0	255

Connector Gray Window (Write) 3

Command	
CIR	**0A12 h**
CIR +1	**0A00**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Cell No.**
CIR +8 , CIR +9	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Individual Judge.	Maximum	0A03 h	0	255
	Minimum	0A04 h		

Connector Gray Window (Write) 4

Command	
CIR	**0A12 h**
CIR +1	**0A00 h**
CIR +2	**18**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Cell No.**
CIR +8 , CIR +9	**Data 1 (Min.)**
CIR +10, CIR +11	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Common Judge.	Max. and Min.	0A05 h	0	255

Connector Gray Edge (Write) 1

Command	
CIR	**0A12 h**
CIR +1	**0B00 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Judge. Pitch	Maximum	0B00 h	0	99999999
	Minimum	0B01 h		
Distance Difference Judge.	Maximum	0B03 h	0	99999999
	Minimum	0B04 h		

* Only integers can be written.

Connector Gray Edge (Write) 2

Command	
CIR	**0A12 h**
CIR +1	**0B00 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Judge. Pitch	Max. and Min.	0B02 h	0	99999999
Distance Difference Judge.	Max. and Min.	0B05 h	0	99999999

* Only integers can be written.

Smart Edge Circle (Write) 1

Command	
CIR	**0A12 h**
CIR +1	**0C00 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Measurement	Maximum	0C00 h	0	99999999
	Minimum	0C01 h		
Standard Deviation	Maximum	0C03 h	0	99999999
	Minimum	0C04 h		
Circularity	Maximum	0C06 h	0	99999999
	Minimum	0C07 h		
Unused Edge Count	Maximum	0C09 h	0	3597

* Only integers can be written.

Smart Edge Circle (Write) 2

Command	
CIR	**0A12 h**
CIR +1	**0C00 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Measurement	Max. and Min.	0C02 h	0	99999999
Standard Deviation	Max. and Min.	0C05 h	0	99999999
Circularity	Max. and Min.	0C08 h	0	99999999

* Only integers can be written.

Smart Edge Line (Write) 1

Command	
CIR	**0A12 h**
CIR +1	**0D00 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Measurement	Maximum	0D00 h	0	99999999
	Minimum	0D01 h		
Standard Deviation	Maximum	0D03 h	0	99999999
	Minimum	0D04 h		
Linearity	Maximum	0D06 h	0	99999999
	Minimum	0D07 h		
Unused Edge Count	Maximum	0D09 h	0	2998

* Only integers can be written.

Smart Edge Line (Write) 2

Command		Response	
CIR	**0A12 h**	COR	**Response completion=1**
CIR +1	**0D00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**14**		
CIR +3	**Code**	COR +2	**0**
CIR +4 , CIR +5	**Checker No.**		
CIR +6 , CIR +7	**Data 1 (Min.)**		
CIR +8 , CIR +9	**Data 2 (Max.)**		

		Code	Lower limit	Upper limit
Measurement	Max. and Min.	0D02 h	0	99999999
Standard Deviation	Max. and Min.	0D05 h	0	99999999
Linearity	Max. and Min.	0D08 h	0	99999999

* Only integers can be written.

Color Window (Write) 1

Command		Response	
CIR	**0A12 h**	COR	**Response completion=1**
CIR +1	**0E00 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**10**		
CIR +3	**Code**	COR +2	**0**
CIR +4 , CIR +5	**Checker No.**		
CIR +6 , CIR +7	**Data**		

		Code	Lower limit	Upper limit
RGray	Maximum	0E00 h	0	255
	Minimum	0E01 h		
RGray Ave.	Maximum	0E03 h	0	255
	Minimum	0E04 h		
RGray Std. Devi.	Maximum	0E06 h	0	127
	Minimum	0E07 h		
GGray	Maximum	0E09 h	0	255
	Minimum	0E0A h		
GGray Ave.	Maximum	0E0C h	0	255
	Minimum	0E0D h		
GGray Std. Devi.	Maximum	0E0F h	0	127
	Minimum	0E10 h		
BGray	Maximum	0E12 h	0	255
	Minimum	0E13 h		
BGray Ave.	Maximum	0E15 h	0	255
	Minimum	0E16 h		
BGray Std. Devi.	Maximum	0E18 h	0	127
	Minimum	0E19 h		

* Only integers can be written.

Color Window (Write) 2

Command	
CIR	**0A12 h**
CIR +1	**0E00 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Checker No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
RGray	Max. and Min.	0E02 h	0	255
RGray Ave.	Max. and Min.	0E05 h	0	255
RGray Std. Devi.	Max. and Min.	0E08 h	0	127
GGray	Max. and Min.	0E0B h	0	255
GGray Ave.	Max. and Min.	0E0E h	0	255
GGray Std. Devi.	Max. and Min.	0E11 h	0	127
BGray	Max. and Min.	0E14 h	0	255
BGray Ave.	Max. and Min.	0E17 h	0	255
BGray Std. Devi.	Max. and Min.	0E1A h	0	127

* Only integers can be written.

Geometry Calculation (Write) 1

Command	
CIR	**0A13 h**
CIR +1	**0000 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Geometry Calculation No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
X COORD.	Maximum	6500 h	-99999999	99999999
(IP X, Center X)	Minimum	6501 h		
Y COORD.	Maximum	6503 h	-99999999	99999999
(IP Y, Center Y)	Minimum	6504 h		
Standard Deviation	Maximum	6506 h	0	99999999
	Minimum	6507 h		
Angle	Maximum	6509 h	-99999999	99999999
	Minimum	650A h		

Distance	Maximum	650C h	0	99999999
	Minimum	650D h		
Intersecting Angle	Maximum	650F h	0	360
	Minimum	6510 h		
Radius	Maximum	6512 h	0	99999999
	Minimum	6513 h		
Major Axis	Maximum	6515 h	0	99999999
	Minimum	6516 h		
Minor Axis	Maximum	6518 h	0	99999999
	Minimum	6519 h		

* Only integers can be written.

Geometry Calculation (Write) 2

Command	
CIR	**0A13 h**
CIR +1	**0000 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Geometry Calculation No.**
CIR +6 , CIR +7	**Data 1 (Min.)**
CIR +8 , CIR +9	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
X COORD.	Max. and Min.	6502 h	-99999999	99999999
Y COORD.	Max. and Min.	6505 h	-99999999	99999999
Standard Deviation	Max. and Min.	6508 h	0	99999999
Angle	Max. and Min.	650B h	-99999999	99999999
Distance	Max. and Min.	650E h	0	99999999
Intersecting Angle	Max. and Min.	6511 h	0	360
Radius	Max. and Min.	6514 h	0	99999999
Major Axis	Max. and Min.	6517 h	0	99999999
Minor Axis	Max. and Min.	651A h	0	99999999

* Only integers can be written.

Numerical Calculation (Write) 1

Command	
CIR	**0A14 h**
CIR +1	**0000 h**
CIR +2	**10**
CIR +3	**Code**
CIR +4 , CIR +5	**Numerical calculation No.**
CIR +6 , CIR +7	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0 or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Judgement	Maximum	6600 h	-99999999	99999999
	Minimum	6601 h		

* Only integers can be written.

Numerical Calculation (Write) 2

Command		Response	
CIR	**0A14 h**	COR	**Response completion=1**
CIR +1	**0000 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**14**		
CIR +3	**Code**	COR +2	**0**
CIR +4 , CIR +5	**Numerical calculation No.**		
CIR +6 , CIR +7	**Data 1 (Min.)**		
CIR +8 , CIR +9	**Data 2 (Max.)**		

		Code	Lower limit	Upper limit
Judgement	Max. and Min.	6602 h	-99999999	99999999

* Only integers can be written.

Marker (Write)

Command		Response	
CIR	**0A15 h**	COR	**Response completion=1**
CIR +1	**0000 h**	COR +1	**Normal end=0 or Error code**
CIR +2	**18**		
CIR +3	**Code**	COR +2	**0**
CIR +4 , CIR +5	**Camera No.**		
CIR +6 , CIR +7	**Marker No.**		
CIR +8 , CIR +9	**Data 1 (Movement amount X)**		
CIR +10 , CIR +11	**Data 2 (Movement amount Y)**		

		Code	Lower limit	Upper limit
Central Coordinate Moving Distance	XY set	6701 h	-6143	6143

* Only integers can be written.

* Witten values are in pixel units before calibration.

Slice Level (Write) 1

Command	
CIR	**0A16 h**
CIR +1	**0000 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Camera No.**
CIR +6 , CIR +7	**Slice Level Group No.**
CIR +8 , CIR +9	**Data**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Slice Level	Maximum	6800 h	0	255
	Minimum	6801 h		

Slice Level (Write) 2

Command	
CIR	**0A16 h**
CIR +1	**0A00 h**
CIR +2	**14**
CIR +3	**Code**
CIR +4 , CIR +5	**Camera No.**
CIR +6 , CIR +7	**Slice Level Group No.**
CIR +8 , CIR +9	**Data 1 (Min.)**
CIR +10, CIR +11	**Data 2 (Max.)**

Response	
COR	**Response completion=1**
COR +1	**Normal end=0** **or Error code**
COR +2	**0**

		Code	Lower limit	Upper limit
Slice Level	Max. and Min.	6802 h	0	255

Chapter 10

Tool Software for PC

10.1 About PVWIN200

PVWIN200 is software of setting and simulation for PV200. Almost items set in PV200 can be also set with PVWIN200.

In PVWIN200, the program can be simulated off-line with PV200. For this, you can adjust the set programs by simulating them to confirm they obtain the expected results on the images captured with a camera and saved in a PC.

Downloading PVWIN200

To use PVWIN200, download the file from our web site. Downloading the software requires registration of your information (for free), MAC address of PV200, and MAC address of your PC.

http://panasonic-denko.co.jp/sunx/e

(“Products” > "Machine Vision" > "PV200" > "Software")

▶ Note

When PVWIN200 is installed, PVImageConverter is also installed at the same time.

Hardware Requirements of PVWIN200

PC	Compatible computer for IBM PC/AT
OS *1	Windows® 7 *2, Windows Vista®, Windows® XP
Hard Disc Capacity Requirement	70 MB or more *(excluding storage for the setting data or images)
CPU	Pentium III 700 MHz or more
Memory Amount	512 MB or more
Display resolution	1024 x 768 or more
Display color	Full Color (32-bit) or more
Communication format	USB 2.0, Ethernet (1000BASE-T/100BASE-TX/10BASE-T)*2

*1: For 32-bit Edition only.

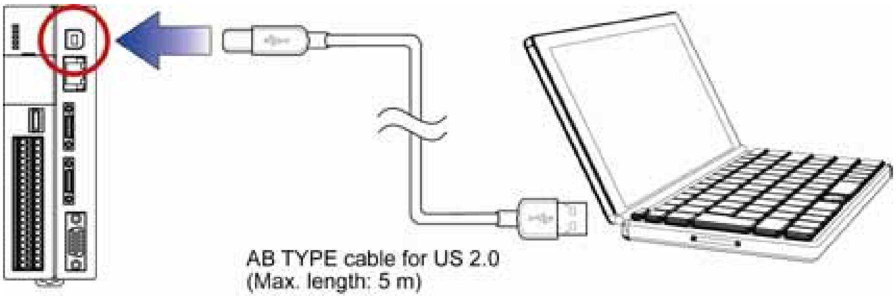
*2: Note that there are some restrictions on installation. For details, refer to the PVWIN200 download page on our web site.

Connecting PV200 with PC

Connect PV200 and the PVWIN200-installed PC with a USB cable or an Ethernet cable.
About connection with an Ethernet cable, refer to page 400.

Connecting with USB Cable

Use a USB cable (for 2.0, AB type) of which length is 5m or less.



10.1.1 Communicating with PV200

Uploading or downloading setting data or image data may not be performed according to the status of PV200.
To communicate with PV200, set the status to be in the conditions listed below.

▶ Note

When the image receiving software "Image Receiver for PV" is running and the connection is established on the PC that PVWIN200 is running, PVWIN200 cannot communicate with PV200.

A: Available N/A: Not available

Operation Status Function	RUN menu		SETUP menu	
	RUN	**STOP**	**"TOOL" - "PC Communication"**	**Other statuses**
Upload/download of setting data (Settings including ENVIRONMENT, TYPE and INSPECTION)	**A***	**A**	**A**	**N/A**
Reading of image data (Images in the inspection image memory of PV200)	**N/A**	**A**	**A**	**A**
Upload of saved images (Images saved in the storage space in PV200)	**N/A**	**A**	**A**	**N/A**
Download of test images (Downloading images saved in a PC into the test image memory of PV200)	**N/A**	**N/A**	**A**	**N/A**

* : READY signal turns off and inspections cannot be executed during the communication.

10.1.2 Upload and Download of Setting Data

In PVWIN200, setting data is called Project File. Project files can be downloaded to PV200 (PVWIN200 to PV200) or uploaded from PV200 (PV200 to PVWIN200).

▶ Note

After downloading a project file from PVWIN200 to PV200, be sure to save the data in PV200. Turning off the power of PV200 without saving data removes the downloaded project file from the PV200.

When PV200 is in RUN menu

Operate uploading or downloading from PVWIN200. (No need to operate from PV200.)

When executing upload, the currently inspecting data are uploaded.

When executing download, the data are overwritten on the currently inspecting data. After downloading is complete, inspections will be executed with the setting data of the downloaded project file.

READY signal turns off and inspections cannot be executed during the upload or download.

When communication error occurs

When a communication error occurs, the notice is displayed on the screen of PVWIN200 or PVWIN200 and PV200. Execute again after solving the problem described on the message.

When PV200 is in SETUP menu

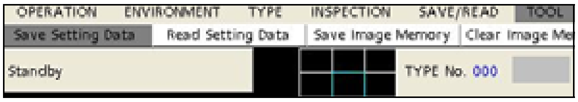
To upload or download the data in SETUP menu, PV200 requires being in the status where it can communicate with PC. Other than the status, you cannot upload and download the data.

When executing upload, the data currently loaded on SETUP menu are uploaded. When executing download, the data are overwritten on the data currently loaded on SETUP menu.

1. **Select "TOOL" > "PC Communi." from the menu bar.**

   The PV200 becomes to be able to communicate with PC and the current communication status is displayed under the menu.

   Refer to
   "10.1.1 Communicating with PV200 (page 483)"



Standby

TYPE No. 000

2. **Execute communication from PVWIN200.**

   The display changes to "Transmitting..." and a project file (setting data) is downloaded or uploaded. Pressing the CANCEL key during the communication stops the transmitting and the display changes to "Terminating..." and eventually to "Standby".

   When communication error occurs
   When the devices cannot communicate, the display shows "Communication Error". (When the next transmission is executed, the display changes to "Transmitting...")
   When a communication error occurs, the notice is displayed on the screen of PVWIN200 or PVWIN200 and PV200. Execute again after solving the problem described on the message. The error occurring during download initializes (deletes all) the setting data loaded on PV200. And the error during upload initializes the contents of the project file being set on PVWIN200.

3. **After transmission is complete, press the CANCEL key to cancel the communication mode.**

10.1.3 Reading the Latest Image of PV200

The latest image of PV200 can be read out on the camera window of PVWIN200 by a command from PVWIN200. Make PV200 be the state that can communicate. Refer to "10.1.1 Communicating with PV200 (page 483)".

1. **Execute an inspection in RUN menu of PV200.**

   The inspected image can be read with PVWIN200. When no inspection is executed, PVWIN200 cannot read because there is no image to read.

2. **Execute image reading from PV200 with PVWIN200.**

   The latest image of PV200 is read out.

Note

When "Detect Trigger" is used as Camera Trigger, the device reads the image of when detect trigger is executed. When no detect trigger is executed, image cannot be read because there is no image to read. (Although a memory image is displayed even when no detect trigger is executed, the memory image cannot be read.)

When communication error occurs

When a communication error occurs, the message is displayed on the screen of PVWIN200 or PVWIN200 and PV200. Execute again after solving the problem described on the message.

10.1.4 Uploading Images in Storage Space in PV200

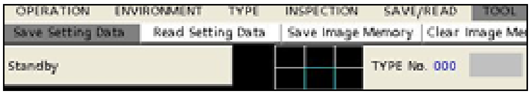
This is the function that efficiently saves the images stored in the storage space in PV200 into a PC by a command from PVWIN200. Make PV200 be the state that can communicate. Refer to "10.1.1 Communicating with PV200 (page 483)".

1. **Go to SETUP menu and select “TOOL” > “PC Communi.” from the menu bar.**

   The PV200 becomes to be able to communicate with PC and the current communication status is displayed under the menu.

   ▼Refer to▼

   "10.1.1 Communicating with PV200 (page 483)"



Standby

TYPE No. 000

2. **Execute communication from PVWIN200.**

   Specifying the destination of images with PVWIN200 starts communication. The display of PV200 changes to “Transmitting…” Pressing the CANCEL key during the communication stops the transmitting and the display changes to “Terminating...” and eventually to “Standby”.

   When communication error occurs
   When the devices cannot communicate, the display shows “Communication Error”. (When the next transmission is executed, the display changes to “Transmitting...”)
   When a communication error occurs, the notice is displayed on the screen of PVWIN200 or PVWIN200 and PV200. Execute again after solving the problem described on the message.

3. **After transmission is completed, press the CANCEL key to cancel the communication mode.**

About File Name

Images are saved in the specified folder as the following name.

For Gray Camera: Cn_NNN.bmp

For Color Camera: Cn_NNN.byr

- Cn_: Camera No. C0_ to C1_
- NNN: Image No. 000 –

▶ Note

Image files for color cameras are created as bayer images (.byr).

Images saved in this format (.byr) cannot be confirmed with general applications such as a PC.

Bayer images can be confirmed on PV200, PVWIN200 or PVImageConverter.

10.1.5 Downloading images into Test Image Memory of PV200

This is the function that downloads the images stored in a PC into the Test Image Memory of PV200 by a command from PVWIN200.

Other than the images uploaded from PV200, images that meet the following conditions can be downloaded.

- Download for Gray Camera
  - 256-color bitmap format (Size of 4 MB or less)
- Download for Color Camera
  - 24-bit color bitmap format (Size of approx. 6 MB or less)
  - Bayer format (Size of approx. 2 MB or less)

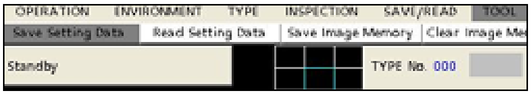
▶ Note

Images compatible with color cameras cannot be downloaded for gray cameras.

Images compatible with gray cameras cannot be downloaded for color cameras.

1. **Go to SETUP menu and select “TOOL” > “PC Communi.” from the menu bar.**

The PV200 becomes to be able to communicate with PC and the current communication status is displayed under the menu.



Standby

TYPE No. 000

2. **Execute communication from PVWIN200.**

Specifying the destination of images with PVWIN200 starts communication. The display of PV200 changes to “Transmitting…” Pressing the CANCEL key during the communication stops the transmitting and the display changes to “Terminating...” and eventually to “Standby”.

When communication error occurs

When the devices cannot communicate, the display shows “Communication Error”. (When the next transmission is executed, the display changes to “Transmitting...”)
When a communication error occurs, the notice is displayed on the screen of PVWIN200 or PVWIN200 and PV200. Execute again after solving the problem described on the message.

3. **After transmission is completed, press the CANCEL key to cancel the communication mode.**

10.2 About PVImageConverter

PVImageConverter is software to check bayer images (refer to page 286) saved with PV200 or Image Receiver for PV on a PC, or to convert bayer images to RGB images (.bmp).

Downloading PVImageConverter

PVImageConverter is installed together when PVWIN200 is installed.

▼Refer to▼ Downloading PVWIN200 (page 482)

Hardware Requirements of PVImageConverter

PC	Compatible computer for IBM PC/AT
OS *1	Windows® 7 *2, Windows Vista®, Windows® XP
CPU	Pentium III 700 MHz or more
Memory Amount	512 MB or more
Display resolution	1024 x 768 or more
Display color	Full Color (32-bit) or more

*1: For 32-bit Edition only.
*2: Note that there are some restrictions on installation. For details, refer to the PVWIN200 download page on our web site.

Checking Bayer Images

1. **Start PVImageConverter.**

2. **Specify the folder saving bayer images**

   You can check bayer images in the folder one by one on the screen in the window.

Converting Bayer Images to RGB Images

1. **Check bayer images with PVImageConverter.**

2. **Convert the bayer image (.byr) you want to convert to RGB image (.bmp). There are two types of conversion, "All Convert" and "Convert".**
   - All Convert: Changes the extension of file names, and creates RGB images in the same folder.
   - Convert : Creates a RGB image by specifying a folder and file name.

Chapter 11

Specifications and List of Product Numbers

11.1 General Specification

PV200

CPU		32-bit RISC CPU & DSP
Number of camera connections		Up to 2 *1)
Processing resolution		0.3-Mega Camera (Gray/Color): Hor. 640 x Ver. 480 pixels 2-Mega Camera (Gray/Color): Hor. 1600 x Ver. 1200 pixels 4-Mega Camera (Gray): Hor. 2048 x Ver. 2048 pixels Partial imaging is available (One area)
Processing function		Gray camera/Color camera: Gray scale processing/Binary) Color camera: Color/Color extraction/Grayscale conversion
Interface	Serial	RS-232C x 1
	Parallel input	I/O terminal (Phoenix): Input 14 points, 24V DC, Bi-directional photo coupler
	Parallel output	I/O terminal (Phoenix): Output 15 points, 5 to 24V DC, Photo Mos output
	USB	For USB2.0, AB type (for PVWIN200 only)
	Ethernet	Ethernet Port x 1 Media: 10-BASE-T / 100BASE-TX / 1000BASE-T Protocol: TCP/IP (General communication), UDP/IP (PLC communication)
	Memory card	SD memory card slot x1
	Monitor output	1ch: VGA (640 X 480) output
	Setting	1 ch: For the dedicated keypad
Rating	Voltage	24 V DC Operating voltage range: 21.6 to 26.4 V DC (with ripples)
	Power Consumption	1.2 A or less
Environmental resistance	Operating temperature range	0 to +45 °C (without icing and dew condensation)
	Operating humidity range	35 to 85% RH (without icing and dew condensation at 25°C)
	Noise resistance	1000 V pulse width 50 ns/1 μs (a noise simulator was used.)
	Vibration resistance	10 to 55 Hz, one sweep per minute, amplitude 0.75 mm, 30 minutes each in X/Y/Z direction
	Shock resistance	196m/ s^2, 5 times each in X, Y and Z directions
	Insulation resistance (initial)	100 MΩ or more (500 V DC by insulation resistance tester)*2 Input terminals and output terminals - Power terminal and functional earth Input terminals and output terminals - Non-electrifiable metal part Power terminal - Non-electrifiable metal part
	Voltage resistance (initial)	500 V AC / minute (600 V AC / second), cutoff current 10 mA *2 Input terminals and output terminals - Power terminal and functional earth Input terminals and output terminals - Non-electrifiable metal part Power terminal - Non-electrifiable metal part
Battery life		Approx. 10 years (at 25°C)
Weight		Approx. 0.5 kg (including Terminal block)

*1) When connecting a 2-Mega camera, only a gray camera can be used in combination. Also, a 4-Mega camera cannot be used with other cameras. (Refer to page58.)

*2) Tested with the varistor and the condenser at the primary side of the power supply for the internal circuit removed.

Keypad

Operation keys		ENTER key, TRIG(TRIGGER) key, FUNC(FUNCTION) key, CANCEL key, F1 key, F2 key, F3 key, OPE/SET switch, LOCK key, and SHIFT key
Environmental resistance	Operating humidity range	35 to 85% RH (without icing and dew condensation at 25°C)
	Operating temperature range	0 to + 45°C (without icing and dew condensation)
Weight		ANPVP03: 170g, ANPVP10: 425g

0.3-Mega Gray Camera: ANPVC1040 / 0.3-Mega Color Camera: ANPVC2040 2-Mega Gray Camera: ANPVC1210 / 2-Mega Color Camera: ANPVC2260

		0.3-Mega Gray/Color Camera	2-Mega Gray/Color Camera
Image sensor		Interline transfer method. 1/3-inch CCD Pixel size: 7.4 μm x 7.4 μm (tetragonal pixel)	Interline transfer method. 1/1.8-inch CCD Pixel size: 4.4 μm x 4.4 μm (tetragonal pixel)
Number of effective pixels		Horizontal 659 x vertical 494 pixels	Horizontal 1628 x vertical 1236 pixels
Scanning method		Non-interlace	
Shutter Speed		0.03 to 1000.00 ms (30 μs to 1 s)	
Lens mount		C mount	
Synchronous Method		Internal synchronous	
Picture output		Digital output	
Rating	Power supply voltage	12 V DC +/- 10%	
	Power Consumption	235 mA or less	360 mA or less
Environmental resistance	Operating ambient temperature	0 to +45°C (without icing and dew condensation)	0 to +40°C (without icing and dew condensation)
	Operating ambient humidity	35 to 85% RH (without icing and dew condensation at 25°C)	
	Vibration resistance	10 to 55 Hz, 1 sweep per minute, amplitude 1 mm, 30 minutes in each X, Y and Z directions	
	Shock resistance	700 m/s^2, 3 times each in X, Y and Z direction	
Weight		Approx. 65g (without lens)	

4-Mega Gray Camera (ANPVC1470)

Image sensor		Interline transfer method. 2/3-inch CCD Pixel size: 3.45 μm x 3.45 μm (tetragonal pixel)
Number of effective pixels		Horizontal 2456 x vertical 2058 pixels
Scanning method		Non-interlace
Shutter Speed		0.03 to 1000.00 ms (30 μs to 1 s)
Lens mount		C mount
Synchronous Method		Internal synchronous
Picture output		Digital output
Rating	Power supply voltage	11.0 to 13.0 V DC
	Power Consumption	310 mA or less
Environmental resistance	Operating ambient temperature	0 to +40°C (without icing and dew condensation)
	Operating ambient humidity	35 to 85% RH (without icing and dew condensation at 25°C)
	Vibration resistance	10 to 55 Hz, 1 sweep per minute, amplitude 1 mm, 30 minutes in each X, Y and Z directions
	Shock resistance	490.3 m/s^2, once each in X, Y and Z direction
Weight		Approx. 125 g (without lens)

XGA Monitor: ANPVM11021

General Specification

Rated power	Power supply voltage	24 V DC Operating voltage range: 21.6 to 26.4 V DC
	Power Consumption	0.5 A (Max. 1 A)
Environmental resistance	Operating ambient temperature	0 to +45 °C
	Operating ambient humidity	35 to 85 %RH (without dew condensation at 25°C)
	Power noise	1,000 V (P-P) or more, pulse width 50 ns, 1 μs between power terminals (a noise simulator was used.)
	Static electricity noise	4000 V or more
	Vibration resistance	10 to 55 Hz (1 sweep per minute), amplitude 0.75 mm, 30 minutes each in X, Y and Z directions
	Shock resistance	196 m/s^2, 3 times each in X, Y and Z direction
Weight		Approx. 1.4kg

Specification for Display Area

Display element		10.4-inch TFT liquid crystal
Number of pixels		1024(H) x 768(V) pixels
Display color		16,777,216 colors
Effective display size		210.4(H) x 157.8(V)
Service life of backlight		Average: 50,000 hours
Input Signal	Picture signal	Analog RGB
	Synchronizing signal	Horizontal/vertical synchronizing signal
	Horizontal operation frequency	48.36 kHz* (Number of all pixels: 1024)
	Vertical operation frequency	60 Hz* (Number of all lines: 768)
	Dot clock	65 MHz
Interface		Analog RGB input, Mini-D-SUB connector 15 pins (female)
Screen adjustment		Brightness, display width, vertical and horizontal positions, flicker, gain(R,G,B)

*The specified signals should be used for the monitor. Failure to do so may result in no screen display and noise occurrence on the screen.

11.2 Product Numbers

PV200

PV200

2-Camera type	I/O COM.: Bi-polar, Language switch over *1	ANPV0202ADP	Compliant with CE*2

Included item:

- I/O connector for discrete cables (2 pcs)

*1
Supported languages: Japanese, English, Simplified Chinese, Korean and Traditional Chinese
*2:
Attach the designated ferrite cores on the both sides of a monitor cable. Do not connect with the USB port.

Keypad

Keypad	Cable length: 3m	ANPVP03	Compliant with CE
	Cable length: 10 m	ANPVP10	

Camera

0.3-Mega Gray Camera*	Adapted for progressive, C-mount, 120 fps	ANPVC1040	Compliant with CE
0.3-Mega Color Camera*	Adapted for progressive, C-mount, 120 fps	ANPVC1040	
2-Mega Gray Camera*	Adapted for progressive, C-mount, 30 fps	ANPVC1210	
2-Mega Color Camera*	Adapted for progressive, C-mount, 30 fps	ANPVC2260	
4-Mega Gray Camera*	Adapted for progressive, C-mount, 16 fps	ANPVC1470	
Camera Cable	Cable length: 3m	ANPVC8103	
	Cable length: 5 m	ANPVC8105	
	Cable length: 10 m	ANPVC8110	
	Durable type, cable length: 3m	ANPVC8103R	
	Durable type, cable length: 5 m	ANPVC8105R	
	Durable type, cable length: 10 m	ANPVC8110R	
Bracket for 4-Mega gray camera	For 4-Mega gray camera	ANPVH005	

* Included item: Adapter ring 2.5 mm (1mm x 2, 0.5 mm x 1)

Lens

For Quad-speed Digital Camera	f = 6 mm	With a lock	ANB842NL
	f = 8.5 mm	With a lock	ANB843L
	f = 16 mm	With a lock, compact type	ANM88161
		With a lock	ANB845NL
	f = 25mm	With a lock, compact type	ANM88251
		With a lock	ANB846NL
	f = 50 mm	With a lock, compact type	ANM88501
		With a lock	ANB847L
		------	ANM8850
For 2-Mega-pixel Digital Camera	f = 16 mm	With a lock	ANPVL162
	f = 25 mm	With a lock	ANPVL252
	f = 50 mm	With a lock	ANPVL502
Adapter ring (for 0.3-Mega Camera and 2-Mega Camera)	5 mm adapter ring		ANB84805
	Adapter ring set (0.5/ 1/ 5/ 10/ 20/ 40 mm)		ANB848

Lenses are noncompliant products with CE.

Monitor

XGA Monitor	10.4-inch (with attachment bracket: 4 pcs)	ANPVM11021	Compliant with CE*[1]
Monitor cable	Cable length: 3m	ANMX83313	Compliant with CE*[1]
	Cable length: 5 m	ANMX83315	

*1: Ferrite cores (equivalent products to RFC-5 produced by Kitagawa Industries. Co., Ltd.) must be attached to both ends of a monitor cable.

Repair Parts

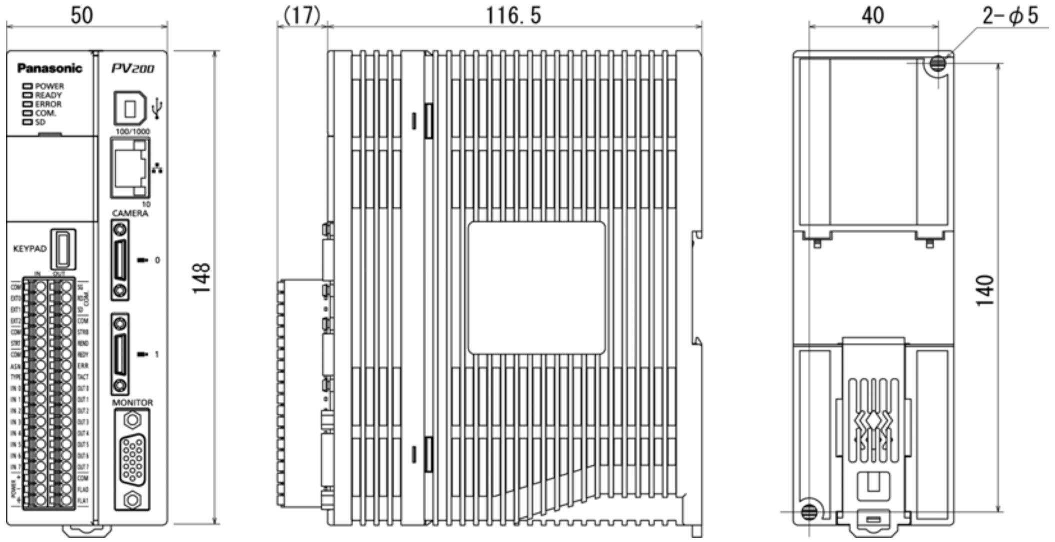
Backup buttery for PV200	Coin-type lithium buttery	AFPX-BATT	Compliant with CE

Lighting

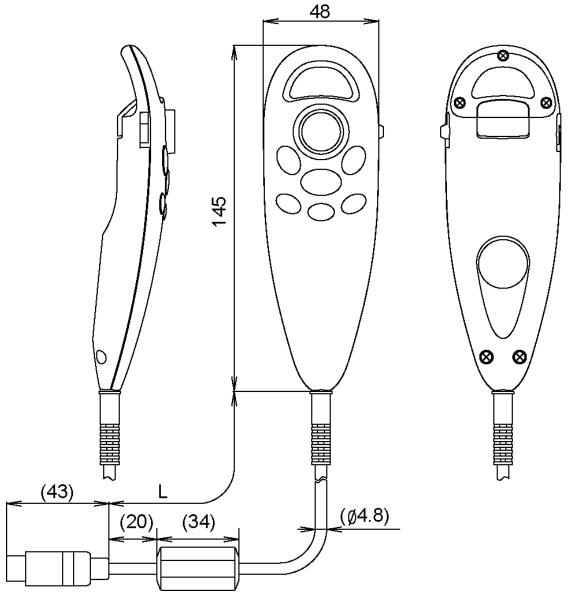
LED	Ring light [Direct lighting]	outside diameter: Ø 50, red		AULDR2-50RD
		outside diameter: Ø 50, white		AULDR2-70SW
		outside diameter: Ø 70, red		AULDR2-70RD
		outside diameter: Ø 70, white		AULDR2-70SW
	Options for ring light [Direct lighting]	For AULDR2-50RD/ AULDR2-50SW	Polarization plate	AUPL-LDR-50B
			Diffusing plate	AUDF-LDR-50B
			Diffusing plate, polarization plate Mounting adapter	AUAD-LDR-50B
		For AULDR2-70RD/ AULDR2-70SW	Polarization plate	AUPL-LDR-70A
			Diffusing plate	AUDF-LDR-70A
	Bar light [Direct lighting]	Red		AULFL-4215
		White		AULDL-4215-SW
	Surface emitting ring light [Indirect lighting]	outside diameter: Ø 74		AULKR-70A
		outside diameter: Ø 102		AULFR-100
	Surface emitting flat light [Indirect lighting]	light source size: 27 x 27		AULDL-TP2727
		light source size: 43 x 35		AULDL-TP4335
		light source size: 80 x 100		AULFL-100
	Surface emitting coaxial light [Indirect lighting]	translucent glass size: 26 x 28		AULFV-34
		translucent glass size: 32 x 36		AULFV-50A
	Power supply	Digital light source (Output: switchover 12V/24V / 10W)		ANB86001
		Digital light source (Output: switchover 12V/24V / 30W)		ANB86003
	Cable	Extension cable for 12V: 3 m		AUCB-3
		Extension cable for 24V: 3 m		AUFCB-3
		Light control cable (for ANB86001/ANB86003) : 3 m		AUEXCB-B3
Inverter ring light	Ø60 ring light			ANMF0064
	Ø92 ring light			ANMF0104
	Replacement lamp: Ø60 ring light (for ANMF0064)			ANMF0060
	Replacement lamp: Ø92 ring light (for ANMF0104)			ANMF0100

11.3 Dimensions

PV200



Keypad

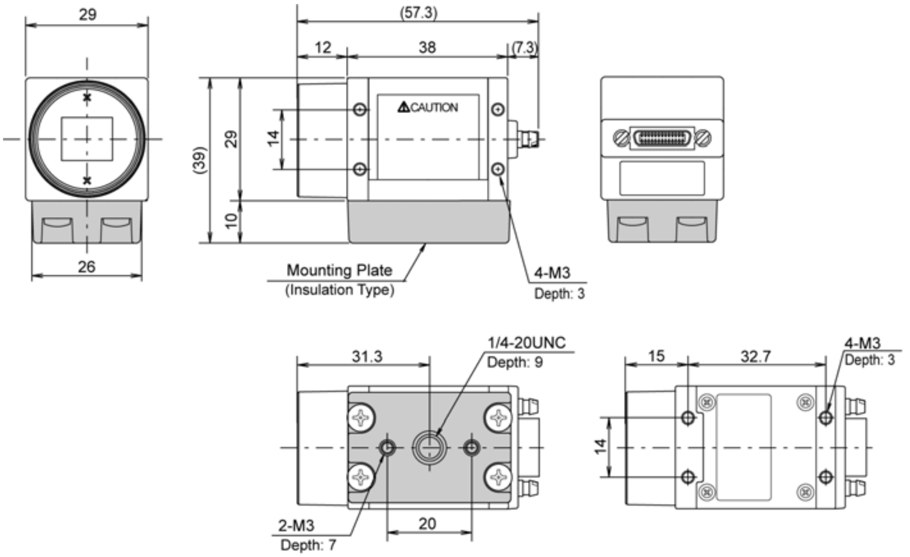


L = cable length
ANPVP03: 3 m
ANPVP10: 10 m

Camera

0.3-Mega Gray Camera: ANPVC1040 / 2-Mega Gray Camera: ANPVC1210

0.3-Mega Color Camera: ANPVC2040 / 2-Mega Color Camera: ANPVC2260



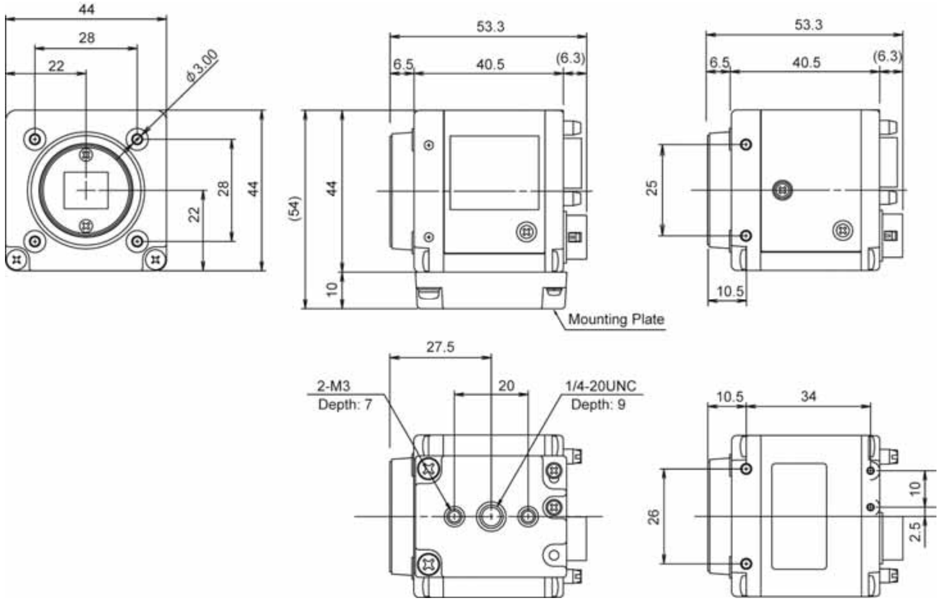
With the mounting plate

Without the mounting plate

▶ Note

The mounting plate can be attached to four sides of camera except lens attaching side and cable connecting side.

4-Mega Gray Camera: ANPVC1070



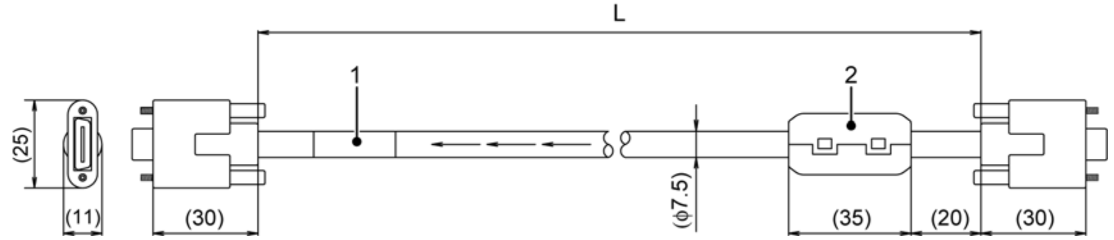
With the mounting plate

Without the mounting plate

▶ Note

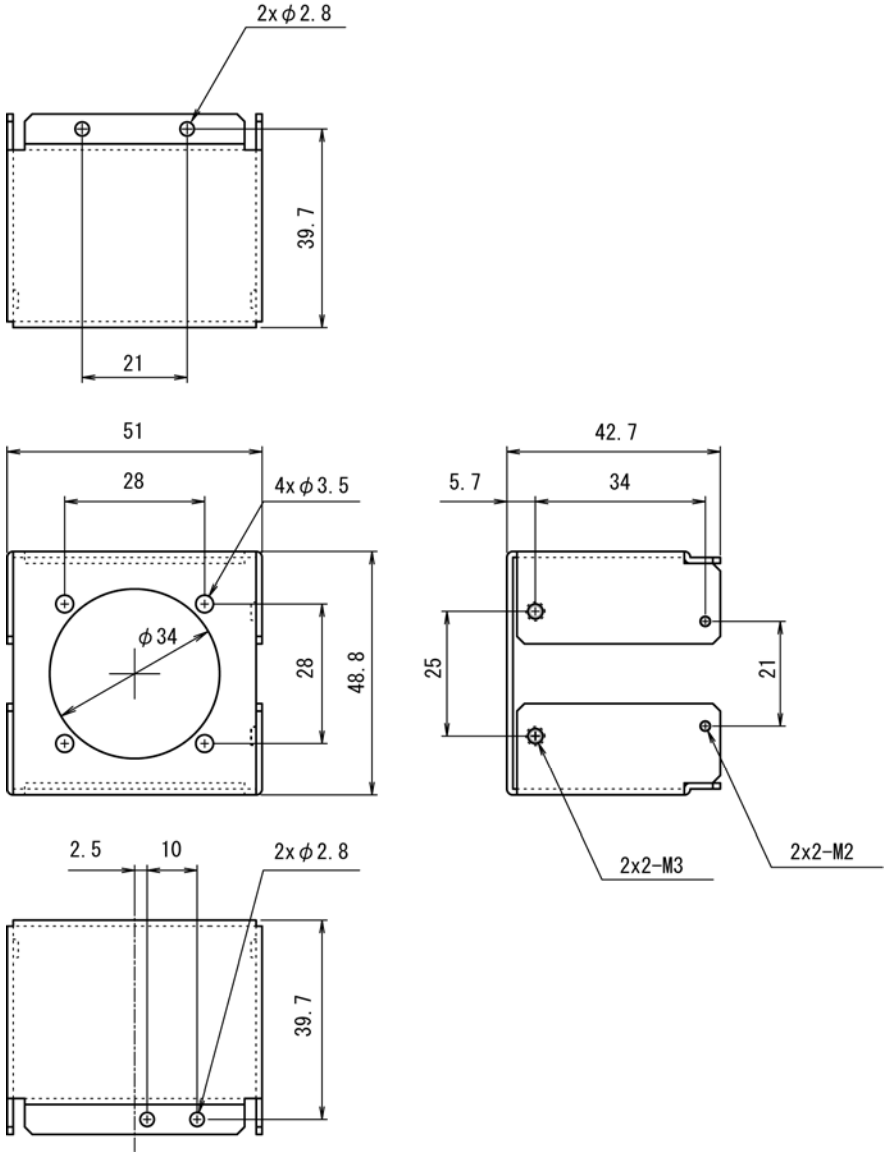
The mounting plate can be attached to the bottom and the top sides of camera. (The sides mentioned above are the side where the plate is initially attached and the opposite side.) The mounting positions of screws are different between the bottom and top sides.

Camera Cable: ANPVC8103, ANPVC8105, ANPVC8110



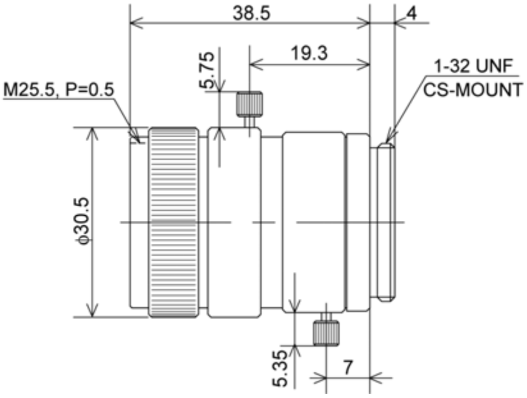
1: Product number label
2: Ferrite core
L: Cable length
ANPVC8103: 3 m, ANPVC8105: 5 m, ANPVC8110: 10 m

Bracket for 4-Mega Gray Camera: ANPVH005

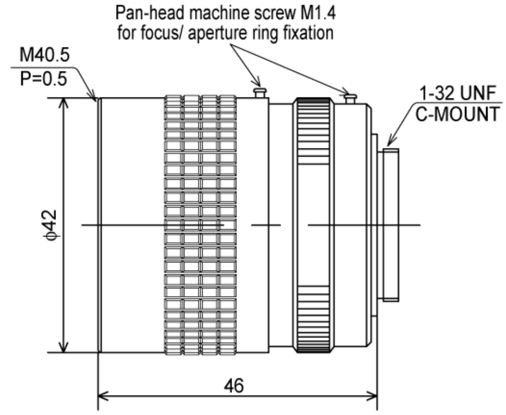


Lens

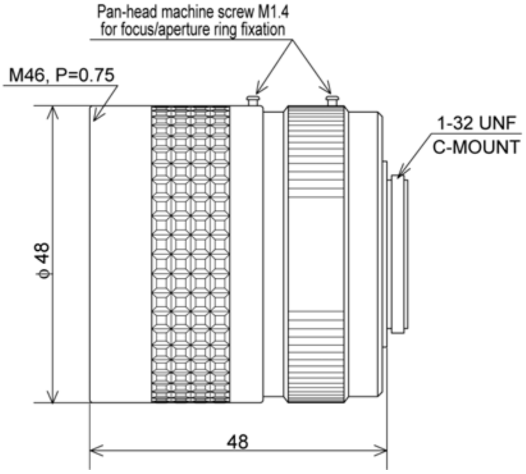
ANM88501



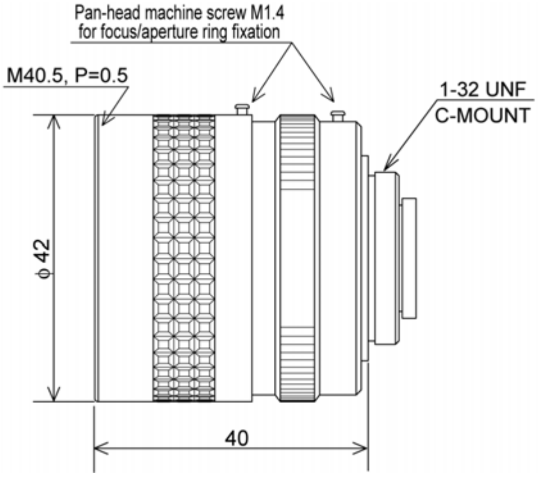
ANB842NL


Pan-head machine screw M1.4
for focus/ aperture ring fixation
M40.5
P=0.5
1-32 UNF
C-MOUNT
ϕ42
46

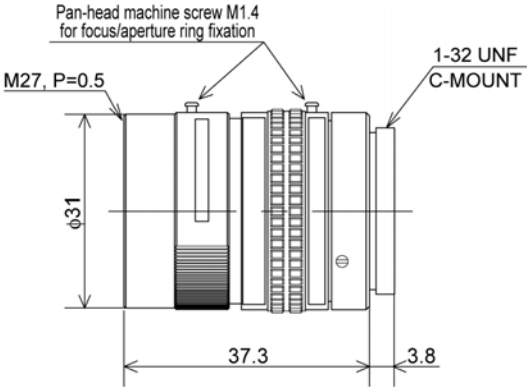
ANB847L



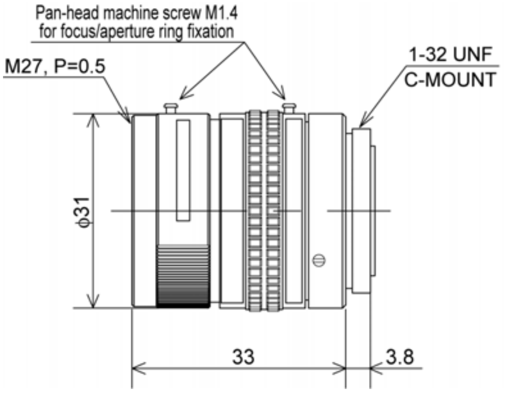
ANB843L



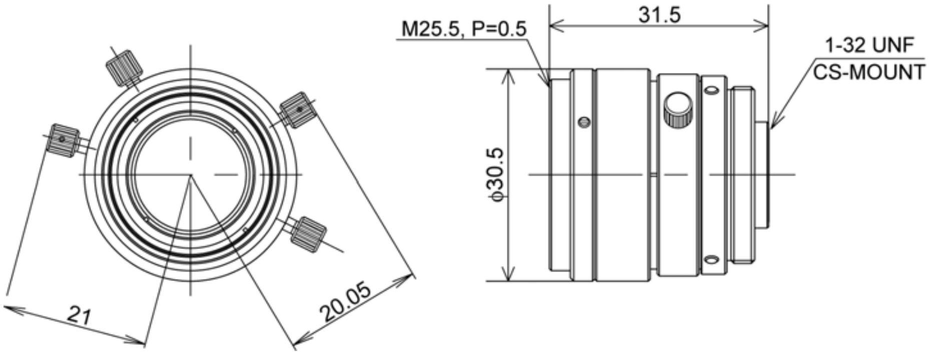
ANB846NL



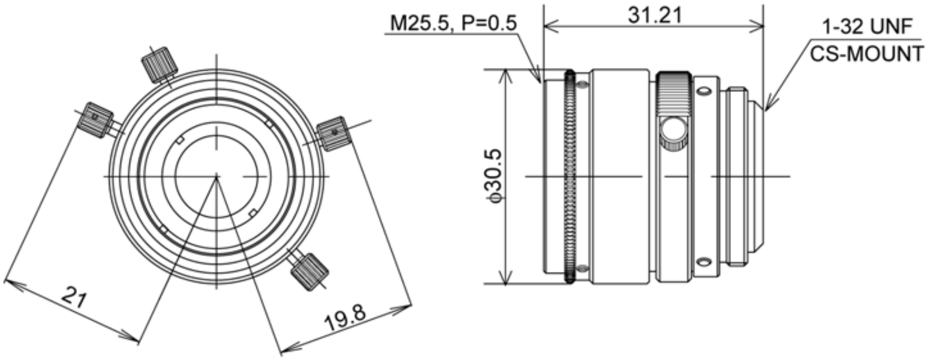
ANB845NL



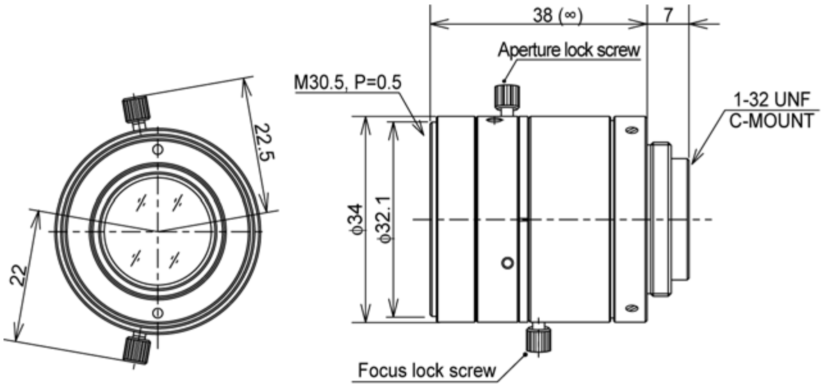
ANM88251



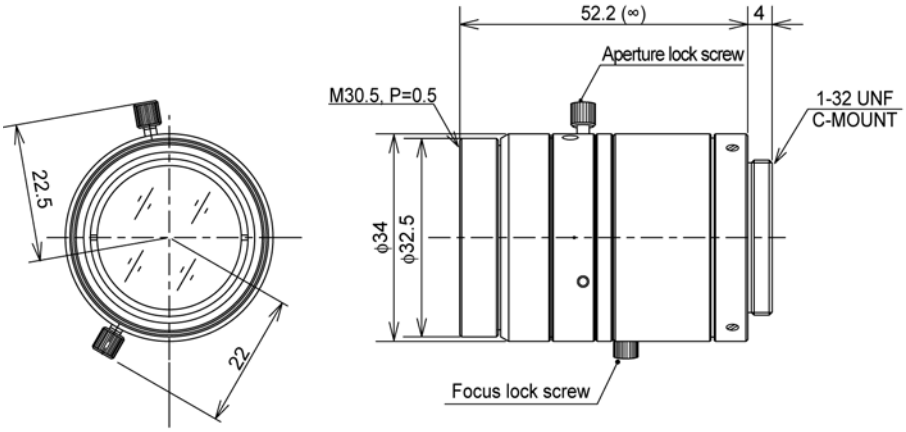
ANM88161



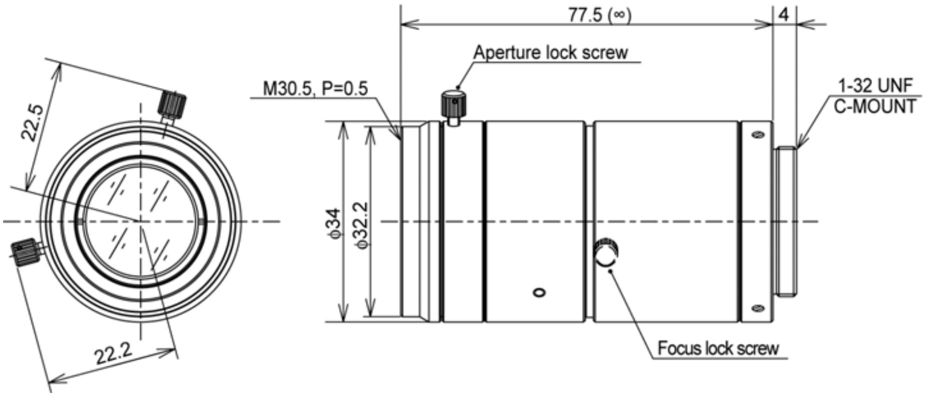
ANPV162



ANPV252

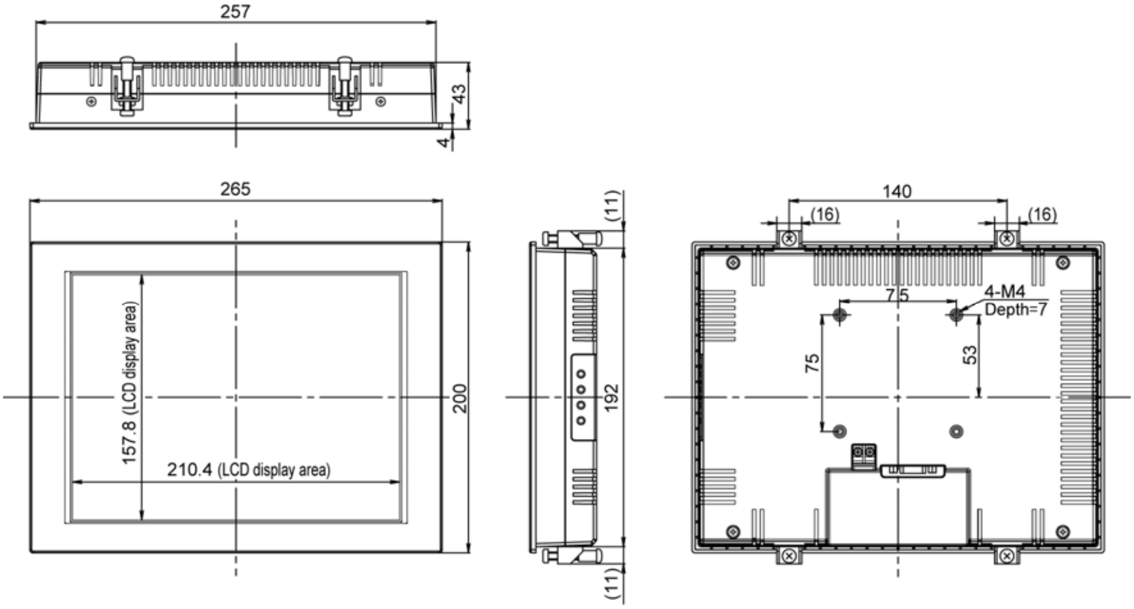


ANPV502

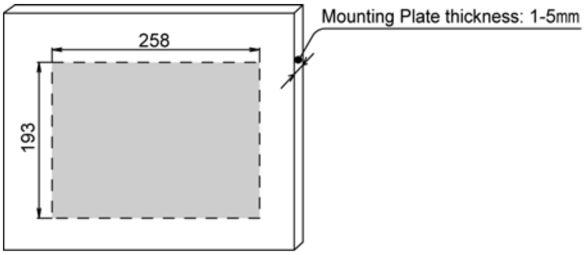


Monitor (10.4-inch)

Product No.: ANPVM11021



Cutting Dimensions of the Mounting Plate



How to read commands

This section describes the command names of the string functions used for Numerical Calculation or Judgement and the meanings in alphabetical order.

"nnn" in the string functions expresses a checker number. "mmm" expresses a result number and the number of "m" expresses the number of digits.

Depending on type of result data of Numerical Calculation, selectable type varies when selecting "Statistics".

Statistics: Type 1

Scan Count	(@COUNT)	OK count	(@OKCOUNT)	NG count	(@NGCOUNT)

Statistics: Type 2

Minimum	(@MIN)	OK Judge. Min.	(@OKMIN)	NG Judge. Min.	(@NGMIN)
Maximum	(@MAX)	OK Judge. Max.	(@OKMAX)	NG Judge. Max.	(@NGMAX)
Average	(@AV)	OK average	(@OKAV)	NG average	(@NGAV)
Range	(@RG)	OK Range	(@OKRG)	NG range	(@NGRG)
Variance	(@DV)	OK Variance	(@OKDV)	NG Variance	(@NGDV)

Example 1)

CGWnnn_ AVE.mm Items used

Connector (Gray Window) / Checker No. / Gray Average / Result No. Numerical Calculation

Example 2)

COS(

Cosine when the value in parentheses is radian Numerical Calculation

Example 3)

FWCnnn_SIZE.mmm@OKRG

Flaw Detection / Checker No. / Flaw Size / Result No. / Statistics / OK Range Numerical Calculation

Example 4)

SELnnn_LIJUDGE

Smart Edge (Line) / Checker No. / Linearity Judgement Numerical Calculation or Judgement

▼Refer to▼

For details of Numerical Calculation, refer to "4.11.2 Data That Can Be Used in Numerical Calculation" (p.235).

For details of Judgement, refer to "Data That Can Be Used in Judgement" (p.249).

List of commands (in alphabetical order)

String function	Numerical Calculation		Judge.	Meaning of function
	Statistics	Result		
ABS(		Yes		Absolute value of value in parentheses
ACOS(		Yes		Arccosine of value in parentheses (unit:radian)
ACOSD(		Yes		Arccosine of value in parentheses (unit:degree)
ASIN(		Yes		Arcsine of value in parentheses (unit:radian)
ASIND(		Yes		Arcsine of value in parentheses (unit:degree)

String function	Numerical Calculation		Judge.	Meaning of function	
	Statistics	Result			
ATAN(		Yes		Arctangent of value in parentheses (unit:radian)	
ATAND(		Yes		Arctangent of value in parentheses (unit:degree)	
AUCnnn_JUDGE	@ (Type1)	Yes	Yes	Area Size Adj.	Judgement
AUCnnn_PX	@ (Type2)	Yes		Area Size Adj.	Proj. X Axis
AUCnnn_PY	@ (Type2)	Yes		Area Size Adj.	Proj. Y Axis
AUCnnn_TIME	@ (Type2)	Yes		Area Size Adj.	Inspection Time
AUCnnn_X	@ (Type2)	Yes		Area Size Adj.	X
AUCnnn_Y	@ (Type2)	Yes		Area Size Adj.	Y
AVE(		Yes		Average of the calculation results for the number specified by the second term in parentheses from the Numerical Calculation No. specified by the first term.	
BECnnn_COLOR.mmm	@ (Type2)	Yes		Binary Edge	Detected Color
BECnnn_COUNT	@ (Type2)	Yes		Binary Edge	No. of Objects
BECnnn_JUDGE	@ (Type1)	Yes	Yes	Binary Edge	Judgement
BECnnn_PX.mmm	@ (Type2)	Yes		Binary Edge	Proj. X Axis
BECnnn_PY.mmm	@ (Type2)	Yes		Binary Edge	Proj. Y Axis
BECnnn_TIME	@ (Type2)	Yes		Binary Edge	Inspection Time
BECnnn_X.mmm	@ (Type2)	Yes		Binary Edge	X
BECnnn_Y.mmm	@ (Type2)	Yes		Binary Edge	Y
BWCnnn_AREA	@ (Type2)	Yes		Binary Window	Area
BWCnnn_JUDGE	@ (Type1)	Yes	Yes	Binary Window	Judgement
BWCnnn_TIME	@ (Type2)	Yes		Binary Window	Inspection Time
CACnnn_JUDGE	@ (Type1)	Yes	Yes	Numerical Calcu.	Judgement
CACnnn_VALUE	@ (Type2)	Yes		Numerical Calcu.	Calculated result
CANGLE(		Yes		Display of a narrow intersecting angle of two lines in radian specified by six values in parentheses.	
CBWnnn_AREA.mm	@ (Type2)	Yes		Connector (Binary Window)	Area
CBWnnn_CELL	@ (Type2)	Yes		Connector (Binary Window)	No. of Cells
CBWnnn_JUDGE	@ (Type1)	Yes	Yes	Connector (Binary Window)	Judgement
CBWnnn_PJUDGE.mm	@ (Type1)	Yes	Yes	Connector (Binary Window)	Individual Judgement
CBWnnn_TIME	@ (Type2)	Yes		Connector (Binary Window)	Inspection Time
CEIL(		Yes		Integer to which a value in parentheses was rounded up	
CGEnnn_CELL	@ (Type2)	Yes		Connector (Gray Edge)	No. of Cells
CGEnnn_D0.mm	@ (Type2)	Yes		Connector (Gray Edge)	Area 0: Edge Differential
CGEnnn_D1.mm	@ (Type2)	Yes		Connector (Gray Edge)	Area 1: Edge Differential
CGEnnn_JUDGE	@ (Type1)	Yes	Yes	Connector (Gray Edge)	Judgement
CGEnnn_PAVE	@ (Type2)	Yes		Connector (Gray Edge)	Average Pitch
CGEnnn_PJUDGE.mm	@ (Type1)	Yes	Yes	Connector (Gray Edge)	Pitch Individual Judgement
CGEnnn_PMAX	@ (Type2)	Yes		Connector (Gray Edge)	Max. Pitch
CGEnnn_PMIN	@ (Type2)	Yes		Connector (Gray Edge)	Min. Pitch

String function	Numerical Calculation		Judge.	Meaning of function	
	Statistics	Result			
CGEnnn_PT.mm	@ (Type2)	Yes		Connector (Gray Edge)	Pitch
CGEnnn_PTJUDG	@ (Type1)	Yes	Yes	Connector (Gray Edge)	Pitch Total Judgment
CGEnnn_TIME	@ (Type2)	Yes		Connector (Gray Edge)	Inspection Time
CGEnnn_UJUDGE.mm	@ (Type1)	Yes	Yes	Connector (Gray Edge)	Distance Difference Judgement
CGEnnn_UPJUDG	@ (Type1)	Yes	Yes	Connector (Gray Edge)	Distance Difference Total Judgement
CGEnnn_UPT.mm	@ (Type2)	Yes		Connector (Gray Edge)	Distance Difference
CGEnnn_X0.mm	@ (Type2)	Yes		Connector (Gray Edge)	Area 0: X-Coord. Edge
CGEnnn_X1.mm	@ (Type2)	Yes		Connector (Gray Edge)	Area 1: X-Coord. Edge
CGEnnn_Y0.mm	@ (Type2)	Yes		Connector (Gray Edge)	Area 0: Y-Coord. Edge
CGEnnn_Y1.mm	@ (Type2)	Yes		Connector (Gray Edge)	Area 1: Y-Coord. Edge
CGWnnn_AVE.mm	@ (Type2)	Yes		Connector (Gray Window)	Gray Average
CGWnnn_CELL	@ (Type2)	Yes		Connector (Gray Window)	No. of Cells
CGWnnn_JUDGE	@ (Type1)	Yes	Yes	Connector (Gray Window)	Judgement
CGWnnn_PJUDGE.mm	@ (Type1)	Yes	Yes	Connector (Gray Window)	Individual Judgement
CGWnnn_TIME	@ (Type2)	Yes		Connector (Gray Window)	Inspection Time
CIRCLER(		Yes		Radius of the circle on three points specified by six values in parentheses	
CIRCLEX(		Yes		Center X of the circle on three points specified by six values in parentheses	
CIRCLEY(		Yes		Center Y of the circle on three points specified by six values in parentheses	
COS(		Yes		Cosine when the value in parentheses is radian	
COSD(		Yes		Cosine when the value in parentheses is degree	
CPOINTX(		Yes		X of the intersection of two lines specified by six values in parentheses	
CPOINTY(		Yes		Y of the intersection of two lines specified by six values in parentheses	
CWCnnn_BAJUDG	@ (Type1)	Yes	Yes	Color Window	B Ave. Judge.
CWCnnn_BAV	@ (Type2)	Yes		Color Window	B Ave.
CWCnnn_BJUDG	@ (Type1)	Yes	Yes	Color Window	B Judge.
CWCnnn_BMAX	@ (Type2)	Yes		Color Window	B Max.
CWCnnn_BMIN	@ (Type2)	Yes		Color Window	B Min.
CWCnnn_BSD	@ (Type2)	Yes		Color Window	B Standard Devi.
CWCnnn_BSJUDG	@ (Type1)	Yes	Yes	Color Window	B Standard Devi. Judge.
CWCnnn_GAJUDG	@ (Type1)	Yes	Yes	Color Window	G Ave. Judge.
CWCnnn_GAV	@ (Type2)	Yes		Color Window	G Ave.
CWCnnn_GJUDG	@ (Type1)	Yes	Yes	Color Window	G Judge.
CWCnnn_GMAX	@ (Type2)	Yes		Color Window	G Max.
CWCnnn_GMIN	@ (Type2)	Yes		Color Window	G Min.
CWCnnn_GSD	@ (Type2)	Yes		Color Window	G Standard Devi.
CWCnnn_GSJUDG	@ (Type1)	Yes	Yes	Color Window	G Standard Devi. Judge.

String function	Numerical Calculation		Judge.	Meaning of function	
	Statistics	Result			
CWCnnn_JUDGE	@ (Type1)	Yes	Yes	Color Window	Judgement
CWCnnn_RAJUDG	@ (Type1)	Yes	Yes	Color Window	R Ave. Judge.
CWCnnn_RAV	@ (Type2)	Yes		Color Window	R Ave.
CWCnnn_RJUDG	@ (Type1)	Yes	Yes	Color Window	R Judge.
CWCnnn_RMAX	@ (Type2)	Yes		Color Window	R Max.
CWCnnn_RMIN	@ (Type2)	Yes		Color Window	R Min.
CWCnnn_RSD	@ (Type2)	Yes		Color Window	R Standard Devi.
CWCnnn_RSJUDG	@ (Type1)	Yes	Yes	Color Window	R Standard Devi. Judge.
CWCnnn_TIME	@ (Type2)	Yes		Color Window	Inspection Time
DEG(		Yes		Convert a value in parentheses (radian) to degree.	
DIST(		Yes		Distance between two points Q0 (X0,Y0) and Q1(X1,Y1) in pixels	
ELINEPA(		Yes		Element a of a line (ax+by+c=0) which connects two points (x0,y0) and (x1,y1).	
ELINEPB(		Yes		Element b of a line (ax+by+c=0) which connects two points (x0,y0) and (x1,y1).	
ELINEPC(		Yes		Element c of a line (ax+by+c=0) which connects two points (x0,y0) and (x1,y1).	
EQ(		Yes		Returns "1" when (the first term in parentheses) = (the second term), otherwise "0".	
FECnnn_ANG.mmmm	@ (Type2)	Yes		Feature Extraction	Principal axis angle
FECnnn_AREA.mmmm	@ (Type2)	Yes		Feature Extraction	Area
FECnnn_COUNT	@ (Type2)	Yes		Feature Extraction	No. of Objects
FECnnn_JUDGE	@ (Type1)	Yes	Yes	Feature Extraction	Judgement
FECnnn_LDX.mmmm	@ (Type2)	Yes		Feature Extraction	Circumscribing Rectangle Lower Left X
FECnnn_LDY.mmmm	@ (Type2)	Yes		Feature Extraction	Circumscribing Rectangle Lower Left Y
FECnnn_LEN.mmmm	@ (Type2)	Yes		Feature Extraction	Perimeter
FECnnn_LUX.mmmm	@ (Type2)	Yes		Feature Extraction	Circumscribing Rectangle Upper Left X
FECnnn_LUY.mmmm	@ (Type2)	Yes		Feature Extraction	Circumscribing Rectangle Upper Left Y
FECnnn_PH.mmmm	@ (Type2)	Yes		Feature Extraction	Projection Height
FECnnn_PW.mmmm	@ (Type2)	Yes		Feature Extraction	Projection Width
FECnnn_PX.mmmm	@ (Type2)	Yes		Feature Extraction	Proj. X Axis
FECnnn_PY.mmmm	@ (Type2)	Yes		Feature Extraction	Proj. Y Axis
FECnnn_RDX.mmmm	@ (Type2)	Yes		Feature Extraction	Circumscribing Rectangle Lower Right X
FECnnn_RDY.mmmm	@ (Type2)	Yes		Feature Extraction	Circumscribing Rectangle Lower Right Y
FECnnn_RUX.mmmm	@ (Type2)	Yes		Feature Extraction	Circumscribing Rectangle Upper Right X
FECnnn_RUY.mmmm	@ (Type2)	Yes		Feature Extraction	Circumscribing Rectangle Upper Right Y
FECnnn_TIME	@ (Type2)	Yes		Feature Extraction	Inspection Time
FECnnn_X.mmmm	@ (Type2)	Yes		Feature Extraction	Gravity X
FECnnn_Y.mmmm	@ (Type2)	Yes		Feature Extraction	Gravity Y

String function	Numerical Calculation		Judge.	Meaning of function	
	Statistics	Result			
FLOOR(		Yes		Integer to which a value in parentheses was rounded down	
FWCnnn_CNO.mmm	@ (Type2)	Yes		Flaw Detection	First Cell of Flaw
FWCnnn_COUNT	@ (Type2)	Yes		Flaw Detection	No. of Objects
FWCnnn_JUDGE	@ (Type1)	Yes	Yes	Flaw Detection	Judgement
FWCnnn_PX.mmm	@ (Type2)	Yes		Flaw Detection	Proj. X Axis
FWCnnn_PY.mmm	@ (Type2)	Yes		Flaw Detection	Proj. Y Axis
FWCnnn_SIZE.mmm	@ (Type2)	Yes		Flaw Detection	Flaw size
FWCnnn_TIME	@ (Type2)	Yes		Flaw Detection	Inspection Time
FWCnnn_X.mmm	@ (Type2)	Yes		Flaw Detection	X
FWCnnn_Y.mmm	@ (Type2)	Yes		Flaw Detection	Y
GE(		Yes		Returns "1" when (the first term in parentheses) is greater than or equal to (the second term), otherwise "0".	
GECnnn_COUNT	@ (Type2)	Yes		Gray Edge	No. of Objects
GECnnn_DIF.mmm	@ (Type2)	Yes		Gray Edge	Differential
GECnnn_JUDGE	@ (Type1)	Yes	Yes	Gray Edge	Judgement
GECnnn_PX.mmm	@ (Type2)	Yes		Gray Edge	Proj. X Axis
GECnnn_PY.mmm	@ (Type2)	Yes		Gray Edge	Proj. Y Axis
GECnnn_TIME	@ (Type2)	Yes		Gray Edge	Inspection Time
GECnnn_X.mmm	@ (Type2)	Yes		Gray Edge	X
GECnnn_Y.mmm	@ (Type2)	Yes		Gray Edge	Y
GGCnnn_AJUDGE	@ (Type1)	Yes	Yes	Geometry Calcu.	Angle Judgement
GGCnnn_ANG	@ (Type2)	Yes		Geometry Calcu.	Angle
GGCnnn_CAJUDGE	@ (Type1)	Yes	Yes	Geometry Calcu.	Intersecting Angle Judgement
GGCnnn_CANG	@ (Type2)	Yes		Geometry Calcu.	Intersecting Angle
GGCnnn_DIST	@ (Type2)	Yes		Geometry Calcu.	Distance
GGCnnn_DJUDGE	@ (Type1)	Yes	Yes	Geometry Calcu.	Distance Judgement
GGCnnn_JUDGE	@ (Type1)	Yes	Yes	Geometry Calcu.	Judgement
GGCnnn_LA	@ (Type2)	Yes		Geometry Calcu.	Major Axis
GGCnnn_LAJUDGE	@ (Type1)	Yes	Yes	Geometry Calcu.	Major Axis Judgement
GGCnnn_LINEA	@ (Type2)	Yes		Geometry Calcu.	Line Parameter A
GGCnnn_LINEB	@ (Type2)	Yes		Geometry Calcu.	Line Parameter B
GGCnnn_LINEC	@ (Type2)	Yes		Geometry Calcu.	Line Parameter C
GGCnnn_R	@ (Type2)	Yes		Geometry Calcu.	Radius
GGCnnn_RJUDGE	@ (Type1)	Yes	Yes	Geometry Calcu.	Radius judgement
GGCnnn_SA	@ (Type2)	Yes		Geometry Calcu.	Minor Axis
GGCnnn_SAJUDGE	@ (Type1)	Yes	Yes	Geometry Calcu.	Minor Axis Judgement
GGCnnn_SJUDGE	@ (Type1)	Yes	Yes	Geometry Calcu.	Standard Devation Judgement
GGCnnn_STD	@ (Type2)	Yes		Geometry Calcu.	Standard Deviation
GGCnnn_TIME	@ (Type2)	Yes		Geometry Calcu.	Inspection Time
GGCnnn_X	@ (Type2)	Yes		Geometry Calcu.	X
GGCnnn_XJUDGE	@ (Type1)	Yes	Yes	Geometry Calcu.	X Judgement
GGCnnn_Y	@ (Type2)	Yes		Geometry Calcu.	Y
GGCnnn_YJUDGE	@ (Type1)	Yes	Yes	Geometry Calcu.	Y Judgement
GT(		Yes		Returns "1" when (the first term in parentheses) is greater than (the second term), otherwise "0".	
GWCnnn_AVE	@ (Type2)	Yes		Gray Window	Gray Average
GWCnnn_JUDGE	@ (Type1)	Yes	Yes	Gray Window	Judgement
GWCnnn_TIME	@ (Type2)	Yes		Gray Window	Inspection Time
INT(		Yes		Integer portion of a value in parentheses	

String function	Numerical Calculation		Judge.	Meaning of function	
	Statistics	Result			
JDCnnn_JUDGE	@ (Type1)	Yes	Yes	Judgement (External output)	Judgement
JRCnnn_JUDGE	@ (Type1)	Yes	Yes	Judgement (Internal)	Judgement
LE(		Yes		Returns "1" when (the first term in parentheses) is less than or equal to (the second term), otherwise "0".	
LICnnn_DCOUNT	@ (Type2)	Yes		Line	No. of pixels
LICnnn_DJUDGE	@ (Type1)	Yes	Yes	Line	Pixel Judgement
LICnnn_JUDGE	@ (Type1)	Yes	Yes	Line	Judgement
LICnnn_LCOUNT	@ (Type2)	Yes		Line	No. of objects
LICnnn_LJUDGE	@ (Type1)	Yes	Yes	Line	Object Judgement
LICnnn_TIME	@ (Type2)	Yes		Line	Inspection Time
LINESA(		Yes		Element a of a regression line expression in least squares calculated by multiple coordinate values specified with three values in parentheses	
LINESB(		Yes		Element b of a regression line expression in least squares calculated by multiple coordinate values specified with three values in parentheses	
LINESC(		Yes		Element c of a regression line expression in least squares calculated by multiple coordinate values specified with three values in parentheses	
LOG10(		Yes		Common logarithm of a value in parentheses	
LT(		Yes		Returns "1" when (the first term in parentheses) is less than (the second term), otherwise "0".	
MAX(		Yes		Maximum value of the calculation results for the number specified by the second term in parentheses from the Numerical Calculation No. specified by the first term.	
MIDDLEX(		Yes		Coordinate X of the median of two pairs of coordinates specified with four values in parentheses.	
MIDDLEY(		Yes		Coordinate Y of the median of two pairs of coordinates specified with four values in parentheses.	
MIN(		Yes		Minimum value of the calculation results for the number specified by the second term in parentheses from the Numerical Calculation No. specified by the first term.	
MOD(		Yes		Remainder when (the first term in parentheses) is divided by (the second term)	
NE(		Yes		Returns "1" when (the first term in parentheses) is not equal to (the second term), otherwise "0".	
OCAnnn_JUDGE	@ (Type1)	Yes	Yes	Numerical Calcu.	Judgement (Previous Value)
OCAnnn_VALUE	@ (Type2)	Yes		Numerical Calcu.	Calculation Result (Previous Value)
PACnnn_AJANG	@ (Type2)	Yes		Position Adjustment	Adjustment Amount Theta
PACnnn_AJX	@ (Type2)	Yes		Position Adjustment	X Adjustment Amount
PACnnn_AJY	@ (Type2)	Yes		Position Adjustment	Y Adjustment Amount
PACnnn_ANG	@ (Type2)	Yes		Position Adjustment	Detect Position Theta

String function	Numerical Calculation		Judge.	Meaning of function	
	Statistics	Result			
PACnnn_BANG	@ (Type2)	Yes		Position Adjustment	Base Position Theta
PACnnn_BJUDGE.m	@ (Type1)	Yes	Yes	Position Adjustment	Judgement of Base Checker
PACnnn_BPOSX	@ (Type2)	Yes		Position Adjustment	Base Position X
PACnnn_BPOSY	@ (Type2)	Yes		Position Adjustment	Base Position Y
PACnnn_BPX.m	@ (Type2)	Yes		Position Adjustment	Base projection X
PACnnn_BPY.m	@ (Type2)	Yes		Position Adjustment	Base projection Y
PACnnn_BTIME.m	@ (Type2)	Yes		Position Adjustment	Base Inspection Time
PACnnn_BX.m	@ (Type2)	Yes		Position Adjustment	Base X
PACnnn_BY.m	@ (Type2)	Yes		Position Adjustment	Base Y
PACnnn_JUDGE	@ (Type1)	Yes	Yes	Position Adjustment	Judgement
PACnnn_TIME	@ (Type2)	Yes		Position Adjustment	Inspection Time
PACnnn_X	@ (Type2)	Yes		Position Adjustment	Detect Position X
PACnnn_Y	@ (Type2)	Yes		Position Adjustment	Detect Position Y
PI()		Yes		Pi (fixed value: 3.142)	
POW(		Yes		Value when (the first term in parentheses) is multiplied by (the second term)	
RAD(		Yes		Convert a value in parentheses (degree) to radian.	
ROUND(		Yes		Integer to which a value in parentheses was rounded off	
SECnnn_AMAX	@ (Type2)	Yes		Smart Edge (Circle)	Max. Angle
SECnnn_AMIN	@ (Type2)	Yes		Smart Edge (Circle)	Min. Angle
SECnnn_CELL	@ (Type2)	Yes		Smart Edge (Circle)	No. of Cells
SECnnn_CIR0	@ (Type2)	Yes		Smart Edge (Circle)	Circularity 0
SECnnn_CIR1	@ (Type2)	Yes		Smart Edge (Circle)	Circularity 1
SECnnn_CJUDGE	@ (Type1)	Yes	Yes	Smart Edge (Circle)	Circularity Judgement
SECnnn_CX0	@ (Type2)	Yes		Smart Edge (Circle)	Center X 0
SECnnn_CX1	@ (Type2)	Yes		Smart Edge (Circle)	Center X 1
SECnnn_CY0	@ (Type2)	Yes		Smart Edge (Circle)	Center Y 0
SECnnn_CY1	@ (Type2)	Yes		Smart Edge (Circle)	Center Y 1
SECnnn_D0.mmmm	@ (Type2)	Yes		Smart Edge (Circle)	Differential 0
SECnnn_D1.mmmm	@ (Type2)	Yes		Smart Edge (Circle)	Differential 1
SECnnn_DEV.mmmm	@ (Type2)	Yes		Smart Edge (Circle)	Deviation
SECnnn_FCNT	@ (Type2)	Yes		Smart Edge (Circle)	Used Edge Count
SECnnn_IJUDGE.mmmm	@ (Type1)	Yes	Yes	Smart Edge (Circle)	Individual Judgement
SECnnn_JUDGE	@ (Type1)	Yes	Yes	Smart Edge (Circle)	Judgement
SECnnn_LAVE	@ (Type2)	Yes		Smart Edge (Circle)	Average
SECnnn_LEN.mmmm	@ (Type2)	Yes		Smart Edge (Circle)	Measurement
SECnnn_LJUDGE	@ (Type1)	Yes	Yes	Smart Edge (Circle)	Measurement Judgement
SECnnn_LMAX	@ (Type2)	Yes		Smart Edge (Circle)	Maximum
SECnnn_LMIN	@ (Type2)	Yes		Smart Edge (Circle)	Minimum
SECnnn_NCNT	@ (Type2)	Yes		Smart Edge (Circle)	Unused Edge Count
SECnnn_NJUDGE	@ (Type1)	Yes	Yes	Smart Edge (Circle)	Unused Edge Count Judgement
SECnnn_R0	@ (Type2)	Yes		Smart Edge (Circle)	Radius 0
SECnnn_R1	@ (Type2)	Yes		Smart Edge (Circle)	Radius 1
SECnnn_SJUDGE	@ (Type1)	Yes	Yes	Smart Edge (Circle)	Standard Devation Judgement
SECnnn_STAT.mmmm	@ (Type2)	Yes		Smart Edge (Circle)	Judgement Code
SECnnn_STD	@ (Type2)	Yes		Smart Edge (Circle)	Standard Deviation
SECnnn_TIME	@ (Type2)	Yes		Smart Edge (Circle)	Inspection Time
SECnnn_X0.mmmm	@ (Type2)	Yes		Smart Edge (Circle)	X 0

String function	Numerical Calculation		Judge.	Meaning of function	
	Statistics	Result			
SECnnn_X1.mmmm	@ (Type2)	Yes		Smart Edge (Circle)	X 1
SECnnn_Y0.mmmm	@ (Type2)	Yes		Smart Edge (Circle)	Y 0
SECnnn_Y1.mmmm	@ (Type2)	Yes		Smart Edge (Circle)	Y 1
SELnnn_ANG0	@ (Type2)	Yes		Smart Edge (Line)	Line 0 Angle
SELnnn_ANG1	@ (Type2)	Yes		Smart Edge (Line)	Line1 Angle
SELnnn_CELL	@ (Type2)	Yes		Smart Edge (Line)	No. of Cells
SELnnn_D0.mmmm	@ (Type2)	Yes		Smart Edge (Line)	Differential 0
SELnnn_D1.mmmm	@ (Type2)	Yes		Smart Edge (Line)	Differential 1
SELnnn_EA0	@ (Type2)	Yes		Smart Edge (Line)	Line0 Element a
SELnnn_EA1	@ (Type2)	Yes		Smart Edge (Line)	Line1 Element a
SELnnn_EB0	@ (Type2)	Yes		Smart Edge (Line)	Line0 Element b
SELnnn_EB1	@ (Type2)	Yes		Smart Edge (Line)	Line1 Element b
SELnnn_EC0	@ (Type2)	Yes		Smart Edge (Line)	Line0 Element c
SELnnn_EC1	@ (Type2)	Yes		Smart Edge (Line)	Line1 Element c
SELnnn_EX0	@ (Type2)	Yes		Smart Edge (Line)	Line 0 End Coordinate X
SELnnn_EX1	@ (Type2)	Yes		Smart Edge (Line)	Line 1 End Coordinate X
SELnnn_EY0	@ (Type2)	Yes		Smart Edge (Line)	Line 0 End Coordinate Y
SELnnn_EY1	@ (Type2)	Yes		Smart Edge (Line)	Line 1 End Coordinate Y
SELnnn_FCNT	@ (Type2)	Yes		Smart Edge (Line)	Used Edge Count
SELnnn_IJUDGE.mmmm	@ (Type1)	Yes	Yes	Smart Edge (Line)	Individual Judgement
SELnnn_JUDGE	@ (Type1)	Yes	Yes	Smart Edge (Line)	Judgement
SELnnn_LAVE	@ (Type2)	Yes		Smart Edge (Line)	Average
SELnnn_LEN.mmmm	@ (Type2)	Yes		Smart Edge (Line)	Measurement
SELnnn_LI0	@ (Type2)	Yes		Smart Edge (Line)	Linearity 0
SELnnn_LI1	@ (Type2)	Yes		Smart Edge (Line)	Linearity 1
SELnnn_LIJUDGE	@ (Type1)	Yes	Yes	Smart Edge (Line)	Linearity Judgement
SELnnn_LJUDGE	@ (Type1)	Yes	Yes	Smart Edge (Line)	Measurement Judgement
SELnnn_LMAX	@ (Type2)	Yes		Smart Edge (Line)	Maximum
SELnnn_LMIN	@ (Type2)	Yes		Smart Edge (Line)	Minimum
SELnnn_NCNT	@ (Type2)	Yes		Smart Edge (Line)	Unused Edge Count
SELnnn_NJUDGE	@ (Type1)	Yes	Yes	Smart Edge (Line)	Unused Edge Count Judgement
SELnnn_SJUDGE	@ (Type1)	Yes	Yes	Smart Edge (Line)	Standard Devation Judgement
SELnnn_STAT.mmmm	@ (Type2)	Yes		Smart Edge (Line)	Judgement Code
SELnnn_STD	@ (Type2)	Yes		Smart Edge (Line)	Standard Deviation
SELnnn_SX0	@ (Type2)	Yes		Smart Edge (Line)	Line 0 Start Coordinate X
SELnnn_SX1	@ (Type2)	Yes		Smart Edge (Line)	Line 1 Start Coordinate X
SELnnn_SY0	@ (Type2)	Yes		Smart Edge (Line)	Line 0 Start Coordinate Y
SELnnn_SY1	@ (Type2)	Yes		Smart Edge (Line)	Line 1 Start Coordinate Y
SELnnn_TIME	@ (Type2)	Yes		Smart Edge (Line)	Inspection Time
SELnnn_X0.mmmm	@ (Type2)	Yes		Smart Edge (Line)	X 0
SELnnn_X1.mmmm	@ (Type2)	Yes		Smart Edge (Line)	X 1
SELnnn_XMAX	@ (Type2)	Yes		Smart Edge (Line)	X of Max. value
SELnnn_XMIN	@ (Type2)	Yes		Smart Edge (Line)	X of Min. value
SELnnn_Y0.mmmm	@ (Type2)	Yes		Smart Edge (Line)	Y 0
SELnnn_Y1.mmmm	@ (Type2)	Yes		Smart Edge (Line)	Y 1
SELnnn_YMAX	@ (Type2)	Yes		Smart Edge (Line)	X of Max. value

String function	Numerical Calculation		Judge.	Meaning of function	
	Statistics	Result			
SELnnn_YMIN	@ (Type2)	Yes		Smart Edge (Line)	X of Min. value
SIN(		Yes		Sine when the value in parentheses is radian	
SIND(		Yes		Sine when the value in parentheses is degree	
SMCnnn_AREA.mmm	@ (Type2)	Yes		Smart Matching	Pixels of Max. Subtracted Object
SMCnnn_CANG.mmm	@ (Type2)	Yes		Smart Matching	Detect Angle
SMCnnn_CLL.m	@ (Type2)	Yes		Smart Matching	Correlation (Interim)
SMCnnn_CNT.m	@ (Type2)	Yes		Smart Matching	Detected Count (Interim)
SMCnnn_COR.mmm	@ (Type2)	Yes		Smart Matching	Correlation Value
SMCnnn_COUNT	@ (Type2)	Yes		Smart Matching	No. of Objects
SMCnnn_JUDGE	@ (Type1)	Yes	Yes	Smart Matching	Judgement
SMCnnn_LCNT.mmm	@ (Type2)	Yes		Smart Matching	No. of Subtracted Objects
SMCnnn_PX.mmm	@ (Type2)	Yes		Smart Matching	Proj. X Axis
SMCnnn_PY.mmm	@ (Type2)	Yes		Smart Matching	Proj. Y Axis
SMCnnn_TEMP.mmm	@ (Type2)	Yes		Smart Matching	Detect Template No.
SMCnnn_TIME	@ (Type2)	Yes		Smart Matching	Inspection Time
SMCnnn_X.mmm	@ (Type2)	Yes		Smart Matching	X
SMCnnn_Y.mmm	@ (Type2)	Yes		Smart Matching	Y
SORT(		Yes		The value of the number specified by the fourth term in parentheses when sorting the number of Calculation Nos. specified by the second term from the Numerical Calculation No. specified by the first term in the order specified by the third term (0=descending, 1=ascending).	
SQRT(		Yes		Square root of a value in parentheses	
SUM(		Yes		Sum of the calculation results for the number specified by the second term in parentheses from the Numerical Calculation No. specified by the first term.	
SYS:REG0		Yes		System Register 0	
SYS:REG1		Yes		System Register 1	
SYS:REG2		Yes		System Register 2	
SYS:REG3		Yes		System Register 3	
SYS:REG4		Yes		System Register 4	
SYS:REG5		Yes		System Register 5	
SYS:REG6		Yes		System Register 6	
SYS:REG7		Yes		System Register 7	
SYS_COUNT		Yes		Scan Count	
TAN(		Yes		Tangent when the value in parentheses is radian	
TAND(		Yes		Tangent when the value in parentheses is degree	
VDIST(		Yes		Length of a perpendicular to a line through a point expressed by five values in parentheses	
VPOINTX(		Yes		X of the foot of a perpendicular to a line through a point expressed by five values in parentheses	
VPOINTY(		Yes		Y of the foot of a perpendicular to a line through a point expressed by five values in parentheses	

List of general communication commands

This section describes communication commands in alphabetical order. "nnn" in commands expresses a checker number.

Command	Meaning	Send	Receive	Refer to
%!10035	BCC error, reception of an undefined command / error		Yes	405
%!11034	Receive buffer overflow / error		Yes	405
%A!20077	Smart Matching template setting / error		Yes	413 414
%A!23074	Smart Matching template setting / error		Yes	413 414
%A!23175	Smart Matching template setting / error		Yes	413 414
%A!23276	Smart Matching template setting / error		Yes	413 414
%A!23377	Smart Matching template setting / error		Yes	413 414
%A$40	Smart Matching template setting		Yes	413 414
%A64	Smart Matching template setting ("Area Display: Yes")	Yes		414
%Annn,??(BCC) ??:Template No.(00-63)	Smart Matching template setting	Yes		413 414
%BC$?(BCC) ?:Valid/Invalid(0-1)	Reading Keypad Operation Status		Yes	412
%BC24	Reading Keypad Operation Status	Yes		412
%BS!27020	Setting Invalid/Valid of Keypad operation / error		Yes	412
%BS!27121	Setting Invalid/Valid of Keypad operation / error		Yes	412
%BS$10	Setting Invalid/Valid of Keypad operation		Yes	412
%BS$?(BCC) ?:Valid/Invalid(0-1)	Setting Invalid/Valid of Keypad operation	Yes		412
%CC$01	Canceling Inspection/ Processing (Cancel specific operation)		Yes	412
%CC25	Canceling Inspection/ Processing (Cancel specific operation)	Yes		412
%CD!21737	Aborting save/read setting data / error		Yes	410
%CD$06	Aborting save/read setting data / error		Yes	410
%CD(BCC)	Aborting save/read setting data / error	Yes		410
%CR!20027	Reading setting data (SD memory card) / error		Yes	409
%CR!21224	Reading setting data (SD memory card) / error		Yes	409
%CR!21325	Reading setting data (SD memory card) / error		Yes	409
%CR!21422	Reading setting data (SD memory card) / error		Yes	409
%CR$10	Reading setting data (SD memory card)		Yes	409
%CR??(BCC) ??:Storage area No.(00-99)	Reading setting data (SD memory card)	Yes		409
%CW!20022	Saving setting data (SD memory card) / error		Yes	408
%CW!21221	Saving setting data (SD memory card) / error		Yes	408
%CW!21625	Saving setting data (SD memory card) / error		Yes	408
%CW$15	Saving setting data (SD memory card)		Yes	408
%CW??(BCC) ??:Storage area No.(00-99)	Saving setting data (SD memory card)	Yes		408

Command	Meaning	Send	Receive	Refer to
%E$44	Resetting error signal		Yes	412
%E60	Resetting error signal	Yes		412
%I!2007F	Switching layout / error		Yes	413
%I!2467D	Switching layout / error		Yes	413
%I$48	Switching layout		Yes	413
%I??(BCC) ??:Layout No.(00-15)	Switching layout	Yes		413
%Ks??(BCC) s:SHIFT OFF/ON(0-1) ??:Button information(01-16)	Keypad Operation (Key Emulation)	Yes		412
%MR!20029	Reading setting data (Storage space in PV200) / error		Yes	409
%MR!2142C	Reading setting data (Storage space in PV200) / error		Yes	409
%MR$1E	Reading setting data (Storage space in PV200)		Yes	409
%MR(BCC)	Reading setting data (Storage space in PV200)	Yes		409
%MW!2002C	Saving setting data (Storage space in PV200) / error		Yes	408
%MW$1B	Saving setting data (Storage space in PV200)		Yes	408
%MW(BCC)	Saving setting data (Storage space in PV200)	Yes		408
%PR BECnnn:MAX(BCC)	Read / Checker / Binary Edge / OK Judge. Max.	Yes		415 417
%PR BECnnn:MIN(BCC)	Read / Checker / Binary Edge / OK Judge. Min.	Yes		415 417
%PR BLVc:H?(BCC) c: Camera No.(0-1) ?:Slice Level Group(A-P)	Read / Slice Level / Maximum Value	Yes		415 420
%PR BLVc:L?(BCC) c: Camera No.(0-1) ?:Slice Level Group(A-P)	Read / Slice Level / Minimum Value	Yes		415 420
%PR BLV:H?(BCC) ?:Slice Level Group(A-P)	Read / Slice Level / Maximum Value	Yes		415 420
%PR BLV:L?(BCC) ?:Slice Level Group(A-P)	Read / Slice Level / Minimum Value	Yes		415 420
%PR BWCnnn:MAX(BCC)	Read / Checker / Binary Window / OK Judge. Max.	Yes		415 417
%PR BWCnnn:MIN(BCC)	Read / Checker / Binary Window / OK Judge. Min.	Yes		415 417
%PR CACnnn:MAX(BCC)	Read / Numerical Calculation / Judge. Max.	Yes		415 420
%PR CACnnn:MIN(BCC)	Read / Numerical Calculation / Judge. Min.	Yes		415 420
%PR CBWnnn:CMAX(BCC)	Read / Checker / Connector(Binary Window) / Common Judge. Max.	Yes		415 418
%PR CBWnnn:CMIN(BCC)	Read / Checker / Connector(Binary Window) / Common Judge. Min.	Yes		415 418
%PR CBWnnn:MAX.ss(BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Binary Window) / Individual Judge. Max.	Yes		415 418
%PR CBWnnn:MIN.ss(BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Binary Window) / Individual Judge. Min.	Yes		415 418
%PR CGEnnn:PMAX(BCC)	Read / Checker / Connector(Gray Edge) / Max. Pitch Judge.	Yes		415 418
%PR CGEnnn:PMIN(BCC)	Read / Checker / Connector(Gray Edge) / Min. Pitch Judge.	Yes		415 418
%PR CGEnnn:UMAX(BCC)	Read / Checker / Connector(Gray Edge) / Max. Distance Difference Judge.	Yes		415 418

Command	Meaning	Send	Receive	Refer to
%PR CGEnnn:UMIN(BCC)	Read / Checker / Connector(Gray Edge) / Min. Distance Difference Judge.	Yes		415 418
%PR CGWnnn:CMAX(BCC)	Read / Checker / Connector(Gray Window) / Common Judge. Max.	Yes		415 418
%PR CGWnnn:CMIN(BCC)	Read / Checker / Connector(Gray Window) / Common Judge. Min.	Yes		415 418
%PR CGWnnn:MAX.ss(BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Gray Window) / Individual Judge. Max.	Yes		415 418
%PR CGWnnn:MIN.ss(BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Gray Window) / Individual Judge. Min.	Yes		415 418
%PR CWCnnn:BAMAX(BCC)	Read / Chcker / Color Window / B Gray Ave. Max.	Yes		415 419
%PR CWCnnn:BAMIN(BCC)	Read / Chcker / Color Window / B Gray Ave. Min.	Yes		415 419
%PR CWCnnn:BMAX(BCC)	Read / Checker / Color Window / B Gray Max.	Yes		415 419
%PR CWCnnn:BMIN(BCC)	Read / Checker / Color Window / B Gray Min.	Yes		415 419
%PR CWCnnn:BSMAX(BCC)	Read / Checker / Color Window / B Gray Standard Deviation Max.	Yes		415 419
%PR CWCnnn:BSMIN(BCC)	Read / Checker / Color Window / B Gray Standard Deviation Min.	Yes		415 419
%PR CWCnnn:GAMAX(BCC)	Read / Checker / Color Window / G Gray Ave. Max.	Yes		415 419
%PR CWCnnn:GAMIN(BCC)	Read / Checker / Color Window / G Gray Ave. Min.	Yes		415 419
%PR CWCnnn:GMAX(BCC)	Read / Checker / Color Window / G Gray Max.	Yes		415 419
%PR CWCnnn:GMIN(BCC)	Read / Checker / Color Window / G Gray Min.	Yes		415 419
%PR CWCnnn:GSMAX(BCC)	Read / Checker / Color Window / G Gray Standard Deviation Max.	Yes		415 419
%PR CWCnnn:GSMIN(BCC)	Read / Checker / Color Window / G Gray Standard Deviation Min.	Yes		415 419
%PR CWCnnn:RAMAX(BCC)	Read / Checker / Color Window / R Gray Ave. Max.	Yes		415 419
%PR CWCnnn:RAMIN(BCC)	Read / Checker / Color Window / R Gray Ave. Min.	Yes		415 419
%PR CWCnnn:RMAX(BCC)	Read / Checker / Color Window / R Gray Max.	Yes		415 419
%PR CWCnnn:RMIN(BCC)	Read / Checker / Color Window / R Gray Min.	Yes		415 419
%PR CWCnnn:RSMAX(BCC)	Read / Checker / Color Window / R Gray Standard Deviation Max.	Yes		415 419
%PR CWCnnn:RSMIN(BCC)	Read / Checker / Color Window / R Gray Standard Deviation Min.	Yes		415 419
%PR FECnnn:MAX(BCC)	Read / Checker / Feature Extraction / OK Judge. Max.	Yes		415 418
%PR FECnnn:MIN(BCC)	Read / Checker / Feature Extraction / OK Judge. Min.	Yes		415 418
%PR FWCnnn:MAX(BCC)	Read / Checker / Flaw Detection/ OK Judge. Max.	Yes		415 418
%PR FWCnnn:MIN(BCC)	Read / Checker / Flaw Detection/ OK Judge. Min.	Yes		415 418
%PR GECnnn:LVL(BCC)	Read / Checker / Gray Edge / Edge Threshold	Yes		415 417
%PR GECnnn:MAX(BCC)	Read / Checker / Gray Edge / OK Judge. Max.	Yes		415 417
%PR GECnnn:MIN(BCC)	Read / Checker / Gray Edge / OK Judge. Min.	Yes		415 417

Command	Meaning	Send	Receive	Refer to
%PR GGCnnn:AMAX(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Angle	Yes		415 420
%PR GGCnnn:AMIN(BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Angle	Yes		415 420
%PR GGCnnn:CAMAX(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Intersect. Angle	Yes		415 420
%PR GGCnnn:CAMIN(BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Intersect. Angle	Yes		415 420
%PR GGCnnn:DMAX(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Distance	Yes		415 420
%PR GGCnnn:DMIN(BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Distance	Yes		415 420
%PR GGCnnn:LAMAX(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Major Axis	Yes		415 420
%PR GGCnnn:LAMIN(BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Major Axis	Yes		415 420
%PR GGCnnn:RMAX(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Radius	Yes		415 420
%PR GGCnnn:RMIN(BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Radius	Yes		415 420
%PR GGCnnn:SAMAX(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Minor Axis	Yes		415 420
%PR GGCnnn:SAMIN(BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Minor Axis	Yes		415 420
%PR GGCnnn:SMAX(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Standard Deviation	Yes		415 420
%PR GGCnnn:SMIN(BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Standard Deviation	Yes		415 420
%PR GGCnnn:XMAX(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. X	Yes		415 420
%PR GGCnnn:XMIN(BCC)	Read / Geometry Calculation / Geometry Calculation / Min. X	Yes		415 420
%PR GGCnnn:YMAX(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Y	Yes		415 420
%PR GGCnnn:YMIN(BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Y	Yes		415 420
%PR GWCnnn:MAX(BCC)	Read / Checker / Gray Window / OK Judge. Max.	Yes		415 417
%PR GWCnnn:MIN(BCC)	Read / Checker / Gray Window / OK Judge. Min.	Yes		415 417
%PR LICnnn:DMAX(BCC)	Read / Checker / Line / Max. No. of Pixels	Yes		415 417
%PR LICnnn:DMIN(BCC)	Read / Checker / Line / Min. No. of Pixels	Yes		415 417
%PR LICnnn:LMAX(BCC)	Read / Checker / Line / Max. No. of Objects	Yes		415 417
%PR LICnnn:LMIN(BCC)	Read / Checker / Line / Min. No. of Objects	Yes		415 417
%PR MRKcg_CXY(BCC) c: Camera No.(0-1) g: Marker No.(0-7)	Read / Marker / Central Coordinate	Yes		415 421
%PR SECnnn:CMAX(BCC)	Read / Checker / Smart Edge(Circle) / Max. Circularity	Yes		415 419
%PR SECnnn:CMIN(BCC)	Read / Checker / Smart Edge(Circle) / Min. Circularity	Yes		415 419
%PR SECnnn:LMAX(BCC)	Read / Checker / Smart Edge(Circle) / Max. Measurement	Yes		415 419
%PR SECnnn:LMIN(BCC)	Read / Checker / Smart Edge(Circle) / Min. Measurement	Yes		415 419
%PR SECnnn:NMAX(BCC)	Read / Checker / Smart Edge(Circle) / Max. Unused Edge Count	Yes		415 419

Command	Meaning	Send	Receive	Refer to
%PR SECnnn:SMAX(BCC)	Read / Checker / Smart Edge(Circle) / Max. Standard Deviation	Yes		415 419
%PR SECnnn:SMIN(BCC)	Read / Checker / Smart Edge(Circle) / Min. Standard Deviation	Yes		415 419
%PR SELnnn:LIMAX(BCC)	Read / Checker / Smart Edge(Line) / Max. Linearity	Yes		415 419
%PR SELnnn:LIMIN(BCC)	Read / Checker / Smart Edge(Line) / Min. Linearity	Yes		415 419
%PR SELnnn:LMAX(BCC)	Read / Checker / Smart Edge(Line) / Max. Measurement	Yes		415 419
%PR SELnnn:LMIN(BCC)	Read / Checker / Smart Edge(Line) / Min. Measurement	Yes		415 419
%PR SELnnn:NMAX(BCC)	Read / Checker / Smart Edge(Line) / Max. Unused Edge Count	Yes		415 419
%PR SELnnn:SMAX(BCC)	Read / Checker / Smart Edge(Line) / Max. Standard Deviation	Yes		415 419
%PR SELnnn:SMIN(BCC)	Read / Checker / Smart Edge(Line) / Min. Standard Deviation	Yes		415 419
%PR SMCnnn:CNT.?(BCC) ?: Sequence Step (1-6)	Read / Checker / Smart Matching / Search Count	Yes		415 418
%PR SMCnnn:DCNTMAX (BCC)	Read / Checker / Smart Matching / Max. OK No. of Subtracted Objects	Yes		415 418
%PR SYS:REG?(BCC) ?: General Register No.(0-7)	Read / System value / General registers 0-7	Yes		415 417
%PR SYS_COUNT(BCC)	Read / System value / Scan Count	Yes		415 417
%PR SYS_DATE(BCC)	Read / System value / Current Date	Yes		415 417
%PR SYS_EDIT(BCC)	Read / System value / Window Status	Yes		415 417
%PR SYS_RESULT(BCC)	Read / System value / Total Judgement	Yes		415 417
%PR SYS_RUN(BCC)	Read / System value / Operation Status	Yes		415 417
%PR SYS_TIME(BCC)	Read / System value / Current Time	Yes		415 417
%PR SYS_TIME1(BCC)	Read / System value / Inspection Time	Yes		415 417
%PR SYS_TIME2(BCC)	Read / System value / Inspection Frequency	Yes		415 417
%PR SYS_TYPE(BCC)	Read / System value / Current Type No.	Yes		415 417
%PR!20034	Read / error		Yes	415
%PR!25130	Read / error		Yes	415
%PR!25233	Read / error		Yes	415
%PR$BECnnn:MAX=[Data] (BCC)	Read / Checker / Binary Edge / OK Judge. Max.		Yes	415 417
%PR$BECnnn:MIN=[Data] (BCC)	Read / Checker / Binary Edge / OK Judge. Min.		Yes	415 417
%PR$BLVc:H?=[Data](BCC) c: Camera No.(0-1) ?: Slice Level Group(A-P)	Read / Slice Level / Maximum Value		Yes	415 420
%PR$BLVc:L?=[Data](BCC) c: Camera No.(0-1) ?: Slice Level Group(A-P)	Read / Slice Level / Minimum Value		Yes	415 420
%PR$BLV:H?=[Data](BCC) ?: Slice Level Group(A-P)	Read / Slice Level / Maximum Value		Yes	415 420
%PR$BLV:L?=[Data](BCC) ?: Slice Level Group(A-P)	Read / Slice Level / Minimum Value		Yes	415 420
%PR$BWCnnn:MAX=[Data] (BCC)	Read / Checker / Binary Window / OK Judge. Max.		Yes	415 417

Command	Meaning	Send	Receive	Refer to
%PR$BWCnnn:MIN=[Data](BCC)	Read / Checker / Binary Window / OK Judge. Min.		Yes	415 417
%PR$CACnnn:MAX=[Data](BCC)	Read / Numerical Calculation / Judge. Max.		Yes	415 420
%PR$CACnnn:MIN=[Data](BCC)	Read / Numerical Calculation / Judge. Min.		Yes	415 420
%PR$CBWnnn:CMAX=[Data](BCC)	Read / Checker / Connector(Binary Window) / Common Judge. Max.		Yes	415 418
%PR$CBWnnn:CMIN=[Data](BCC)	Read / Checker / Connector(Binary Window) / Common Judge. Min.		Yes	415 418
%PR$CBWnnn:MAX.ss=[Data](BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Binary Window) / Individual Judge. Max.		Yes	415 418
%PR$CBWnnn:MIN.ss=[Data](BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Binary Window) / Individual Judge. Min.		Yes	415 418
%PR$CGEnnn:PMAX=[Data](BCC)	Read / Checker / Connector(Gray Edge) / Max. Pitch Judge.		Yes	415 418
%PR$CGEnnn:PMIN=[Data](BCC)	Read / Checker / Connector(Gray Edge) / Min. Pitch Judge.		Yes	415 418
%PR$CGEnnn:UMAX=[Data](BCC)	Read / Checker / Connector(Gray Edge) / Max. Distance Difference Judge.		Yes	415 418
%PR$CGEnnn:UMIN=[Data](BCC)	Read / Checker / Connector(Gray Edge) / Min. Distance Difference Judge.		Yes	415 418
%PR$CGWnnn:CMAX=[Data](BCC)	Read / Checker / Connector(Gray Window) / Max. Common Judge.		Yes	415 418
%PR$CGWnnn:CMIN=[Data](BCC)	Read / Checker / Connector(Gray Window) / Common Judge. Min.		Yes	415 418
%PR$CGWnnn:MAX.ss=[Data](BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Gray Window) / Individual Judge. Max.		Yes	415 418
%PR$CGWnnn:MIN.ss=[Data](BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Gray Window) / Individual Judge. Min.		Yes	415 418
%PR$CWCnnn:BAMAX=[Data](BCC)	Read / Checker / Color Window / B Gray Ave. Max.		Yes	415 419
%PR$CWCnnn:BAMIN=[Data](BCC)	Read / Checker / Color Window / B Gray Ave. Min.		Yes	415 419
%PR$CWCnnn:BMAX=[Data](BCC)	Read / Checker / Color Window / B Gray Max.		Yes	415 419
%PR$CWCnnn:BMIN=[Data](BCC)	Read / Checker / Color Window / B Gray Min.		Yes	415 419
%PR$CWCnnn:BSMAX=[Data](BCC)	Read / Checker / Color Window / B Gray Standard Deviation Max.		Yes	415 419
%PR$CWCnnn:BSMIN=[Data](BCC)	Read / Checker / Color Window / B Gray Standard Deviation Min.		Yes	415 419
%PR$CWCnnn:GAMAX=[Data](BCC)	Read / Checker / Color Window / G Gray Ave. Max.		Yes	415 419
%PR$CWCnnn:GAMIN=[Data](BCC)	Read / Checker / Color Window / G Gray Ave. Min.		Yes	415 419
%PR$CWCnnn:GMAX=[Data](BCC)	Read / Checker / Color Window / G Gray Max.		Yes	415 419
%PR$CWCnnn:GMIN=[Data](BCC)	Read / Checker / Color Window / G Gray Min.		Yes	415 419
%PR$CWCnnn:GSMAX=[Data](BCC)	Read / Checker / Color Window / G Gray Standard Deviation Max.		Yes	415 419
%PR$CWCnnn:GSMIN=[Data](BCC)	Read / Checker / Color Window / G Gray Standard Deviation Min.		Yes	415 419
%PR$CWCnnn:RAMAX=[Data](BCC)	Read / Checker / Color Window / R Gray Ave. Max.		Yes	415 419

Command	Meaning	Send	Receive	Refer to
%PR$CWCnnn:RAMIN=[Data](BCC)	Read / Checker / Color Window / R Gray Ave. Min.		Yes	415 419
%PR$CWCnnn:RMAX=[Data](BCC)	Read / Checker / Color Window / R Gray Max.		Yes	415 419
%PR$CWCnnn:RMIN=[Data](BCC)	Read / Checker / Color Window / R Gray Min.		Yes	415 419
%PR$CWCnnn:RSMAX=[Data](BCC)	Read / Checker / Color Window / R Gray Standard Deviation Max.		Yes	415 419
%PR$CWCnnn:RSMIN=[Data](BCC)	Read / Checker / Color Window / R Gray Standard Deviation Min.		Yes	415 419
%PR$FECnnn:MAX=[Data](BCC)	Read / Checker / Feature Extraction / OK Judge. Max.		Yes	415 418
%PR$FECnnn:MIN=[Data](BCC)	Read / Checker / Feature Extraction / OK Judge. Min.		Yes	415 418
%PR$FWCnnn:MAX=[Data](BCC)	Read / Checker / Flaw Detection/ OK Judge. Max.		Yes	415 418
%PR$FWCnnn:MIN=[Data](BCC)	Read / Checker / Flaw Detection/ OK Judge. Min.		Yes	415 418
%PR$GECnnn:LVN=[Data](BCC)	Read / Checker / Gray Edge / Edge Threshold		Yes	415 417
%PR$GECnnn:MAX=[Data](BCC)	Read / Checker / Gray Edge / OK Judge. Max.		Yes	415 417
%PR$GECnnn:MIN=[Data](BCC)	Read / Checker / Gray Edge / OK Judge. Min.		Yes	415 417
%PR$GGCnnn:AMAX=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Angle		Yes	415 420
%PR$GGCnnn:AMIN=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Angle		Yes	415 420
%PR$GGCnnn:CAMAX=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Intersect. Angle		Yes	415 420
%PR$GGCnnn:CAMIN=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Intersect. Angle		Yes	415 420
%PR$GGCnnn:DMAX=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Distance		Yes	415 420
%PR$GGCnnn:DMIN=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Distance		Yes	415 420
%PR$GGCnnn:LAMAX=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Major Axis		Yes	415 420
%PR$GGCnnn:LAMIN=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Major Axis		Yes	415 420
%PR$GGCnnn:RMAX=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Radius		Yes	415 420
%PR$GGCnnn:RMIN=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Radius		Yes	415 420
%PR$GGCnnn:SAMAX=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Minor Axis		Yes	415 420
%PR$GGCnnn:SAMIN=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Minor Axis		Yes	415 420
%PR$GGCnnn:SMAX=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Standard Deviation		Yes	415 420
%PR$GGCnnn:SMIN=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Standard Deviation		Yes	415 420
%PR$GGCnnn:XMAX=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. X		Yes	415 420
%PR$GGCnnn:XMIN=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Min. X		Yes	415 420
%PR$GGCnnn:YMAX=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. Y		Yes	415 420
%PR$GGCnnn:YMIN=[Data](BCC)	Read / Geometry Calculation / Geometry Calculation / Min. Y		Yes	415 420

Command	Meaning	Send	Receive	Refer to
%PR$GWCnnn:MAX=[Data](BCC)	Read / Checker / Gray Window / OK Judge. Max.		Yes	415 417
%PR$GWCnnn:MIN=[Data](BCC)	Read / Checker / Gray Window / OK Judge. Min.		Yes	415 417
%PR$LICnnn:DMAX=[Data](BCC)	Read / Checker / Line / Max. No. of Pixels		Yes	415 417
%PR$LICnnn:DMIN=[Data](BCC)	Read / Checker / Line / Min. No. of Pixels		Yes	415 417
%PR$LICnnn:LMAX=[Data](BCC)	Read / Checker / Line / Max. No. of Objects		Yes	415 417
%PR$LICnnn:LMIN=[Data](BCC)	Read / Checker / Line / Min. No. of Objects		Yes	415 417
%PR$MRKcg_CXY=[Data](BCC) c: Camera No.(0-1) g: Marker No.(0-7)	Read / Marker / Central Coordinate		Yes	415 421
%PR$SECnnn:CMAX=[Data](BCC)	Read / Checker / Smart Edge(Circle) / Max. Circularity		Yes	415 419
%PR$SECnnn:CMIN=[Data](BCC)	Read / Checker / Smart Edge(Circle) / Min. Circularity		Yes	415 419
%PR$SECnnn:LMAX=[Data](BCC)	Read / Checker / Smart Edge(Circle) / Max. Measurement		Yes	415 419
%PR$SECnnn:LMIN=[Data](BCC)	Read / Checker / Smart Edge(Circle) / Min. Measurement		Yes	415 419
%PR$SECnnn:NMAX=[Data](BCC)	Read / Checker / Smart Edge(Circle) / Max. Unused Edge Count		Yes	415 419
%PR$SECnnn:SMAX=[Data](BCC)	Read / Checker / Smart Edge(Circle) / Max. Standard Deviation		Yes	415 419
%PR$SECnnn:SMIN=[Data](BCC)	Read / Checker / Smart Edge(Circle) / Min. Standard Deviation		Yes	415 419
%PR$SELnnn:LIMAX=[Data](BCC)	Read / Checker / Smart Edge(Line) / Max. Linearity		Yes	415 419
%PR$SELnnn:LIMIN=[Data](BCC)	Read / Checker / Smart Edge(Line) / Min. Linearity		Yes	415 419
%PR$SELnnn:LMAX=[Data](BCC)	Read / Checker / Smart Edge(Line) / Max. Measurement		Yes	415 419
%PR$SELnnn:LMIN=[Data](BCC)	Read / Checker / Smart Edge(Line) / Min. Measurement		Yes	415 419
%PR$SELnnn:NMAX=[Data](BCC)	Read / Checker / Smart Edge(Line) / Max. Unused Edge Count		Yes	415 419
%PR$SELnnn:SMAX=[Data](BCC)	Read / Checker / Smart Edge(Line) / Max. Standard Deviation		Yes	415 419
%PR$SELnnn:SMIN=[Data](BCC)	Read / Checker / Smart Edge(Line) / Min. Standard Deviation		Yes	415 419
%PR$SMCnnn:CNT.?=[Data](BCC) ?: Sequence Step(1-6)	Read / Checker / Smart Matching / Search Count		Yes	415 418
%PR$SMCnnn:DCNTMAX=[Data](BCC)	Read / Checker / Smart Matching / Max. OK No. of Subtracted Objects		Yes	415 418
%PR$SYS:REG?=[Data](BCC) ?: General Register No.(0-7)	Read / System value / General registers 0-7		Yes	415 417
%PR$SYS_COUNT=[Data](BCC)	Read / System value / Scan Count		Yes	415 417
%PR$SYS_DATE=[Data](BCC)	Read / System value / Current Date		Yes	415 417
%PR$SYS_EDIT=[Data](BCC)	Read / System value / Window Status		Yes	415 417
%PR$SYS_RESULT=[Data](BCC)	Read / System value / Total Judgement		Yes	415 417

Command	Meaning	Send	Receive	Refer to
%PR$SYS_RUN=[Data] (BCC)	Read / System value / Operation Status		Yes	415 417
%PR$SYS_TIME=[Data] (BCC)	Read / System value / Current Time		Yes	415 417
%PR$SYS_TIME1=[Data] (BCC)	Read / System value / Inspection Time		Yes	415 417
%PR$SYS_TIME2=[Data] (BCC)	Read / System value / Inspection Frequency		Yes	415 417
%PR$SYS_TYPE=[Data] (BCC)	Read / System value / Current Type No.		Yes	415 417
%PRP BECnnn:LPAIR(BCC)	Read / Checker / Binary Edge / OK Judge. Max. and Min.	Yes		415 417
%PRP BLVc:PAIR?(BCC) c: Camera No.(0-1) ?: Slice Level Group (A-P)	Read / Slice Level / Max. and Min.	Yes		415 420
%PRP BLV:PAIR?(BCC) ?: Slice Level Group (A-P)	Read / Slice Level / Max. and Min.	Yes		415 420
%PRP BWCnnn:LPAIR(BCC)	Read / Checker / Binary Window / OK Judge. Max. and Min.	Yes		415 417
%PRP CACnnn:LPAIR(BCC)	Read / Numerical Calculation / Max. and Min.	Yes		415 420
%PRP CBWnnn:CPAIR(BCC)	Read / Checker / Connector(Binary Window) / Common Judge. Max. and Min.	Yes		415 418
%PRP CBWnnn:LPAIR.ss (BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Binary Window) / Individual Judge. Max. and Min.	Yes		415 418
%PRP CGEnnn:PPAIR(BCC)	Read / Checker / Connector(Gray Edge) / Max. and Min. Pitch Judge.	Yes		415 418
%PRP CGEnnn:UPAIR(BCC)	Read / Checker / Connector(Gray Edge) / Max. and Min. Distance Difference Judge.	Yes		415 418
%PRP CGWnnn:CPAIR(BCC)	Read / Checker / Connector(Gray Window) / Common Judge. Max. and Min.	Yes		415 418
%PRP CGWnnn:LPAIR.ss (BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Gray Window) / Individual Judge. Max. and Min.	Yes		415 418
%PRP CWCnnn:BAPAIR (BCC)	Read / Checker / Color Window / B Gray Ave. Max. and Min.	Yes		415 419
%PRP CWCnnn:BPAIR(BCC)	Read / Checker / Color Window / B Gray Max. and Min.	Yes		415 419
%PRP CWCnnn:BSPAIR (BCC)	Read / Checker / Color Window / B Gray Standard Deviation Max. and Min.	Yes		415 419
%PRP CWCnnn:GAPAIR (BCC)	Read / Checker / Color Window / G Gray Ave. Max. and Min.	Yes		415 419
%PRP CWCnnn:GPAIR(BCC)	Read / Checker / Color Window / G Gray Max. and Min.	Yes		415 419
%PRP CWCnnn:GSPAIR (BCC)	Read / Checker / Color Window / G Gray Standard Deviation Max. and Min.	Yes		415 419
%PRP CWCnnn:RAPAIR (BCC)	Read / Checker / Color Window / R Gray Ave. Max. and Min.	Yes		415 419
%PRP CWCnnn:RPAIR(BCC)	Read / Checker / Color Window / R Gray Max. and Min.	Yes		415 419
%PRP CWCnnn:RSPAIR (BCC)	Read / Checker / Color Window / R Gray Standard Deviation Max. and Min.	Yes		415 419
%PRP FECnnn:LPAIR(BCC)	Read / Checker / Feature Extraction / OK Judge. Max. and Min.	Yes		415 418
%PRP FWCnnn:LPAIR(BCC)	Read / Checker / Flaw Detection / OK Judge. Max. and Min.	Yes		415 419
%PRP GECnnn:LPAIR(BCC)	Read / Checker / Gray Edge / OK Judge. Max. and Min.	Yes		415 417
%PRP GGCnnn:APAIR(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Angle	Yes		415 420

Command	Meaning	Send	Receive	Refer to
%PRP GGCnnn:CAPAIR (BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Intersect. Angle	Yes		415 420
%PRP GGCnnn:DPAIR(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Distance	Yes		415 420
%PRP GGCnnn:LAPAIR(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Major Axis	Yes		415 420
%PRP GGCnnn:RPAIR(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Radius	Yes		415 420
%PRP GGCnnn:SAPAIR (BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Minor Axis	Yes		415 420
%PRP GGCnnn:SPAIR(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Standard Deviation	Yes		415 420
%PRP GGCnnn:XPAIR(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. X	Yes		415 420
%PRP GGCnnn:YPAIR(BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Y	Yes		415 420
%PRP GWCnnn:LPAIR(BCC)	Read / Checker / Gray Window / OK Judge. Max. and Min.	Yes		415 417
%PRP LICnnn:DPAIR(BCC)	Read / Checker / Line / Max. and Min. No. of Pixels	Yes		415 417
%PRP LICnnn:LPAIR(BCC)	Read / Checker / Line / Max. and Min. No. of Objects	Yes		415 417
%PRP SECnnn:CPAIR(BCC)	Read / Checker / Smart Edge(Circle) / Max. and Min. Circularity	Yes		415 419
%PRP SECnnn:LPAIR(BCC)	Read / Checker / Smart Edge(Circle) / Max. and Min. Measurement	Yes		415 419
%PRP SECnnn:SPAIR(BCC)	Read / Checker / Smart Edge(Circle) / Max. and Min. Standard Deviation	Yes		415 419
%PRP SELnnn:LIPAIR(BCC)	Read / Checker / Smart Edge(Line) / Max. and Min. Linearity	Yes		415 419
%PRP SELnnn:LPAIR(BCC)	Read / Checker / Smart Edge(Line) / Max. and Min. Measurement	Yes		415 419
%PRP SELnnn:SPAIR(BCC)	Read / Checker / Smart Edge(Line) / Max. and Min. Standard Deviation	Yes		415 419
%PRP!20064	Read / Error		Yes	415
%PRP!25160	Read / Error		Yes	415
%PRP!25263	Read / Error		Yes	415
%PRP$BECnnn:LPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Binary Edge / OK Judge. Max. and Min.		Yes	415 417
%PRP$BLVc:PAIR?=[Data 1], [Data 2](BCC) c: Camera No.(0-1) ?: Slice Level Group(A-P)	Read / Slice Level / Max. and Min.		Yes	415 420
%PRP$BLV:PAIR?=[Data 1], [Data 2](BCC) ?: Slice Level Group(A-P)	Read / Slice Level / Max. and Min.		Yes	415 420
%PRP$BWCnnn:LPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Binary Window / OK Judge. Max. and Min.		Yes	415 417
%PRP$CACnnn:LPAIR=[Data 1],[Data 2](BCC)	Read / Numerical Calculation / Max. and Min.		Yes	415 420
%PRP$CBWnnn:CPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Connector(Binary Window) / Common Judge. Max. and Min.		Yes	415 418
%PRP$CBWnnn:LPAIR.ss=[Data 1],[Data 2](BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Binary Window) / Individual Judge. Max. and Min.		Yes	415 418
%PRP$CGEnnn:PPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Connector(Gray Edge) / Min. and Min. Pitch Judge.		Yes	415 418
%PRP$CGEnnn:UPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Connector(Gray Edge) / Max. and Min. Distance Difference Judge.		Yes	415 418

Command	Meaning	Send	Receive	Refer to
%PRP$CGWnnn:CPAIR=[Data1],[Data 2](BCC)	Read / Checker / Connector(Gray Window) / Common Judge. Max. and Min.		Yes	415 418
%PRP$CGWnnn:LPAIR.ss= [Data 1],[Data 2](BCC) ss: Cell No.(00-99)	Read / Checker / Connector(Gray Window) / Individual Judge. Max. and Min.		Yes	415 418
%PRP$CWCnnn:BAPAIR=[Data 1],[Data 2](BCC)	Read / Chcker / Color Window / B Gray Ave. Max. and Min.		Yes	415 419
%PRP$CWCnnn:BPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Color Window / B Gray Max. and Min.		Yes	415 419
%PRP$CWCnnn:BSPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Color Window / B Gray Standard Deviation Max. and Min.		Yes	415 419
%PRP$CWCnnn:GAPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Color Window / G Gray Ave. Max. and Min.		Yes	415 419
%PRP$CWCnnn:GPAIR=[Data1],[Data 2](BCC)	Read / Checker / Color Window / G Gray Max. and Min.		Yes	415 419
%PRP$CWCnnn:GSPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Color Window / G Gray Standard Deviation Max. and Min.		Yes	415 419
%PRP$CWCnnn:RAPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Color Window / R Gray Ave. Max. and Min.		Yes	415 419
%PRP$CWCnnn:RPAIR=[Data1],[Data 2](BCC)	Read / Checker / Color Window / R Gray Max. and Min.		Yes	415 419
%PRP$CWCnnn:RSPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Color Window / R Gray Standard Deviation Max. and Min.		Yes	415 419
%PRP$FECnnn:LPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Feature Extraction / OK Judge. Max. and Min.		Yes	415 418
%PRP$FWCnnn:LPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Flaw Detection / OK Judge. Max. and Min.		Yes	415 418
%PRP$GECnnn:LPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Gray Edge / OK Judge. Max. and Min.		Yes	415 417
%PRP$GGCnnn:APAIR=[Data 1],[Data 2](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Angle		Yes	415 420
%PRP$GGCnnn:CAPAIR=[Data 1],[Data 2](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Intersect. Angle		Yes	415 420
%PRP$GGCnnn:DPAIR=[Data 1],[Data 2](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Distance		Yes	415 420
%PRP$GGCnnn:LAPAIR=[Data 1],[Data 2](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Major Axis		Yes	415 420
%PRP$GGCnnn:RPAIR=[Data 1],[Data 2](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Radius		Yes	415 420
%PRP$GGCnnn:SAPAIR=[Data 1],[Data 2](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Minor Axis		Yes	415 420
%PRP$GGCnnn:SPAIR=[Data 1],[Data 2](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Standard Deviation		Yes	415 420
%PRP$GGCnnn:XPAIR=[Data 1],[Data 2](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. X		Yes	415 420
%PRP$GGCnnn:YPAIR=[Data 1],[Data 2](BCC)	Read / Geometry Calculation / Geometry Calculation / Max. and Min. Y		Yes	415 420
%PRP$GWCnnn:LPAIR=[Data 1],Data 2](BCC)	Read / Checker / Gray Window / OK Judge. Max. and Min.		Yes	415 417
%PRP$LICnnn:DPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Line / Max. and Min. No. of Pixels		Yes	415 417
%PRP$LICnnn:LPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Line / Max. and Min. No. of Objects		Yes	415 417
%PRP$SECnnn:CPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Smart Edge(Circle) / Max. and Min. Circularity		Yes	415 419
%PRP$SECnnn:LPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Smart Edge(Circle) / Max. and Min. Measurement		Yes	415 419
%PRP$SECnnn:SPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Smart Edge(Circle) / Max. and Min. Standard Deviation		Yes	415 419

Command	Meaning	Send	Receive	Refer to
%PRP$SELnnn:LIPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Smart Edge(Line) / Max. and Min. Linearity		Yes	415 419
%PRP$SELnnn:LPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Smart Edge(Line) / Max. and Min. Measurement		Yes	415 419
%PRP$SELnnn:SPAIR=[Data 1],[Data 2](BCC)	Read / Checker / Smart Edge(Line) / Max. and Min. Standard Deviation		Yes	415 419
%PS!20035	Print Screen / Error		Yes	411
%PS!26536	Print Screen / Error		Yes	411
%PS$02	Print Screen		Yes	411
%PS26	Print Screen	Yes		411
%PW BECnnn:MAX=[Data](BCC)	Write / Checker / Binary Edge / OK Judge. Max.	Yes		416 417
%PW BECnnn:MIN=[Data](BCC)	Write / Checker / Binary Edge / OK Judge. Min.	Yes		416 417
%PW BLVc:H?=[Data](BCC) c: Camera No.(0-1) ?: Slice Level Group(A-P)	Write / Slice Level / Max. Value	Yes		416 420
%PW BLVc:L?=[Data](BCC) c: Camera No.(0-1) ?: Slice Level Group(A-P)	Write / Slice Level / Min. Value	Yes		416 420
%PW BLV:H?=[Data](BCC) ?: Slice Level Group(A-P)	Write / Slice Level / Max. Value	Yes		416 420
%PW BLV:L?=[Data](BCC) ?: Slice Level Group(A-P)	Write / Slice Level / Min. Value	Yes		416 420
%PW BWCnnn:MAX=[Data](BCC)	Write / Checker / Binary Window / OK Judge. Max.	Yes		416 417
%PW BWCnnn:MIN=[Data](BCC)	Write / Checker / Binary Window / OK Judge. Min.	Yes		416 417
%PW CACnnn:MAX=[Data](BCC)	Write / Numerical Calculation / Judge. Max.	Yes		416 420
%PW CACnnn:MIN=[Data](BCC)	Write / Numerical Calculation / Judge. Min.	Yes		416 420
%PW CBWnnn:CMAX=[Data](BCC)	Write / Checker / Connector(Binary Window) / Common Judge. Max.	Yes		416 418
%PW CBWnnn:CMIN=[Data](BCC)	Write / Checker / Connector(Binary Window) / Common Judge. Min.	Yes		416 418
%PW CBWnnn:MAX.ss=[Data](BCC) ss: Cell No.(00-99)	Write / Checker / Connector(Binary Window) / Individual Judge. Max.	Yes		416 418
%PW CBWnnn:MIN.ss=[Data](BCC) ss: Cell No.(00-99)	Write / Checker / Connector(Binary Window) / Individual Judge. Min.	Yes		416 418
%PW CGEnnn:PMAX=[Data](BCC)	Write / Checker / Connector(Gray Edge) / Max. Pitch Judge.	Yes		416 418
%PW CGEnnn:PMIN=[Data](BCC)	Write / Checker / Connector(Gray Edge) / Min. Pitch Judge.	Yes		416 418
%PW CGEnnn:UMAX=[Data](BCC)	Write / Checker / Connector(Gray Edge) / Max. Distance Difference Judge.	Yes		416 418
%PW CGEnnn:UMIN=[Data](BCC)	Write / Checker / Connector(Gray Edge) / Min. Distance Difference Judge.	Yes		416 418
%PW CGWnnn:CMAX=[Data](BCC)	Write/ Checker / Connector(Gray Window) / Common Judge. Max.	Yes		416 418
%PW CGWnnn:CMIN=[Data](BCC)	Write/ Checker / Connector(Gray Window) / Common Judge. Min.	Yes		416 418
%PW CGWnnn:MAX.ss=[Data](BCC) ss: Cell No.(00-99)	Write/ Checker / Connector(Gray Window) / Common Judge. Max.	Yes		416 418
%PW CGWnnn:MIN.ss=[Data](BCC) ss: Cell No.(00-99)	Write/ Checker / Connector(Gray Window) / Individual Judge. Max.	Yes		416 418

Command	Meaning	Send	Receive	Refer to
%PW CWCnnn:BAMAX=[Data](BCC)	Write / Checker / Color Window / B Gray Ave. Max.	Yes		416 419
%PW CWCnnn:BAMIN=[Data](BCC)	Write / Checker / Color Window / B Gray Ave. Min.	Yes		416 419
%PW CWCnnn:BMAX=[Data](BCC)	Write / Checker / Color Window / B Gray Max.	Yes		416 419
%PW CWCnnn:BMIN=[Data](BCC)	Write / Checker / Color Window / B Gray Min.	Yes		416 419
%PW CWCnnn:BSMAX=[Data](BCC)	Write / Checker / Color Window / B Gray Standard Deviation Max.	Yes		416 419
%PW CWCnnn:BSMIN=[Data](BCC)	Write / Checker / Color Window / B Gray Standard Deviation Min	Yes		416 419
%PW CWCnnn:GAMAX=[Data](BCC)	Write / Checker / Color Window / G Gray Ave. Max.	Yes		416 419
%PW CWCnnn:GAMIN=[Dataタ](BCC)	Write / Checker / Color Window / G Gray Ave. Min.	Yes		416 419
%PW CWCnnn:GMAX=[Data](BCC)	Write / Checker / Color Window / G Gray Max.	Yes		416 419
%PW CWCnnn:GMIN=[Data](BCC)	Write / Checker / Color Window / G Gray Min.	Yes		416 419
%PW CWCnnn:GSMAX=[Data](BCC)	Write / Checker / Color Window / G Gray Standard Deviation Max.	Yes		416 419
%PW CWCnnn:GSMIN=[Data](BCC)	Write / Checker / Color Window / G Gray Standard Deviation Min.	Yes		416 419
%PW CWCnnn:RAMAX=[Data](BCC)	Write / Checker / Color Window / R Gray Ave. Max.	Yes		416 419
%PW CWCnnn:RAMIN=[Data](BCC)	Write / Checker / Color Window / R Gray Ave. Min.	Yes		416 419
%PW CWCnnn:RMAX=[Data](BCC)	Write / Checker / Color Window / R Gray Max.	Yes		416 419
%PW CWCnnn:RMIN=[Data](BCC)	Write / Checker / Color Window / R Gray Min.	Yes		416 419
%PW CWCnnn:RSMAX=[Data](BCC)	Write / Checker / Color Window / R Gray Standard Deviation Max.	Yes		416 419
%PW CWCnnn:RSMIN=[Data](BCC)	Write / Checker / Color Window / R Gray Standard Deviation Min.	Yes		416 419
%PW FECnnn:MAX=[Data](BCC)	Write / Checker / Feature Extraction / OK Judge. Max.	Yes		416 418
%PW FECnnn:MIN=[Data](BCC)	Write / Checker / Feature Extraction / OK Judge. Min.	Yes		416 418
%PW FWCnnn:MAX=[Data](BCC)	Write / Checker / Flaw Detection / OK Judge. Max.	Yes		416 418
%PW FWCnnn:MIN=[Data](BCC)	Write / Checker / Flaw Detection / OK Judge. Min.	Yes		416 418
%PW GECnnn:LVN=[Data](BCC)	Write / Checker / Gray Edge / Edge Threshold	Yes		416 417
%PW GECnnn:MAX=[Data](BCC)	Write / Checker / Gray Edge / OK Judge. Max.	Yes		416 417
%PW GECnnn:MIN=[Data](BCC)	Write / Checker / Gray Edge / OK Judge. Min.	Yes		416 417
%PW GGCnnn:AMAX=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Angle	Yes		416 420
%PW GGCnnn:AMIN=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Angle	Yes		416 420
%PW GGCnnn:CAMAX=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Intersect. Angle	Yes		416 420
%PW GGCnnn:CAMIN=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Intersect. Angle	Yes		416 420
%PW GGCnnn:DMAX=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Distance	Yes		416 420

Command	Meaning	Send	Receive	Refer to
%PW GGCnnn:DMIN=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Distance	Yes		416 420
%PW GGCnnn:LAMAX=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Major Axis	Yes		416 420
%PW GGCnnn:LAMIN=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Min.. Major Axis	Yes		416 420
%PW GGCnnn:RMAX=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Radius	Yes		416 420
%PW GGCnnn:RMIN=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Radius	Yes		416 420
%PW GGCnnn:SAMAX=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Minor Axis	Yes		416 420
%PW GGCnnn:SAMIN=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Minor Axis	Yes		416 420
%PW GGCnnn:SMAX=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Standard Deviation	Yes		416 420
%PW GGCnnn:SMIN=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Standard Deviation	Yes		416 420
%PW GGCnnn:XMAX=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. X	Yes		416 420
%PW GGCnnn:XMIN=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Min. X	Yes		416 420
%PW GGCnnn:YMAX=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Y	Yes		416 420
%PW GGCnnn:YMIN=[Data](BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Y	Yes		416 420
%PW GWCnnn:MAX=[Data](BCC)	Write / Checker / Gray Window / OK Judge. Max.	Yes		416 417
%PW GWCnnn:MIN=[Data](BCC)	Write / Checker / Gray Window / OK Judge. Min.	Yes		416 417
%PW LICnnn:DMAX=[Data](BCC)	Write / Checker / Line / Max. No. of Pixels	Yes		416 417
%PW LICnnn:DMIN=[Data](BCC)	Write / Checker / Line / Min. No. of Pixels	Yes		416 417
%PW LICnnn:LMAX=[Data](BCC)	Write / Checker / Line / Max. No. of Objects	Yes		416 417
%PW LICnnn:LMIN=[Data](BCC)	Write / Checker / Line / Min. No. of Objects	Yes		416 417
%PW MRKcg_MOVE=[Data](BCC) c: Camera No.(0-1) g: Marker No.(0-7)	Write / Marker / Central Coordinate Moving Distance	Yes		416 421
%PW SECnnn:CMAX=[Data](BCC)	Write / Checker / Smart Edge(Circle) / Max. Circularity	Yes		416 419
%PW SECnnn:CMIN=[Data](BCC)	Write / Checker / Smart Edge(Circle) / Min. Circularity	Yes		416 419
%PW SECnnn:LMAX=[Data](BCC)	Write / Checker / Smart Edge(Circle) / Max. Measurement	Yes		416 419
%PW SECnnn:LMIN=[Data](BCC)	Write / Checker / Smart Edge(Circle) / Min. Measurement	Yes		416 419
%PW SECnnn:NMAX=[Data](BCC)	Write / Checker / Smart Edge(Circle) / Max. Unused Edge Count	Yes		416 419
%PW SECnnn:SMAX=[Data](BCC)	Write / Checker / Smart Edge(Circle) / Max. Standard Deviation	Yes		416 419
%PW SECnnn:SMIN=[Data](BCC)	Write / Checker / Smart Edge(Circle) / Min. Standard Deviation	Yes		416 419
%PW SELnnn:LIMAX=[Data](BCC)	Write / Checker / Smart Edge(Line) / Max. Linearity	Yes		416 419
%PW SELnnn:LIMIN=[Data](BCC)	Write / Checker / Smart Edge(Line) / Min. Linearity	Yes		416 419

Command	Meaning	Send	Receive	Refer to
%PW SELnnn:LMAX=[Data] (BCC)	Write / Checker / Smart Edge(Line) / Max. Measurement	Yes		416 419
%PW SELnnn:LMIN=[Data] (BCC)	Write / Checker / Smart Edge(Line) / Min. Measurement	Yes		416 419
%PW SELnnn:NMAX=[Data] (BCC)	Write / Checker / Smart Edge(Line) / Max. Unused Edge Count	Yes		416 419
%PW SELnnn:SMAX=[Data] (BCC)	Write / Checker / Smart Edge(Line) / Max. Standard Deviation	Yes		416 419
%PW SELnnn:SMIN=[Data] (BCC)	Write / Checker / Smart Edge(Line) / Min. Standard Deviation	Yes		416 419
%PW SMCnnn:CNT.?=[Data] (BCC) ?: Sequence Step(1-6)	Write / Checker / Smart Matching / Search Count	Yes		416 418
%PW SMCnnn:DCNTMAX= [Data](BCC)	Write / Checker / Smart Matching / Max. OK No. of Subtracted Objects	Yes		416 418
%PW SYS:REG?=[Data] (BCC) ?: General Register No.(0-7)	Write / System value / General registers 0-7	Yes		416 417
%PW SYS_DATE=[Data] (BCC)	Write / System value / Current Date	Yes		416 417
%PW SYS_TIME=[Data] (BCC)	Write / System value / Current Time	Yes		416 417
%PW!20031	Write / Error		Yes	416
%PW!25135	Write / Error		Yes	416
%PW!25236	Write / Error		Yes	416
%PW!25430	Write / Error		Yes	416
%PW$BECnnn:MAX(BCC)	Write / Checker / Binary Edge / OK Judge. Max.		Yes	416 417
%PW$BECnnn:MIN(BCC)	Write / Checker / Binary Edge / OK Judge. Min.		Yes	416 417
%PW$BLVc:H?(BCC) c: Camera No.(0-1) ?: Slice Level Group (A-P)	Write / Slice Level / Max. Value		Yes	416 420
%PW$BLVc:L?(BCC) c: Camera No.(0-1) ?: Slice Level Group (A-P)	Write / Slice Level / Min. Value		Yes	416 420
%PW$BLV:H?(BCC) ?: Slice Level Group (A-P)	Write / Slice Level / Max. Value		Yes	416 420
%PW$BLV:L?(BCC) ?: Slice Level Group (A-P)	Write / Slice Level / Min. Value		Yes	416 420
%PW$BWCnnn:MAX(BCC)	Write / Checker / Binary Window / OK Judge. Max.		Yes	416 417
%PW$BWCnnn:MIN(BCC)	Write / Checker / Binary Window / OK Judge. Min.		Yes	416 417
%PW$CACnnn:MAX(BCC)	Write / Numerical Calculation / Judge. Max.		Yes	416 420
%PW$CACnnn:MIN(BCC)	Write / Numerical Calculation / Judge. Min.		Yes	416 420
%PW$CBWnnn:CMAX(BCC)	Write / Checker / Connector(Binary Window) / Common Judge. Max.		Yes	416 418
%PW$CBWnnn:CMIN(BCC)	Write / Checker / Connector(Binary Window) / Common Judge. Min.		Yes	416 418
%PW$CBWnnn:MAX.ss(BCC) ss: Cell No.(00-99)	Write / Checker / Connector(Binary Window) / Individual Judge. Max.		Yes	416 418
%PW$CBWnnn:MIN.ss(BCC) ss: Cell No.(00-99)	Write / Checker / Connector(Binary Window) / Individual Judge. Min.		Yes	416 418
%PW$CGEnnn:PMAX(BCC)	Write / Checker / Connector(Gray Edge) / Max. Pitch Judge.		Yes	416 418
%PW$CGEnnn:PMIN(BCC)	Write / Checker / Connector(Gray Edge) / Min. Pitch Judge.		Yes	416 418

Command	Meaning	Send	Receive	Refer to
%PW$CGEnnn:UMAX(BCC)	Write / Checker / Connector(Gray Edge) / Max. Distance Difference Judge.		Yes	416 418
%PW$CGEnnn:UMIN(BCC)	Write / Checker / Connector(Gray Edge) / Min. Distance Difference Judge.		Yes	416 418
%PW$CGWnnn:CMAX(BCC)	Write/ Checker / Connector(Gray Window) / Max. Common Judge.		Yes	416 418
%PW$CGWnnn:CMIN(BCC)	Write/ Checker / Connector(Gray Window) / Common Judge. Min.		Yes	416 418
%PW$CGWnnn:MAX.ss(BCC) ss: Cell No.(00-99)	Write/ Checker / Connector(Gray Window) / Common Judge. Max.		Yes	416 418
%PW$CGWnnn:MIN.ss(BCC) ss: Cell No.(00-99)	Write/ Checker / Connector(Gray Window) / Individual Judge. Max.		Yes	416 418
%PW$CWCnnn:BAMAX(BCC)	Write / Checker / Color Window / B Gray Ave. Max.		Yes	416 419
%PW$CWCnnn:BAMIN(BCC)	Write / Checker / Color Window / B Gray Ave. Min.		Yes	416 419
%PW$CWCnnn:BMAX(BCC)	Write / Checker / Color Window / B Gray Max.		Yes	416 419
%PW$CWCnnn:BMIN(BCC)	Write / Checker / Color Window / B Gray Min.		Yes	416 419
%PW$CWCnnn:BSMAX(BCC)	Write / Checker / Color Window / B Gray Standard Deviation Max.		Yes	416 419
%PW$CWCnnn:BSMIN(BCC)	Write / Checker / Color Window / B Gray Standard Deviation Min		Yes	416 419
%PW$CWCnnn:GAMAX(BCC)	Write / Checker / Color Window / G Gray Ave. Max.		Yes	416 419
%PW$CWCnnn:GAMIN(BCC)	Write / Checker / Color Window / G Gray Ave. Min.		Yes	416 419
%PW$CWCnnn:GMAX(BCC)	Write / Checker / Color Window / G Gray Max.		Yes	416 419
%PW$CWCnnn:GMIN(BCC)	Write / Checker / Color Window / G Gray Min.		Yes	416 419
%PW$CWCnnn:GSMAX(BCC)	Write / Checker / Color Window / G Gray Standard Deviation Max.		Yes	416 419
%PW$CWCnnn:GSMIN(BCC)	Write / Checker / Color Window / G Gray Standard Deviation Min.		Yes	416 419
%PW$CWCnnn:RAMAX(BCC)	Write / Checker / Color Window / R Gray Ave. Max.		Yes	416 419
%PW$CWCnnn:RAMIN(BCC)	Write / Checker / Color Window / R Gray Ave. Min.		Yes	416 419
%PW$CWCnnn:RMAX(BCC)	Write / Checker / Color Window / R Gray Max.		Yes	416 419
%PW$CWCnnn:RMIN(BCC)	Write / Checker / Color Window / R Gray Min.		Yes	416 419
%PW$CWCnnn:RSMAX(BCC)	Write / Checker / Color Window / R Gray Standard Deviation Max.		Yes	416 419
%PW$CWCnnn:RSMIN(BCC)	Write / Checker / Color Window / R Gray Standard Deviation Min.		Yes	416 419
%PW$FECnnn:MAX(BCC)	Write / Checker / Feature Extraction / OK Judge. Max.		Yes	416 418
%PW$FECnnn:MIN(BCC)	Write / Checker / Feature Extraction / OK Judge. Min.		Yes	416 418
%PW$FWCnnn:MAX(BCC)	Write / Checker / Flaw Detection / OK Judge. Max.		Yes	416 418
%PW$FWCnnn:MIN(BCC)	Write / Checker / Flaw Detection / OK Judge. Min.		Yes	416 418
%PW$GECnnn:LVN(BCC)	Write / Checker / Gray Edge / Edge Threshold		Yes	416 417
%PW$GECnnn:MAX(BCC)	Write / Checker / Gray Edge / OK Judge. Max.		Yes	416 417

Command	Meaning	Send	Receive	Refer to
%PW$GECnnn:MIN(BCC)	Write / Checker / Gray Edge / OK Judge. Min.		Yes	416 417
%PW$GGCnnn:AMAX(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Angle		Yes	416 420
%PW$GGCnnn:AMIN(BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Angle		Yes	416 420
%PW$GGCnnn:CAMAX(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Intersect. Angle		Yes	416 420
%PW$GGCnnn:CAMIN(BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Intersect. Angle		Yes	416 420
%PW$GGCnnn:DMAX(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Distance		Yes	416 420
%PW$GGCnnn:DMIN(BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Distance		Yes	416 420
%PW$GGCnnn:LAMAX(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Major Axis		Yes	416 420
%PW$GGCnnn:LAMIN(BCC)	Write / Geometry Calculation / Geometry Calculation / Min.. Major Axis		Yes	416 420
%PW$GGCnnn:RMAX(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Radius		Yes	416 420
%PW$GGCnnn:RMIN(BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Radius		Yes	416 420
%PW$GGCnnn:SAMAX(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Minor Axis		Yes	416 420
%PW$GGCnnn:SAMIN(BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Minor Axis		Yes	416 420
%PW$GGCnnn:SMAX(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Standard Deviation		Yes	416 420
%PW$GGCnnn:SMIN(BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Standard Deviation		Yes	416 420
%PW$GGCnnn:XMAX(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. X		Yes	416 420
%PW$GGCnnn:XMIN(BCC)	Write / Geometry Calculation / Geometry Calculation / Min. X		Yes	416 420
%PW$GGCnnn:YMAX(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. Y		Yes	416 420
%PW$GGCnnn:YMIN(BCC)	Write / Geometry Calculation / Geometry Calculation / Min. Y		Yes	416 420
%PW$GWCnnn:MAX(BCC)	Write / Checker / Gray Window / OK Judge. Max.		Yes	416 417
%PW$GWCnnn:MIN(BCC)	Write / Checker / Gray Window / OK Judge. Min.		Yes	416 417
%PW$LICnnn:DMAX(BCC)	Write / Checker / Line / Max. No. of Pixels		Yes	416 417
%PW$LICnnn:DMIN(BCC)	Write / Checker / Line / Min. No. of Pixels		Yes	416 417
%PW$LICnnn:LMAX(BCC)	Write / Checker / Line / Max. No. of Objects		Yes	416 417
%PW$LICnnn:LMIN(BCC)	Write / Checker / Line / Min. No. of Objects		Yes	416 417
%PW$MRKcg_MOVE(BCC) c: Camera No.(0-1) g: Marker No.(0-7)	Write / Marker / Central Coordinate Moving Distance		Yes	416 421
%PW$SECnnn:CMAX(BCC)	Write / Checker / Smart Edge(Circle) / Max. Circularity		Yes	416 419
%PW$SECnnn:CMIN(BCC)	Write / Checker / Smart Edge(Circle) / Min. Circularity		Yes	416 419
%PW$SECnnn:LMAX(BCC)	Write / Checker / Smart Edge(Circle) / Max. Measurement		Yes	416 419
%PW$SECnnn:LMIN(BCC)	Write / Checker / Smart Edge(Circle) / Min. Measurement		Yes	416 419

Command	Meaning	Send	Receive	Refer to
%PW$SECnnn:NMAX(BCC)	Write / Checker / Smart Edge(Circle) / Max. Unused Edge Count			416 419
%PW$SECnnn:SMAX(BCC)	Write / Checker / Smart Edge(Circle) / Max. Standard Deviation		Yes	416 419
%PW$SECnnn:SMIN(BCC)	Write / Checker / Smart Edge(Circle) / Min. Standard Deviation		Yes	416 419
%PW$SELnnn:LIMAX(BCC)	Write / Checker / Smart Edge(Line) / Max. Linearity		Yes	416 419
%PW$SELnnn:LIMIN(BCC)	Write / Checker / Smart Edge(Line) / Min. Linearity		Yes	416 419
%PW$SELnnn:LMAX(BCC)	Write / Checker / Smart Edge(Line) / Max. Measurement		Yes	416 419
%PW$SELnnn:LMIN(BCC)	Write / Checker / Smart Edge(Line) / Min. Measurement		Yes	416 419
%PW$SELnnn:NMAX(BCC)	Write / Checker / Smart Edge(Line) / Max. Unused Edge Count		Yes	416 419
%PW$SELnnn:SMAX(BCC)	Write / Checker / Smart Edge(Line) / Max. Standard Deviation		Yes	416 419
%PW$SELnnn:SMIN(BCC)	Write / Checker / Smart Edge(Line) / Min. Standard Deviation		Yes	416 419
%PW$SMCnnn:CNT.?(BCC) ?: Sequence Step(1-6)	Write / Checker / Smart Matching / Search Count		Yes	416 418
%PW$SMCnnn:DCNTMAX (BCC)	Write / Checker / Smart Matching / Max. OK No. of Subtracted Objects		Yes	416 418
%PW$SYS:REG?(BCC) ?: General Register No.(0-7)	Write / System value / General registers 0-7		Yes	416 417
%PW$SYS_DATE14	Write / System value / Current Date		Yes	416 417
%PW$SYS_TIME15	Write / System value / Current Time		Yes	416 417
%PWP BECnnn:LPAIR= [Data1],[Data2](BCC)	Write / Checker / Binary Edge / OK Judge. Max. and Min.	Yes		416 417
%PWP BLVc:PAIR?=[Data1], [Data2](BCC) c: Camera No.(0-1) ?: Slice Level Group(A-P)	Write / Slice Level / Max. and Min.	Yes		416 420
%PWP BLV:PAIR?=[Data1], [Data2](BCC) ?: Slice Level Group(A-P)	Write / Slice Level / Max. and Min.	Yes		416 420
%PWP BWCnnn:LPAIR= [Data1],[Data2](BCC)	Write / Checker / Binary Window / OK Judge. Max. and Min.	Yes		416 417
%PWP CACnnn:LPAIR= [Data1],[Data2](BCC)	Write / Numerical Calculation / Max. and Min.	Yes		416 420
%PWP CBWnnn:CPAIR= [Data1],[Data2](BCC)	Write / Checker / Connector(Binary Window) / Common Judge. Max. and Min.	Yes		416 418
%PWP CBWnnn:LPAIR.ss= [Data1],[Data2](BCC) ss: Cell No.(00-99)	Write / Checker / Connector(Binary Window) / Individual Judge. Max. and Min.	Yes		416 418
%PWP CGEnnn:PPAIR= [Data1],[Data2](BCC)	Write / Checker / Connector(Gray Edge) / Min. and Min. Pitch Judge.	Yes		416 418
%PWP CGEnnn:UPAIR= [Data1],[Data2](BCC)	Write / Checker / Connector(Gray Edge) / Max. and Min. Distance Difference Judge.	Yes		416 418
%PWP CGWnnn:CPAIR= [Data1],[Data2](BCC)	Write / Checker / Connector(Gray Window) / Common Judge. Max. and Min.	Yes		416 418
%PWP CGWnnn:LPAIR.ss= [Data1],[Data2](BCC) ss: Cell No.(00-99)	Write / Checker / Connector(Gray Window) / Individual Judge. Max. and Min.	Yes		416 418
%PWP CWCnnn:BAPAIR= [Data1],[Data2](BCC)	Write / Checker / Color Window / B Gray Ave. Max. and Min.	Yes		416 419
%PWP CWCnnn:BPAIR= [Data1],[Data2](BCC)	Write / Checker / Color Window / B Gray Max. and Min.	Yes		416 419

Command	Meaning	Send	Receive	Refer to
%PWP CWCnnn:BSPAIR= [Data1],[Data2](BCC)	Write / Checker / Color Window / B Gray Standard Deviation Max. and Min.	Yes		416 419
%PWP CWCnnn:GAPAIR= [Data1],[Data2](BCC)	Write / Checker / Color Window / G Gray Ave. Max. and Min.	Yes		416 419
%PWP CWCnnn:GPAIR= [Data1],[Data2](BCC)	Write / Checker / Color Window / G Gray Max. and Min.	Yes		416 419
%PWP CWCnnn:GSPAIR= [Data1],[Data2](BCC)	Write / Checker / Color Window / G Gray Standard Deviation Max. and Min.	Yes		416 419
%PWP CWCnnn:RAPAIR= [Data1],[Data2](BCC)	Write / Checker / Color Window / R Gray Ave. Max. and Min.	Yes		416 419
%PWP CWCnnn:RPAIR= [Data1],[Data2](BCC)	Write / Checker / Color Window / R Gray Max. and Min.	Yes		416 419
%PWP CWCnnn:RSPAIR= [Data1],[Data2](BCC)	Write / Checker / Color Window / R Gray Standard Deviation Max. and Min.	Yes		416 419
%PWP FECnnn:LPAIR= [Data1],[Data2](BCC)	Write / Checker / Feature Extraction / OK Judge. Max. and Min.	Yes		416 418
%PWP FWCnnn:LPAIR= [Data1],[Data2](BCC)	Write / Checker / Flaw Detection / OK Judge. Max. and Min.	Yes		416 418
%PWP GECnnn:LPAIR= [Data1],[Data2](BCC)	Write / Checker / Gray Edge / OK Judge. Max. and Min.	Yes		416 417
%PWP GGCnnn:APAIR= [Data1],[Data2](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Angle	Yes		416 420
%PWP GGCnnn:CAPAIR= [Data1],[Data2](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Intersect. Angle	Yes		416 420
%PWP GGCnnn:DPAIR= [Data1],[Data2](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Distance	Yes		416 420
%PWP GGCnnn:LAPAIR= [Data1],[Data2](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Major Axis	Yes		416 420
%PWP GGCnnn:RPAIR= [Data1],[Data2](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min.Radius	Yes		416 420
%PWP GGCnnn:SAPAIR= [Data1],[Data2](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Minor Axis	Yes		416 420
%PWP GGCnnn:SPAIR= [Data1],[Data2](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Standard Deviation	Yes		416 420
%PWP GGCnnn:XPAIR= [Data1],[Data2](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. X	Yes		416 420
%PWP GGCnnn:YPAIR= [Data1],[Data2](BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Y	Yes		416 420
%PWP GWCnnn:LPAIR= [Data1],[Data2](BCC)	Write / Checker / Gray Window / OK Judge. Max. and Min.	Yes		416 417
%PWP LICnnn:DPAIR= [Data1],[Data2](BCC)	Write / Checker / Line / Max. and Min. No. of Pixels	Yes		416 417
%PWP LICnnn:LPAIR= [Data1],[Data2](BCC)	Write / Checker / Line / Max. and Min. No. of Objects	Yes		416 417
%PWP SECnnn:CPAIR= [Data1],[Data2](BCC)	Write / Checker / Smart Edge(Circle) / Max. and Min. Circularity	Yes		416 419
%PWP SECnnn:LPAIR= [Data1],[Data2](BCC)	Write / Checker / Smart Edge(Circle) / Max. and Min. Measurement	Yes		416 419
%PWP SECnnn:SPAIR= [Data1],[Data2](BCC)	Write / Checker / Smart Edge(Circle) / Max. and Min. Standard Deviation	Yes		416 419
%PWP SELnnn:LIPAIR= [Data1],[Data2](BCC)	Write / Checker / Smart Edge(Line) / Max. and Min. Linearity	Yes		416 419
%PWP SELnnn:LPAIR= [Data1],[Data2](BCC)	Write / Checker / Smart Edge(Line) / Max. and Min. Measurement	Yes		416 419
%PWP SELnnn:SPAIR= [Data1],[Data2](BCC)	Write / Checker / Smart Edge(Line) / Max. and Min. Standard Deviation	Yes		416 419
%PWP!20061	Write / Error		Yes	416
%PWP!25165	Write / Error		Yes	416
%PWP!25266	Write / Error		Yes	416
%PWP!25460	Write / Error		Yes	416

Command	Meaning	Send	Receive	Refer to
%PWP$BECnnn:LPAIR(BCC)	Write / Checker / Binary Edge / OK Judge. Max. and Min.		Yes	416 417
%PWP$BLVc:PAIR?(BCC) c: Camera No.(0-1) ?: Slice Level Group(A-P)	Write / Slice Level / Max. and Min.		Yes	416 420
%PWP$BLV:PAIR?(BCC) ?: Slice Level Group(A-P)	Write / Slice Level / Max. and Min.		Yes	416 420
%PWP$BWCnnn:LPAIR(BCC)	Write / Checker / Binary Window / OK Judge. Max. and Min.		Yes	416 417
%PWP$CACnnn:LPAIR(BCC)	Write / Numerical Calculation / Max. and Min.		Yes	416 420
%PWP$CBWnnn:CPAIR(BCC)	Write / Checker / Connector(Binary Window) / Common Judge. Max. and Min.		Yes	416 418
%PWP$CBWnnn:LPAIR.ss(BCC) ss: Cell No.(00-99)	Write / Checker / Connector(Binary Window) / Individual Judge. Max. and Min.		Yes	416 418
%PWP$CGEnnn:PPAIR(BCC)	Write / Checker / Connector(Gray Edge) / Min. and Min. Pitch Judge.		Yes	416 418
%PWP$CGEnnn:UPAIR(BCC)	Write / Checker / Connector(Gray Edge) / Max. and Min. Distance Difference Judge.		Yes	416 418
%PWP$CGWnnn:CPAIR (BCC)	Write / Checker / Connector(Gray Window) / Common Judge. Max. and Min.		Yes	416 418
%PWP$CGWnnn:LPAIR.ss(BCC) ss: Cell No.(00-99)	Write / Checker / Connector(Gray Window) / Individual Judge. Max. and Min.		Yes	416 418
%PWP$CWCnnn:BAPAIR(BCC)	Write / Chcker / Color Window / B Gray Ave. Max. and Min.		Yes	416 419
%PWP$CWCnnn:BPAIR(BCC)	Write / Checker / Color Window / B Gray Max. and Min.		Yes	416 419
%PWP$CWCnnn:BSPAIR(BCC)	Write / Checker / Color Window / B Gray Standard Deviation Max. and Min.		Yes	416 419
%PWP$CWCnnn:GAPAIR(BCC)	Write / Checker / Color Window / G Gray Ave. Max. and Min.		Yes	416 419
%PWP$CWCnnn:GPAIR (BCC)	Write / Checker / Color Window / G Gray Max. and Min.		Yes	416 419
%PWP$CWCnnn:GSPAIR(BCC)	Write / Checker / Color Window / G Gray Standard Deviation Max. and Min.		Yes	416 419
%PWP$CWCnnn:RAPAIR(BCC)	Write / Checker / Color Window / R Gray Ave. Max. and Min.		Yes	416 419
%PWP$CWCnnn:RPAIR (BCC)	Write / Checker / Color Window / R Gray Max. and Min.		Yes	416 419
%PWP$CWCnnn:RSPAIR(BCC)	Write / Checker / Color Window / R Gray Standard Deviation Max. and Min.		Yes	416 419
%PWP$FECnnn:LPAIR(BCC)	Write / Checker / Feature Extraction / OK Judge. Max. and Min.		Yes	416 418
%PWP$FWCnnn:LPAIR(BCC)	Write / Checker / Flaw Detection / OK Judge. Max. and Min.		Yes	416 418
%PWP$GECnnn:LPAIR(BCC)	Write / Checker / Gray Edge / OK Judge. Max. and Min.		Yes	416 417
%PWP$GGCnnn:APAIR(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Angle		Yes	416 420
%PWP$GGCnnn:CAPAIR(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Intersect. Angle		Yes	416 420
%PWP$GGCnnn:DPAIR(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Distance		Yes	416 420
%PWP$GGCnnn:LAPAIR(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Major Axis		Yes	416 420
%PWP$GGCnnn:RPAIR(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min.Radius		Yes	416 420
%PWP$GGCnnn:SAPAIR(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Minor Axis		Yes	416 420

Command	Meaning	Send	Receive	Refer to
%PWP$GGCnnn:SPAIR(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Standard Deviation		Yes	416 420
%PWP$GGCnnn:XPAIR(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. X		Yes	416 420
%PWP$GGCnnn:YPAIR(BCC)	Write / Geometry Calculation / Geometry Calculation / Max. and Min. Y		Yes	416 420
%PWP$GWCnnn:LPAIR(BCC)	Write / Checker / Gray Window / OK Judge. Max. and Min.		Yes	416 417
%PWP$LICnnn:DPAIR(BCC)	Write / Checker / Line / Max. and Min. No. of Pixels		Yes	416 417
%PWP$LICnnn:LPAIR(BCC)	Write / Checker / Line / Max. and Min. No. of Objects		Yes	416 417
%PWP$SECnnn:CPAIR(BCC)	Write / Checker / Smart Edge(Circle) / Max. and Min. Circularity		Yes	416 419
%PWP$SECnnn:LPAIR(BCC)	Write / Checker / Smart Edge(Circle) / Max. and Min. Measurement		Yes	416 419
%PWP$SECnnn:SPAIR(BCC)	Write / Checker / Smart Edge(Circle) / Max. and Min. Standard Deviation		Yes	416 419
%PWP$SELnnn:LIPAIR(BCC)	Write / Checker / Smart Edge(Line) / Max. and Min. Linearity		Yes	416 419
%PWP$SELnnn:LPAIR(BCC)	Write / Checker / Smart Edge(Line) / Max. and Min. Measurement		Yes	416 419
%PWP$SELnnn:SPAIR(BCC)	Write / Checker / Smart Edge(Line) / Max. and Min. Standard Deviation		Yes	416 419
%Q!20067	Statistics Data Reset / Error		Yes	411
%Q$50	Statistics Data Reset		Yes	411
%Q74	Statistics Data Reset	Yes		411
%R77	Reinspect (Execution Mode is “All” or “Automatic Switch”)	Yes		407
%R!20064	Reinspect / Error		Yes	407
%R!20165	Reinspect (Execution Mode is "User Defined") / Error		Yes	407
%R!20266	Reinspect / Error		Yes	407
%R!20367	Reinspect / Error		Yes	407
%R!20460	Reinspect / Error		Yes	407
%R$53	Reinspect		Yes	407
%R?(BCC) ?: Execution Block No.(0-9)	Reinspect (Execution Mode is "User Defined")	Yes		407
%RM!2402D	Switch between Run/Stop / Error		Yes	411
%RM$?(BCC) ? : RUN/STOP(0-1)	Switch between Run/Stop		Yes	411
%RM?(BCC) ? : RUN/STOP(0-1)	Switch between Run/Stop	Yes		411
%S!16060	Inspection Start / Error		Yes	406
%S!20065	Inspection Start (When using common trigger and Execution Mode is "All" or "Automatic Switch") / Error		Yes	406
%S!20164	Inspection Start (When using common trigger and Execution Mode is "User Defined") / Error		Yes	406
%S!20267	Inspection Start / Error		Yes	406
%S!20366	Inspection Start / Error		Yes	406
%S$52	Inspection start		Yes	406
%S?(BCC) ?: Execution Block No.(0-9)	Inspection Start (When using common trigger and Execution Mode is "User Defined")	Yes		406
%S76	Inspection Start (When using common trigger and Execution Mode is "All" or "Automatic Switch")	Yes		406

Command	Meaning	Send	Receive	Refer to
%SR$00	Clearing the Image Memory stored in PV		Yes	410
%SR24	Clearing the Image Memory stored in PV	Yes		410
%SS!20036	Saving Images stored in the Image Memory of PV into a SD memory card / Error		Yes	410
%SS!26030	Saving Images stored in the Image Memory of PV into a SD memory card / Error		Yes	410
%SS$01	Saving Images stored in the Image Memory of PV into a SD memory card		Yes	410
%SS25	Saving Images stored in the Image Memory of PV into a SD memory card	Yes		410
%X!2006E	Switching Type / error		Yes	408
%X!2106F	Switching Type / error		Yes	408
%X$59	Switching Type		Yes	408
%X???(BCC) ???:Type No.(000-255)	Switching Type	Yes		408

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Record of Changes

Manual No.	Date	Revision detail
ARCT1F516E	February 2011	First edition
ARCT1F516E-1	March 2011	Second edition ・ Revision and addition along with version update to Ver.1.1 ・ Addition of Appendix ・ Correction of errors
ARCT1F516E-2	July 2011	Third edition ・ Revision and addition along with version update to Ver.1.2 ・ Correction of errors

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