

Panasonic[®]

IMAGECHECKER

PV500

User's Manual

BEFORE BEGINNING

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- When physical defects are due to modifications/repairs by someone other than PEWEU.
- When physical defects are due to natural disasters.

Safety Instructions

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 cause damage to the lithium battery or other electronic parts.**
- **Do not store a lens in the locations subject to direct sunlight. It could cause smoke generation.**
- **Do not look at the sun through a lens. It could cause 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.**
- **Do not dismantle or remodel the product. It could cause 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 cause 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 cause 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.**

Important Symbols

One or more of the following symbols may be used in this documentation:



DANGER!

The warning triangle indicates especially important safety instructions. If they are not adhered to, the results could be fatal or critical injury.



◆ CAUTION

Indicates that you should proceed with caution. Failure to do so may result in injury or significant damage to instruments or their contents, e.g. data.



◆ NOTE

Contains important additional information.



◆ EXAMPLE

Contains an illustrative example of the previous text section.



◆ Procedure

Indicates that a step-by-step procedure follows.



◆ REFERENCE

Indicates where you can find additional information on the subject at hand.



◆ KEY POINTS

Summarizes key points in a concise manner.



◆ SHORTCUTS

Provides helpful keyboard shortcuts.



◆ EXPLANATION

Provides brief explanation of a function, e.g. why or when you should use it.

➡ next page

Indicates that the text will be continued on the next page.

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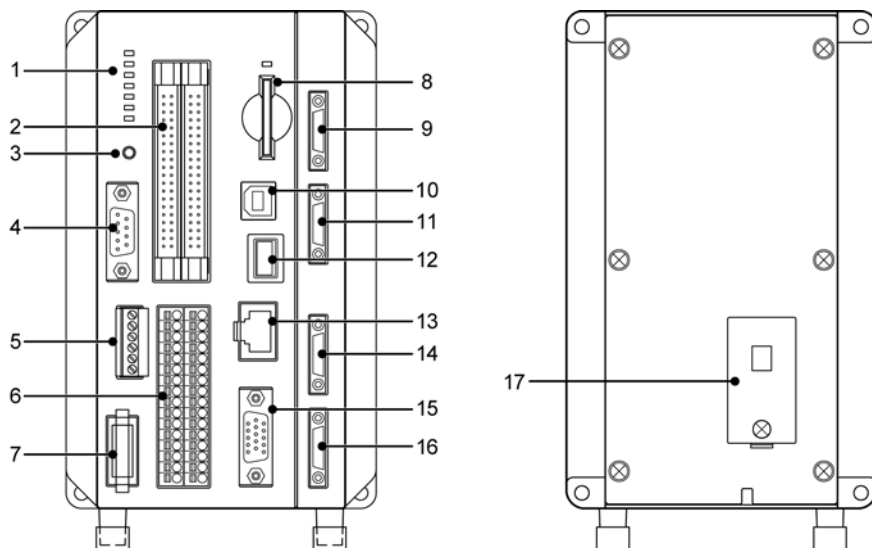
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Chapter 1

Names and Functions of Parts

1.1 PV500



No.	Description	Further information
1	Operating LEDs	Displays the status of the following signals. POWER / READY / ERROR0 / ERROR1 / COM.0 / COM.1 / COM.2
2	Parallel I/O Connector	I/O interface
3	Reset Switch	Reboots PV500.
4	COM0 Port	RS-232C Communication port.
5	COM1 Port	Terminal block type of RS-232C Communication port. Not available for Ver. 1.0.
6	Parallel I/O Terminal Block	I/O interface.
7	Power Input Terminal	Supplies 24V DC through the included power cable.
8	SD Memory Card Slot	Complies with SD memory card with up to 32 GB of memory. During accessing to a SD memory card, the LED above the slot flashes.
9	Camera 0 Connect Port	For connecting camera 0
10	USB Port	Not available for Ver. 1.0.
11	Camera 1 Connect Port	For connecting camera 1
12	Keypad connector	For connection a keypad (ANPV03 / ANPV10).
13	Ethernet Port	The operation LED flashes during the communication.
14	Camera 2 Connect Port	For connecting camera 2 (only for 4-camera type).
15	Monitor	Analog RGB output terminal for connecting a monitor.
16	Camera 3 Connect Port	For connecting camera 3 (only for 4-camera type).
17	Battery	The battery is used for the internal clock and calendar.

1.1.1 Connecting the Battery

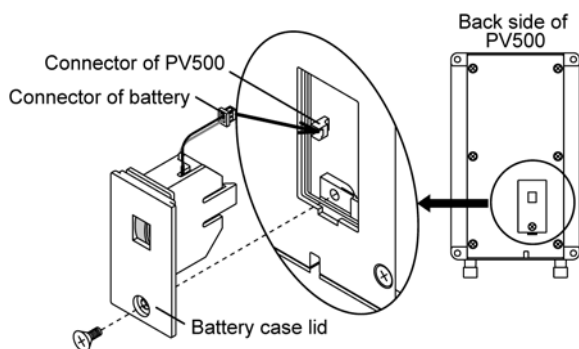
Before you start the Imagechecker for the first time, you need to connect the battery. Please proceed as follows:



◆ Procedure

1. **Switch off the Imagechecker**
2. **Open the lid on the back**

Note that the battery is attached to the lid.



3. **Connect the connector of the battery with the connector of the Imagechecker**
4. **Close the lid on the back**

1.2 Camera

Independent of the type of camera you are using, please note the following:



◆ NOTE

- Use only the camera and the camera cable with the proper product numbers specified by Panasonic.
- 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.

1.2.1 Camera Types

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

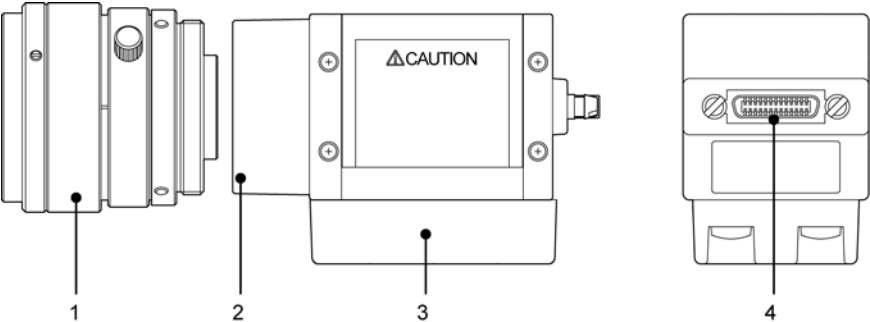
	2-Mega-pixel digital camera (ANPVC1210)	Quad-speed digital camera (ANPVC1040)	Ultra compact double speed digital camera (ANPVC1021)
Number of Pixels	2 million pixels	300 thousand pixels	300 thousand pixels
Time to transfer image	Approximately 34ms	Approximately 9ms	Approximately 17ms
Dimension	29 x 29 x 58mm	29 x 29 x 58mm	12 x 13 x 48mm
CCD Size	1 /1.8 inch	1/3 inch	1/3 inch
Pixel Size	4.4 x 4.4μm	7.4 x 7.4μm	7.4 x 7.4μm

1.2.1.1 2-Mega-Pixel Digital Camera/Quad-Speed Digital Camera

The cameras have the following product numbers:

- 2-Mega-pixel digital camera: ANPVC1210

- Quad-speed digital camera: ANPVC1040



No.	Description	Further information
1	Lens	Attach an exclusive lens for each camera.
2	Lens fixture	C-mount
3	Mounting plate	Insulation type plate. The plate can be attached to four sides of the camera.
4	Cable connector	Connects a camera cable.

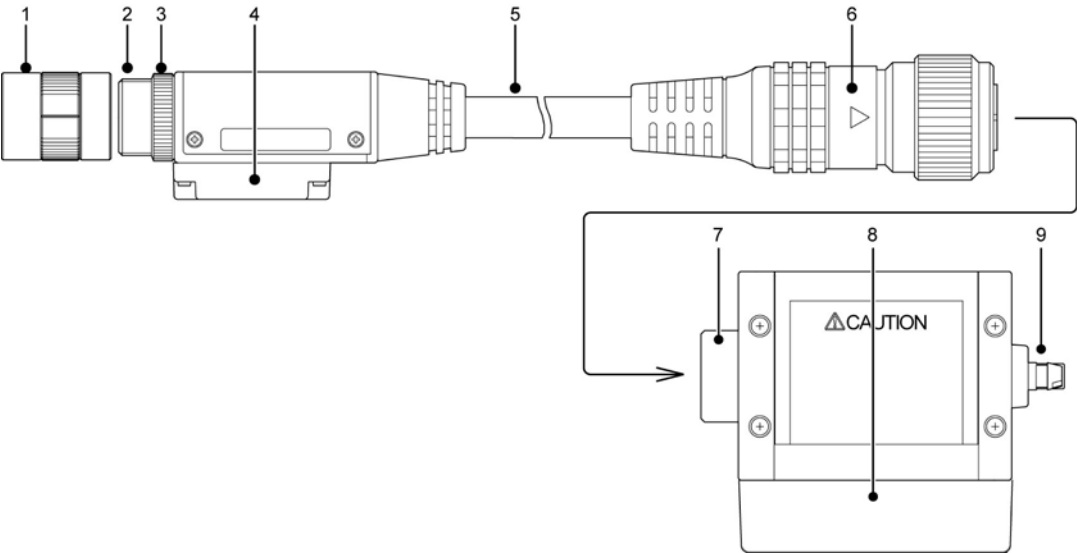


◆ NOTE

From now on, the 2-mega-pixel digital camera ANPVC1210 will be referred to as "2-Mega camera" and the quad-speed digital camera ANPVC1040 will be referred to as "quad-speed camera".

1.2.1.2 Ultra Compact Double Speed Digital Camera

The camera has the following product number: ANPVC1021.



Camera head

No.	Description	Further information
1	Lens	
2	Lens fixture	Special mounting fixture.
3	Lens securing ring	Use the ring to fix the lens.
4	Mounting plate	Insulation type plate.
5	Camera cable	Mounted directly to the camera. It cannot be removed.
6	CCU connector	Connects to the camera with the camera control unit (CCU).

Camera control unit (CCU)

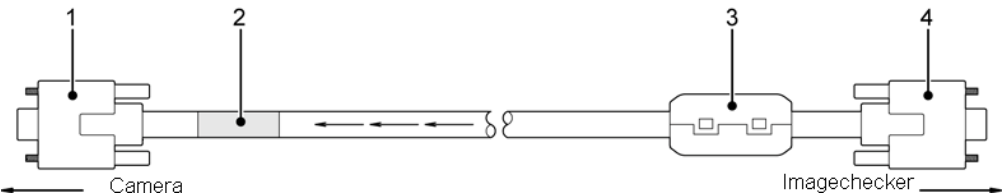
No.	Description	Further information
7	Camera head connector	Connects the cable of the camera head.
8	Mounting plate	Insulation type plate.
9	Cable connector	Connects the CCU to the Imagechecker

**◆ NOTE**

From now on, the Ultra compact double speed digital camera ANPVC1021 will be referred to as "ultra compact camera".

1.3 Camera Cable

The camera cable has the following product number: ANPVC81XX, ANPVC81XXR (XX=03, 05, 10 referring to the cable length)



No.	Description	Further information
1	Camera-side connector	Connects to a camera.
2	Product number label	The label shows the product number of the camera cable.
3	Ferrite core	Attach this whenever you use the product. (ZCAT2035-0930A produced by TDK)
4	Imagechecker-side connector	Plug into one of the CAMERA connectors of the Imagechecker.

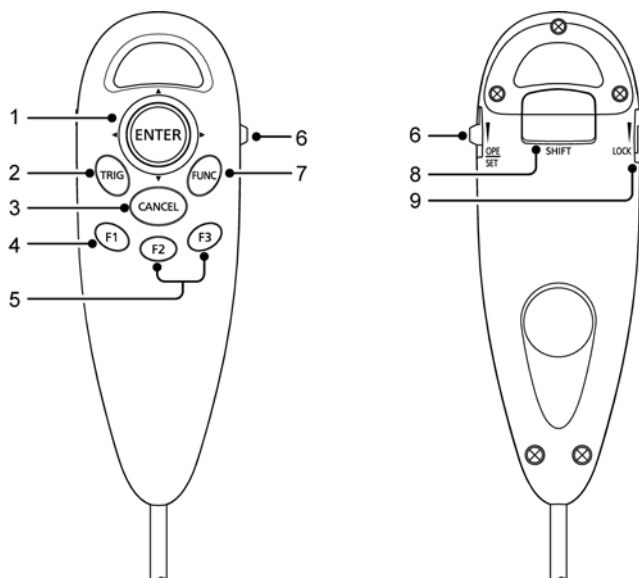


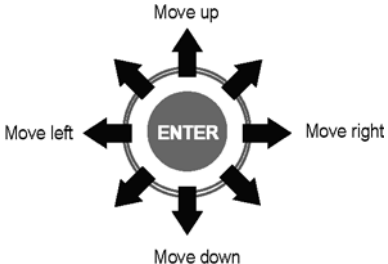
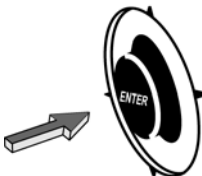
◆ NOTE

The camera cable has a direction. Make sure to plug the side of the cable with the product number label into the camera, and the connector with the ferrite into the Imagechecker.

1.4 Keypad

This is the keypad as seen from front/above.



No.	Description	Further information
1	Cursor lever	<p>The lever can move in 8 directions. Use it to move and position the cursor, for example when selecting menus or options and when setting the start and end point of a checker or to enter a value.</p> 
1	ENTER button	<p>Press <Enter> straight down to select a menu, option or value and to confirm an operation.</p> 
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	Refer to the key guide at the bottom of the screen (see page 65, see page 68) for information on their current function.

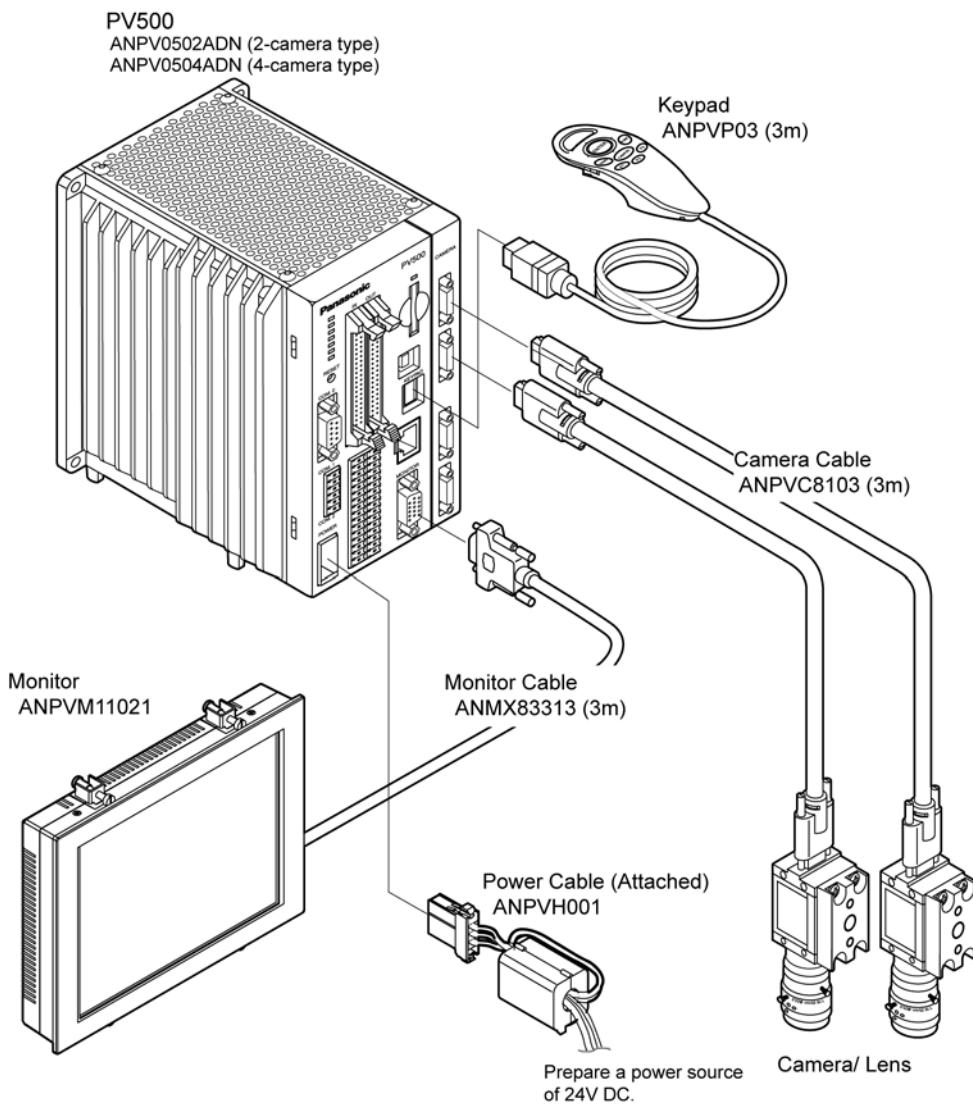
No.	Description	Further information
6	OPE/SET switch	To switch windows between SETUP and RUN. This is a snap type switch and the window switches every time you snap it.
7	FUNC key (FUNCTION)	To display the pop-up menu. Pressing the key two seconds or more captures the screen (print screen).
8	SHIFT key	Use it when "SHIFT" sign is shown on the screen. The SHIFT key makes the cursor move faster combining with cursor lever operation.
9	LOCK switch	To lock or disable all other keys by moving the switch on the "Lock" side.

Chapter 2

Installation and Wiring

2.1 Overview of Connecting Peripherals

This is an example of how to connect the peripherals when you use two cameras.



2.2 Installing the Imagechecker

Install the Imagechecker by using the four mounting holes on the back or using the screw holes on the bottom side after removing the rubber legs.

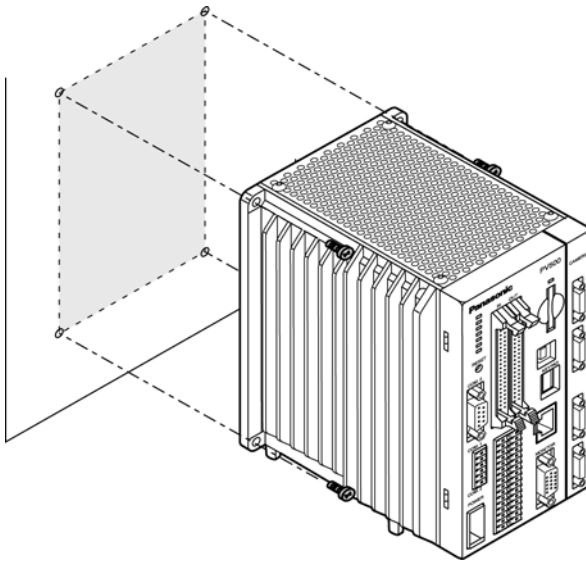


◆ NOTE

Before you mount the Imagechecker, connect the backup battery (see page 3).

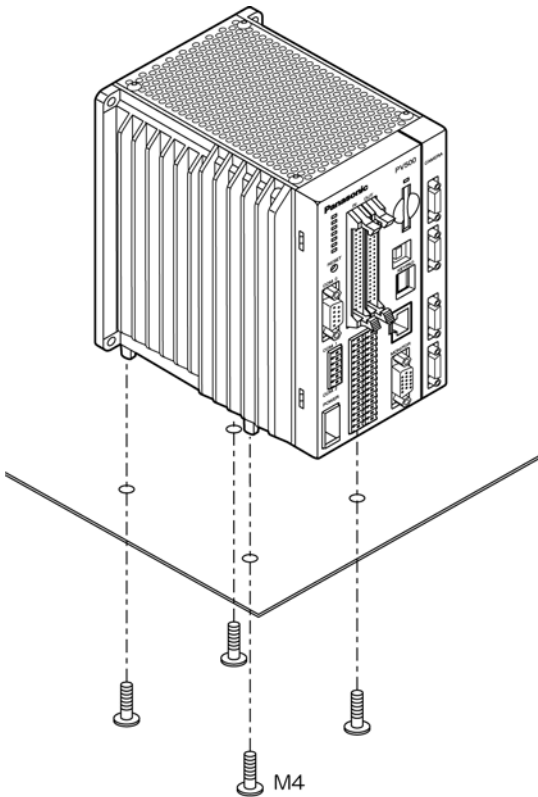
2.2.1 Back Mounting

Mount the Imagechecker by using the four mounting holes (Ø4.6). Use M4 screws (minimum length 10mm) to mount.



2.2.2 Bottom Mounting

Remove the rubber legs on the bottom and use four M4 screws (maximum length of screw joint 8mm).



2.2.3 Installation Environment

Make sure to observe the correct mounting direction and the requirements for mounting space.



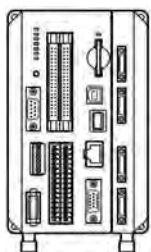
◆ NOTE

- Do not block the ventilators on the top and bottom of the unit. It might cause the device to malfunction.
- When installing the Imagechecker on a control board, attach a cooling system to lower the ambient temperature so that it stays in the specified range; 4-camera type: 0 - 40°C, 2-camera type: 0 - 45°C.

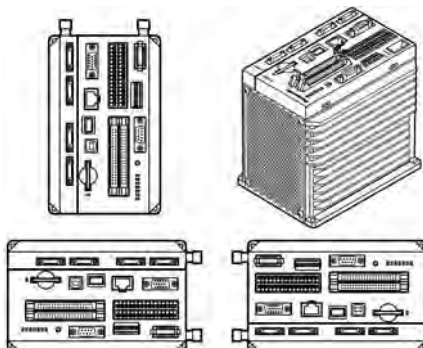
2.2.3.1 Mounting Direction

Install the Imagechecker in the correct direction (see the figures below) to allow the heat to dissipate. Do not mount the Imagechecker sideways or upside down.

Correct

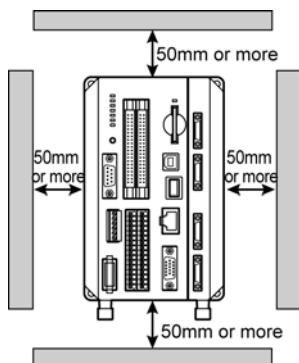


Incorrect



2.2.3.2 Mounting Space

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



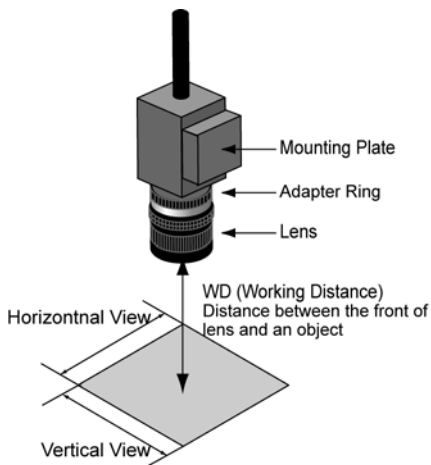
◆ NOTE

When installing several Imagechecker next to each other, keep more than 50mm of space between them.

2.3 Camera Installation

2.3.1 View Range and Lens Selection Table

The view range depends on the size of the inspection object. Refer to the view range table of each camera, find the distance to work (WD) from the object to the camera and select a suitable lens.



◆ NOTE

- The table is designed primarily for use as a focusing guide. Use the camera itself to make the final adjustments to focus, view range, distance to work, resolution and any other settings that need to be made before running the system.
- Unless otherwise noted, the focus values in the table are all infinity.
- Adapter rings may be needed in some cases. When you use adapter rings, fix them between the lens and the camera.

2.3.1.1 View Range Table for Quad-Speed Camera ANPVC1040

View range (mm)		ANM8850 ANM88501 f=50 mm		ANB847L f=50 mm		ANB846NL ANM88251 f=25 mm		Resolution μm/pixel	
Ver.	Hor.	WD	Adapter ring	WD	Adapter ring	WD	Adapter ring	Ver.	Hor.
1	1.3	59	178	48	178			2.1	2.1
2	2.7	73	89	62	89			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	36	104	36	31	18	10.4	10.4
7.5	10.0	150	24	139	24	49	12	15.6	15.6
10	13.3	186	18	175	18	66	9	20.8	20.8
12.5	16.7	221	14	210	14	84	7	26.0	26.0
15	20.0	256	12	245	12	101	6	31.3	31.3
20	26.7	326	9	315	9	137	2 ^{N2}	41.7	41.7
30	40.0	467	6	456	6	207	2 ^{N3}	62.5	62.5
40	53.3	608	2 ^{N2}	597	2 ^{N2}	277	2	83.3	83.3
50	66.7	749	2 ^{N3}	738	2 ^{N3}	348	2	104.2	104.2
75	100.0	1101	2	1090	2	524	1	156.3	156.3
100	133.3	1452	2	1441	2	700	1	208.3	208.3
150	200.0	2156	1	2145	1	1052	0.5	312.5	312.5
200	266.7	2860	1	2849	1	1403	0.5	416.7	416.7
250	333.3	3564	0.5	3553	0.5	1755	0.5	520.8	520.8
300	400.0	4268	0.5	4257	0.5	2107	0.5	625.0	625.0
350	466.7	4972	0.5	4961	0.5	2459	0.5	729.2	729.2
400	533.3	5675	0.5	5664	0.5	2811	0	833.3	833.3
450	600.0	6379	0.5	6368	0.5	3163	0	937.5	937.5
500	666.7	7083	0.5	7072	0.5	3515	0	1041.7	1041.7
600	800.0	8491	0.5	8480	0.5	4219	0	1250.0	1250.0
700	933.3	9898	0.5	9887	0.5	4923	0	1458.3	1458.3
800	1066.7	11306	0	11295	0	5626	0	1666.7	1666.7
900	1200.0	12714	0	12703	0	6330	0	1875.0	1875.0
1000	1333.3	14121	0	14110	0	7034	0	2083.3	2083.3

View range (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	Ver.	Hor.
1	1.3							2.1	2.1
2	2.7							4.2	4.2
3	4.0							6.3	6.3
4	5.3							8.3	8.3
5	6.7							10.4	10.4
7.5	10.0							15.6	15.6
10	13.3	31	6					20.8	20.8
12.5	16.7	42	4.5					26.0	26.0
15	20.0	53	2 ^{N2}					31.3	31.3
20	26.7	76	2 ^{N3}	30	1.5			41.7	41.7
30	40.0	121	2	54	1	32	1	62.5	62.5
40	53.3	166	1.5	78	1	49	1	83.3	83.3
50	66.7	211	1	102	0.5	66	0.5	104.2	104.2
75	100.0	323	1	162	0.5	108	0.5	156.3	156.3
100	133.3	436	0.5	221	0.5	150	0.0	208.3	208.3
150	200.0	661	0.5	341	0	235	0	312.5	312.5
200	266.7	886	0.5	461	0	319	0	416.7	416.7
250	333.3	1112	0	580	0	404	0	520.8	520.8
300	400.0	1337	0	700	0	488	0	625.0	625.0
350	466.7	1562	0	820	0	573	0	729.2	729.2
400	533.3	1787	0	939	0	657	0	833.3	833.3
450	600.0	2013	0	1059	0	741	0	937.5	937.5
500	666.7	2238	0	1179	0	826	0	1041.7	1041.7
600	800.0	2688	0	1418	0	995	0	1250.0	1250.0
700	933.3	3139	0	1657	0	1164	0	1458.3	1458.3
800	1066.7	3589	0	1897	0	1333	0	1666.7	1666.7
900	1200.0	4040	0	2136	0	1502	0	1875.0	1875.0
1000	1333.3	4490	0	2375	0	1671	0	2083.3	2083.3

Ver. = vertical, Hor. = horizontal, WD = distance to work, *1 = note 1, *2 = note 2, *3 = note 3



◆ NOTE

1. WD = +4 mm
2. Lens focal ring is in the ∞ position.

3. Lens focal position is halfway between the ∞ position and the smallest focus possible.

2.3.1.2 View Range Table for 2 Mega Camera ANPVC1210

View range (mm)		ANPVL502 f=50 mm		ANPVL252 f=25 mm		ANPVL162 f=16 mm		Resolution $\mu\text{m}/\text{pixel}$	
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	53					4.2	4.2
7.5	10.0	92	35					6.3	6.3
10	13.3	115	26	30	13			8.3	8.3
12.5	16.7	139	21	41	11			10.4	10.4
15	20.0	163	18	53	9			12.5	12.5
20	26.7	210	13	77	7			16.7	16.7
30	40.0	305	9	124	2 ^{N2}	74	2 ^{N5}	25.0	25.0
40	53.3	399	7	172	2 ^{N3}	104	2	33.3	33.3
50	66.7	494	5	219	2 ^{N4}	135	1.5	41.7	41.7
75	100.0	731	2 ^{N1}	337	2	210	1	62.5	62.5
100	133.3	968	2	456	2	286	1	83.3	83.3
150	200.0	1441	2	693	1	438	0.5	125.0	125.0
200	266.7	1915	1.5	929	1	589	0.5	166.7	166.7
250	333.3	2388	1	1166	1	741	0.5	208.3	208.3
300	400.0	2862	1	1403	0.5	892	0.5	250.0	250.0
350	466.7	3335	1	1639	0.5	1044	0	291.7	291.7
400	533.3	3809	0.5	1876	0.5	1195	0	333.3	333.3
450	600.0	4282	0.5	2113	0.5	1347	0	375.0	375.0
500	666.7	4756	0.5	2350	0.5	1498	0	416.7	416.7
600	800.0	5703	0.5	2823	0	1801	0	500.0	500.0
700	933.3	6649	0.5	3297	0	2104	0	583.3	583.3
800	1066.7	7596	0.5	3770	0	2407	0	666.7	666.7
900	1200.0	8543	0.5	4244	0	2710	0	750.0	750.0
1000	1333.3	9490	0	4717	0	3013	0	833.3	833.3

Ver. = vertical, Hor. = horizontal, WD = distance to work, N1 = note 1, N2 = note 2, N3 = note 3

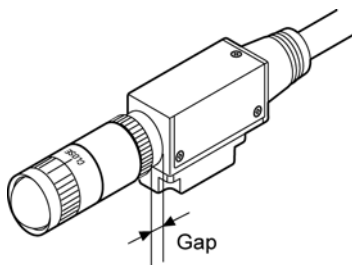


◆ NOTE

1. Lens focal position is around 2.
2. Lens focal position is the closest point.
3. Lens focal position is around 0.5.
4. Lens focal position is around 1.
5. Lens focal position is around 0.3.

2.3.1.3 View Range Table for Ultra Compact Camera ANPVC1021

For the ultra compact camera you also need to consider the gap:



View range (mm)		ANPVL3001 f=30 mm			ANPVL1201 f=12 mm			ANPVL0401 f=4 mm			Resolution μm/pixel	
Ver.	Hor.	WD	Gap	AR	WD	Gap	AR	WD	Gap	AR	Ver.	Hor.
1	1.3	33	0	110 ^{N1}							2.1	2.1
2	2.7				15	0.7	20				4.2	4.2
3	4.0	50	1	35							6.3	6.3
4	5.3	58	0	30 ^{N1}	22	0	10				8.3	8.3
5	6.7	67	1.8	20							10.4	10.4
8	10.7				36	0	5				16.7	16.7
10	13.3	109	1.2	10				9	1.8	---	20.8	20.8
13	17.3							12	1.5	---	27.1	27.1
15	20.0							14	1.3	---	31.3	31.3
18	24.0	176	1.2	5				18	1.2	---	37.5	37.5
20	26.7	193	0.6	5				20	1.1	---	41.7	41.7
23	30.7	219	0	5				23	1.0	---	47.9	47.9
25	33.3							26	1.0	---	52.1	52.1

View range (mm)		ANPVL3001 f=30 mm			ANPVL1201 f=12 mm			ANPVL0401 f=4 mm			Resolution μm/pixel	
Ver.	Hor.	WD	Gap	AR	WD	Gap	AR	WD	Gap	AR	Ver.	Hor.
30	40.0				110	1.8	---				62.5	62.5
35	46.7				127	1.6	---				72.9	72.9
40	53.3				144	1.5	---				83.3	83.3
45	60.0				161	1.3	---				93.8	93.8
50	66.7				178	1.3	---				104.2	104.2
55	73.3				194	1.2	---				114.6	114.6
60	80.0	531	0	5 ^{N1}	211	1.1	---				125.0	125.0
65	86.7	573	0	5 ^{N1}	228	1.1	---				135.4	135.4
70	93.3	658	0	5 ^{N1}	245	1.0	---				145.8	145.8
75	100.0	658	1.9	---	262	1.0	---				156.3	156.3
80	106.7	700	1.8	---							166.7	166.7
85	113.3	742	1.8	---							177.1	177.1
90	120.0	785	1.7	---							187.5	187.5
95	126.7	827	1.6	---							197.9	197.9
100	133.3	869	1.6	---							208.3	208.3
150	200.0	1291	1.2	---							312.5	312.5
200	266.7	1714	1.0	---							416.7	416.7
250	333.3	2136	0.9	---							520.8	520.8
300	400.0	2558	0.9	---							625.0	625.0
350	466.7	2981	0.8	---							729.2	729.2
400	533.3	3403	0.8	---							833.3	833.3
450	600.0	3825	0.7	---							937.5	937.5
500	666.7	4247	0.7	---							1041.7	1041.7

Ver. = vertical, Hor. = horizontal, WD = distance to work, AR = adapter ring, N1 = use instead of lens securing ring.

2.3.2 Mounting the Cameras

The correct mounting procedure depends on the camera type you are using.



◆ NOTE

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

- The orientation of the camera is such that the side of the camera with the mounting plate is treated as the bottom of the camera. This orientation affects the capturing of images and how images are displayed on the screen.
- In the case of the quad-speed camera and the 2 mega camera, it is possible to fix the mounting plate in a different position to the camera. In this case the bottom of the camera is the side where the mounting plate was initially attached. As it is impossible to rotate captured images with the Imagechecker, make sure to mount the camera with the correct orientation.



Danger of damage to the camera!

Be sure to mount the camera in an electrically insulated way. Without insulation, the internal circuit may be damaged when the electric potentials of the mounting point and the camera case are different. Use the mounting plate (insulation type) that comes attached to the camera to mount the camera in an electrically insulated way.

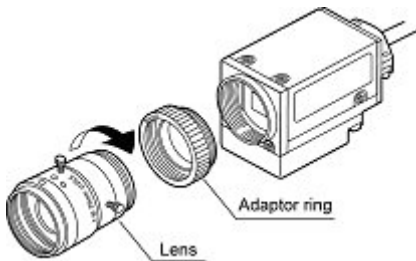
2.3.2.1 Mounting a Quad-Speed or 2 Mega Camera



◆ Procedure

1. Remove the camera cap
2. Attach the selected lens

If necessary, use an adaptor ring between the camera and the lens.



3. Use the mounting plate (insulation type) screwed to the camera to mount the camera to the installation point

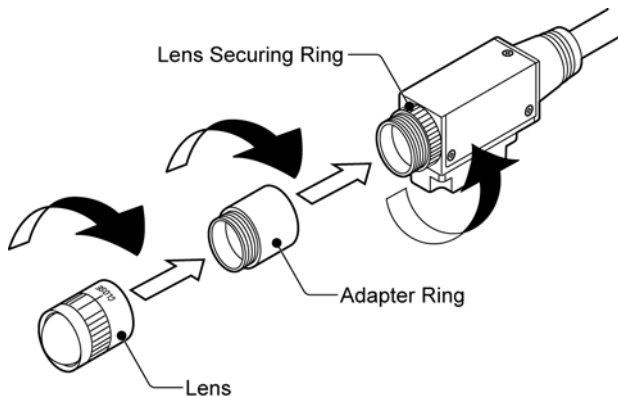
When you mount the camera directly without a mounting plate, do not screw into the bottom of the camera over 3mm.

**◆ NOTE**

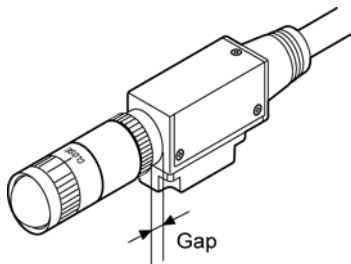
- Protect the CCD (image sensor) from dust.
- Do not touch the glass surface of CCD image sensor.

2.3.2.2 Mounting an Ultra Compact Camera**◆ Procedure**

1. Rotate the lens securing ring to place it at the appropriate position.
2. If you are using an adapter ring, fix it to the lens
3. Screw the lens into the lens securing ring



4. Rotate the lens securing ring to fix the lens
5. Adjust the gap between the lens securing ring and the camera to gap value in the view range table



6. Use the mounting plate (insulation type) screwed to the camera to mount the camera to the installation point

When you mount the camera directly without a mounting plate, do not screw into the bottom of the camera over 1.5mm.

2.4 Connecting Peripherals



◆ NOTE

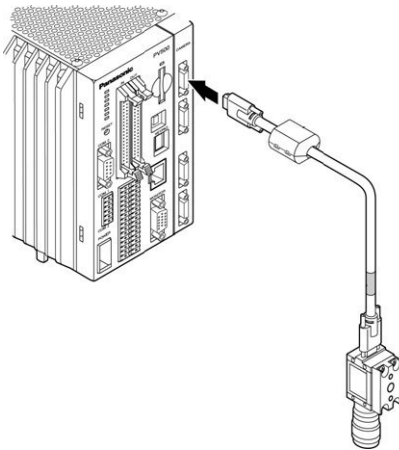
Connect peripherals only when the Imagechecker power is turned OFF. Otherwise, the Imagechecker or the peripherals could be damaged.



◆ Procedure

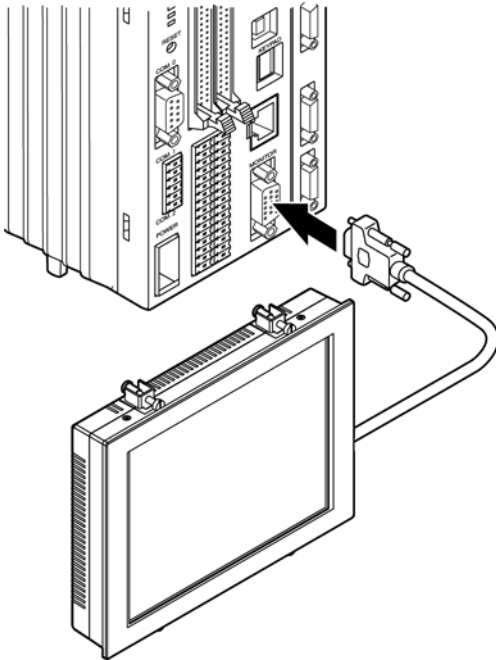
1. Connect the camera(s)

The camera cable has a direction. Make sure to plug the side of the cable with the product number label into the camera, and the connector with the ferrite into the Imagechecker.



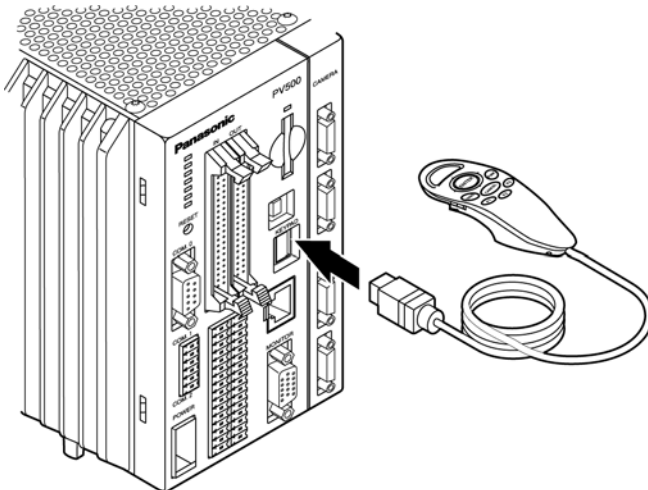
2. Connect the monitor

Plug the monitor cable into the connector labeled "MONITOR" on the Imagechecker.



3. Connect the keypad

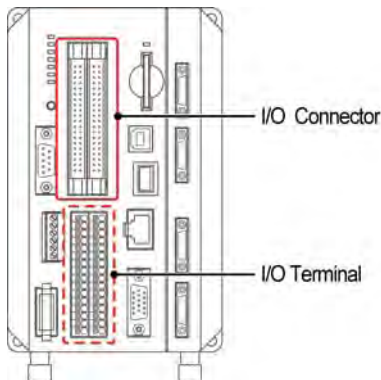
Plug the keypad cable into the connector labeled "Keypad" on the Imagechecker.



2.5 Input and Output Terminals

The Imagechecker is equipped with two parallel interfaces:

- I/O connector (MIL connector type) with 32 input pins, 32 output pins
- I/O terminal block with 14 input pins, 15 output pins



Danger of damage to the Imagechecker!
 Some signals are available both via the I/O connector and the I/O block terminal. Make sure to connect only **ONE** type of parallel interface. Connecting both types may damage the Imagechecker.

2.5.1 Inputs of the I/O Connector and the I/O Terminal Block

The table below gives an overview of the commands which external devices can send via the inputs and which pins are used. Entries printed in bold perform user-defined functions and are shared by both interfaces. Please refer to the notes for details.

Command	Input at I/O connector	Input at I/O terminal block
Execute inspection	STA0-3	STA0
Execute reinspection	ASN0-5	ASN0-2
Execute type switch	TYPE+IN0-7	TYPE+IN0-7
Re-register template	RENT+IN0-15	ASN0-2+IN0-7
Switch layout	DISP+IN0-4	DISP+IN0-4
Switch mode between Run/Stop	R/S	ASN0-2
Reset statistics data	ASN0-5	ASN0-2
Reset error signal	ASN0-5	ASN0-2
Save all types in the main memory (backup)	ASN0-5 IN0-6	ASN0-5 IN0-6
Save all types on the SD memory card (backup)	ASN0-5 IN0-6	ASN0-5 IN0-6
Read all types from the main memory (restore)	ASN0-5 IN0-6	ASN0-5 IN0-6

Command	Input at I/O connector	Input at I/O terminal block
Command of reading all types (restore) from a SD memory card	ASN0-5 IN0-6	ASN0-5 IN0-6
Save images of the image memory in a SD memory card	ASN0-5	ASN0-2
Delete the image memory of PV	ASN0-5	ASN0-2
Print screen	ASN0-5	ASN0-2
Save the latest inspection image (where)	ASN0-5	ASN0-2
Stop inspection/process	ASN0-5	ASN0-2



◆ NOTE

- For the I/O connector, you can assign up to 6 different functions to the inputs ASN0 to ASN5 (option "Parallel I/O" in the "Input/Output" submenu in the ENVIRONMENT menu).
- For the I/O terminal block, you can assign up to 3 different functions to the inputs ASN0 to ASN2 (option "Parallel I/O" in the "Input/Output" submenu in the ENVIRONMENT menu).
- When you want to output more than 7 judgement results and/or numerical calculation results, use the I/O connector because this kind of data output requires the strobe signal and there is no Strobe signal on the I/O terminal block.

2.5.2 Outputs of the I/O Connector and the I/O Terminal Block

The table below lists the data that can be output by the Imagechecker during inspection. The total judgement will always be output without condition. For all other data, the user can select whether to output the data or not.

Type of data	Output at I/O connector	Output at I/O terminal block
Total judgement	RSLT	RSLT
Scan count	OUT0-15	OUT0-7
Judgements (JDC formulas)	OUT0-15	OUT0-7
Numerical calculation results	OUT0-15	OUT0-7



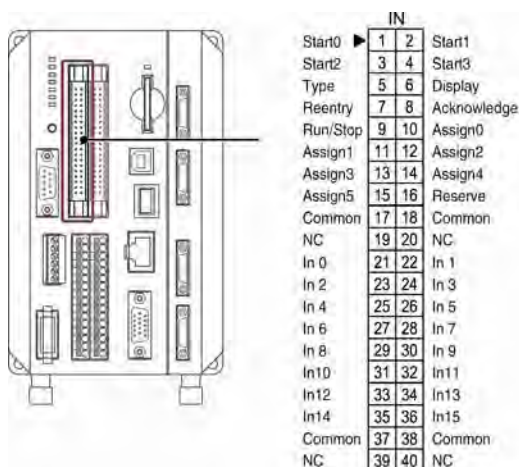
◆ NOTE

All output settings are made in the ENVIRONMENT menu in the submenu "Input/Output", option "Parallel I/O Output" (see page 402).

2.5.3 Pin Assignment of the I/O Connector

When you want to output more than 7 judgement results and/or numerical calculation results, use the I/O connector because this kind of data output requires the Strobe signal and there is no strobe signal on the I/O terminal block.

2.5.3.1 Inputs



Inputs of the I/O connector

Signals printed in bold are shared by both the I/O connector and the I/O terminal block.

No.	Signal	Content
1	Start 0	Image capture with camera 0
3	Start 2	Image capture with camera 2
5	Type	Type switch
7	Reentry	Re-register the template
9	Run/Stop	Switch between modes Run/Stop
11	Assign 1	Function assignment 0-5 (select from 14 functions)
13	Assign 3	
15	Assign 5	
17	Common	
19	NC	Not connected
21	In 0	Input data 0-15
23	In 2	
25	In 4	
27	In 6	

No.	Signal	Content
2	Start 1	Image capture with camera 1
4	Start 3	Image capture with camera 3
6	Display	Layout switch
8	Acknowledge	Data reception completion signal at handshake
10	Assign 0	Function assignment 0-5 (select from 14 functions)
12	Assign 2	
14	Assign 4	
16	Reserved	Spare (unavailable)
18	Common	Common for input
20	NC	Not connected
22	In 1	Input data 0-15
24	In 3	
26	In 5	
28	In 7	

No.	Signal	Content
29	In 8	
31	In 10	
33	In 12	
35	In 14	
37	Common	Common for input
39	NC	Not connected

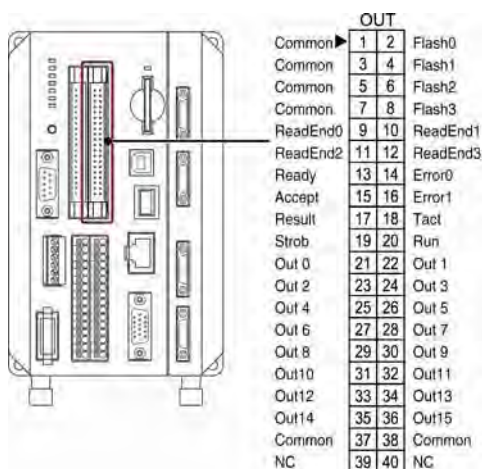
No.	Signal	Content
30	In 9	
32	In 11	
34	In 13	
36	In 15	
38	Common	Common for input
40	NC	Not connected



◆ NOTE

The four **Common** signal pins 17, 18, 37, 38 are common for all input signals of the I/O connector.

2.5.3.2 Outputs



Outputs of the I/O connector

No.	Signal	
1	Common	Flash 0 designated common
3	Common	Flash 1 designated common
5	Common	Flash 2 designated common
7	Common	Flash 3 designated common
9	Read end 0	Image capture with camera 0 complete
11	Read end 2	Image capture with camera 2 complete

No.	Signal	
2	Flash 0	Flash signal for Camera 0
4	Flash 1	Flash signal for Camera 1
6	Flash 2	Flash signal for Camera 2
8	Flash 3	Flash signal for Camera 3
10	Read end 1	Image capture with camera 1 complete
12	Read end 3	Image capture with camera 3 complete

No.	Signal	
13	Ready	Ready signal
15	Accept	Indicates that the next command signal input will be accepted: <ul style="list-style-type: none"> Type Display Reentry (see notes) Assign (see notes)
17	Result	Total judgement
19	Strobe	Data output complete
21	Out 0	Output data 0-15
23	Out 2	
25	Out 4	
27	Out 6	
29	Out 8	
31	Out 10	
33	Out 12	
35	Out 14	
37	Common	Common for output
39	NC	Not connected

No.	Signal	
14	Error 0	Error signal 0
16	Error 1	Error signal 1
18	Tact	Inspection data read timing
20	Run	Running status (On when running)
22	Out 1	Output data 0-15
24	Out 3	
26	Out 5	
28	Out 7	
30	Out 9	
32	Out 11	
34	Out 13	
36	Out 15	
38	Common	Common for output
40	NC	Not connected

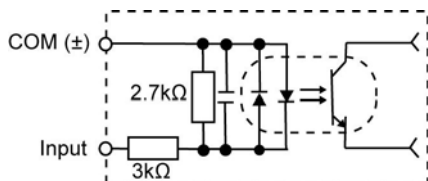


◆ NOTE

- The Reentry signal will not be accepted when the Read End signal is OFF.
- The Assign signal stops inspection and processing, unless another function has been assigned (ENVIRONMENT menu, submenu "Input/Output, option "Parallel I/O).
- The Common signal pins 37, 38 are pin No. 9 to 36.
- When you are using the Flash signals 0-3, connect them with the respective designated common pins No. 1, 3, 5, 7.

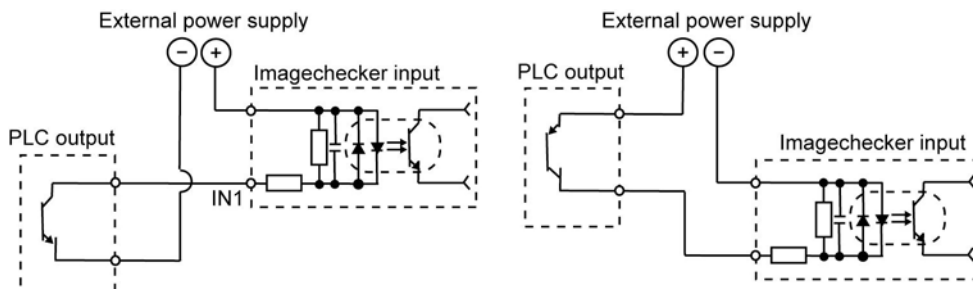
2.5.3.3 Input Circuit

The input circuit works with a rated operating voltage of 24V DC. The operating voltage range is 21.6 to 26.4V DC.



Input circuit

This is how you connect the Imagechecker with a PLC.



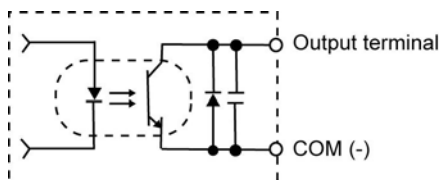
Connection example with a PLC

2.5.3.4 Output Circuit

There are two output types available, NPN and PhotoMOS.

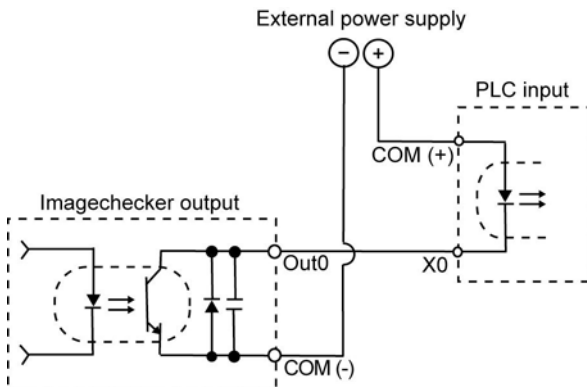
NPN output

The NPN output circuit works with a rated operating voltage of 5V to 24V.



NPN output circuit.

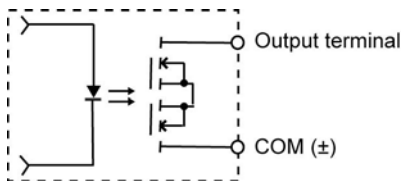
This is how you connect the Imagechecker with a PLC.



Connection example of NPN output with a PLC

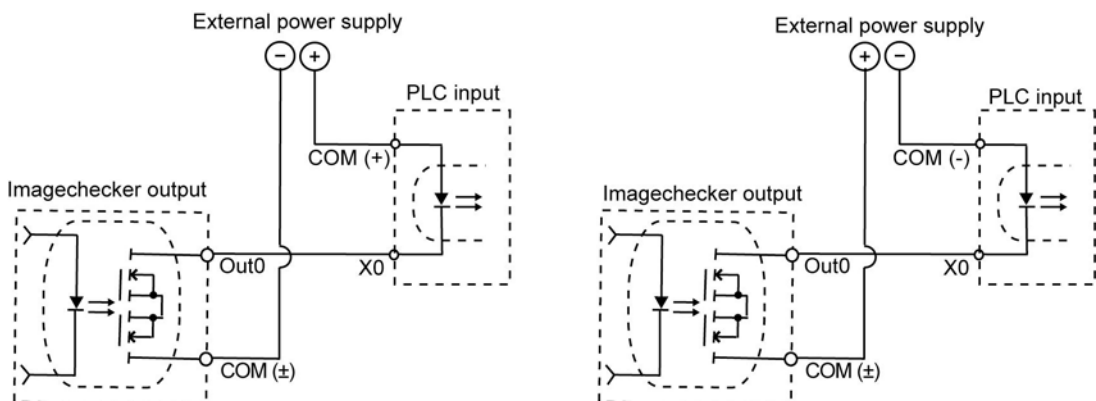
PhotoMOS output

The PhotoMOS output circuit works with a rated operating voltage of 5V to 24V.



Danger of damage to the controller!
Do not apply more than the maximum current load of 24mA to an output.

This is how you connect the Imagechecker with a PLC.



Connection example of PhotoMOS outputs with a PLC

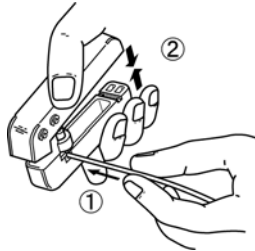
2.5.3.5 Attaching Wiring to the I/O Connector

To wire the I/O connector, please proceed as follows:



◆ Procedure

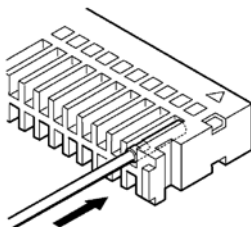
1. Bend the contact from the carrier
2. Set the contact in the pressure welding tool



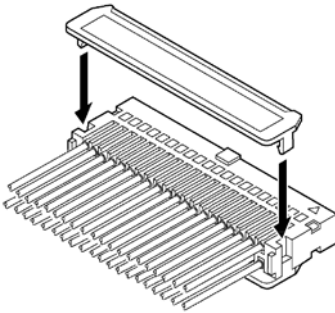
3. Insert the wire without removing its insulation until it stops, and lightly grip the tool

The wire is welded.

4. Insert the welded wire into the housing

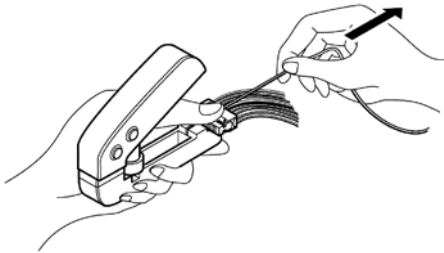


5. Attach the cover



◆ NOTE

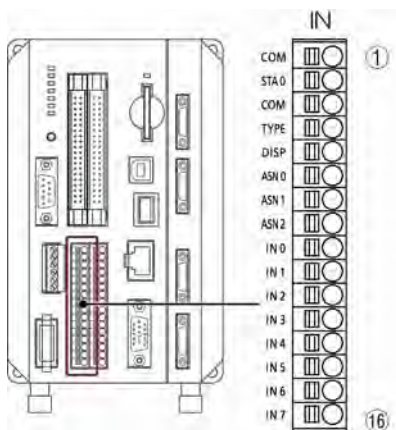
You can rewire the I/O connector by pulling out the contacts with the special tool.



2.5.4 Pin Assignment of the I/O Terminal Block

All input signals are also available via the I/O connector.

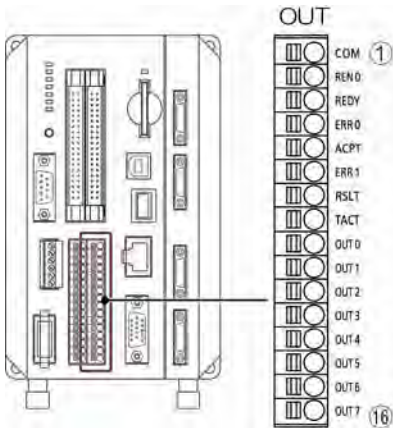
2.5.4.1 Inputs



Inputs of the I/O terminal block

No.	Signal name on Imagechecker	Full name)	Description
1	COM	Common	Common for input
2	STA0	Start 0	Image capture with Camera 0. Use Start 0 as the common trigger when you want to start capturing images with all connected cameras simultaneously (option "Camera Trigger" is set to "Common" in the TYPE menu, submenu "Type Setting"; option "Camera").
3	COM	Common	Common for input
4	TYPE	Type	Use this signal to switch types with a signal from the external device. Input the type number you want to switch to at IN0 to IN7 and turn on the TYPE signal to execute the type switch.
5	DISP	Display	Use this signal to switch layouts with a signal from the external device. Input the layout number you want to switch to at IN0 to IN4 and turn on the DISP signal to execute the layout switch
6	ASN0	Assign 0	Function assignment 0-2 (select from 14 functions)
7	ASN1	Assign 1	
8	ASN2	Assign 2	
9	IN0	Input 0	Input data 0-7
10	IN1	Input 1	
11	IN2	Input 2	
12	IN3	Input 3	
13	IN4	Input 4	
14	IN5	Input 5	
15	IN6	Input 6	
16	IN7	Input 7	

2.5.4.2 Outputs



Outputs of the I/O terminal block

No.	Signal (name on Imagechecker)	Description
1	Common (COM)	Common for output
2	Read end 0 (REN0)	Image capture with Camera 0 complete
3	Ready0 (REDY)	Ready completion signal
4	Error 0 (ERR0)	Error signal 0
5	Accept (ACPT)	Indicates that the next command signal input will be accepted: <ul style="list-style-type: none"> Type Display Reentry Assign Run/Stop
6	Error 1 (ERR1)	Error signal 1
7	Result (RSLT)	Total Judgement
8	TACT	Reading timing of inspection data
9	OUT0	Output data 0-7
10	OUT1	
11	OUT2	
12	OUT3	
13	OUT4	
14	OUT5	
15	OUT6	
16	OUT7	

The I/O terminal block plugs into the Imagechecker, and the terminals are fastened by tightening the screws. Use the fittings and cable listed in the table below.



◆ **NOTE**

Attach wires and attach or remove the terminal block only when the power is OFF.

Article	Manufacturer	Description
Terminal input block	Phoenix Contact	Model number FMC1.5/16-ST-3.5
Wire specification		AWG #24 to 16, 0.2 to 1.5mm ²

2.5.4.3 Wiring Method

To wire the terminal blocks proceed as follows.

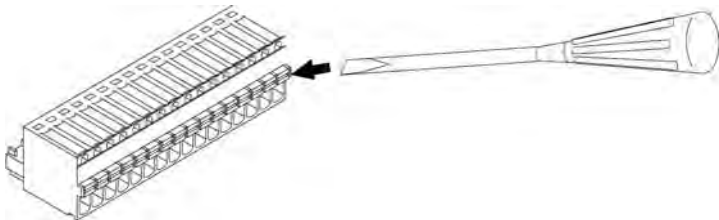


◆ **Procedure**

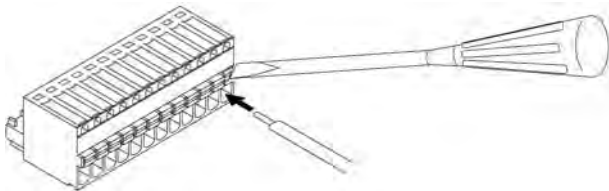
1. Remove the wire shield

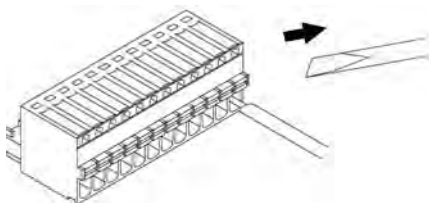
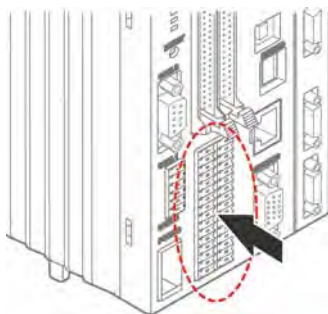


2. Push the orange part into the socket with a slotted screwdriver



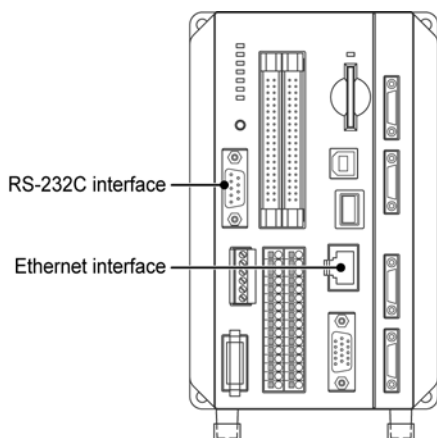
3. Insert the lead wire all the way into the round hole while pressing the orange part down with the screwdriver



4. Release the screw driver**5. When all wires are connected, attach the I/O terminal block to the Imagechecker**

2.6 The COM.0 Port and the Ethernet Port

The COM.0 port serves as the RS232C interface to communicate with an peripheral device. The Ethernet port is used for communication with a PC.



2.6.1 The COM.0 Port

There are 2 communication protocols for communication via the COM.0 port:

- General Output (**see page 404**)
- PLC Communication (**see page 405**)

Select the protocol best suited for your purposes in **ENVIRONMENT** → **Input/Output** → **General Output**.

2.6.1.1 Specifications of the Communication via COM.0

Make the settings for communication via the COM.0 port in **ENVIRONMENT** → **Input/Output** → **Serial**.

Item		Specification
Connector		9-pin Sub-D
Communication method		Full duplex
Synchronization method		A
Communication speed (baud rate)		1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 bit/second (default: 9600)
Transmission code		ASCII
Transmission format	Bit length	7 bit, 8 bit (default: 8 bit)
	Stop bit	1 bit, 2 bit (default: 1 bit)
	Parity	None, odd, even (default: odd)
	Flow control	None or software (default: none)
	Delimiter	CR (Carriage Return)



◆ NOTE

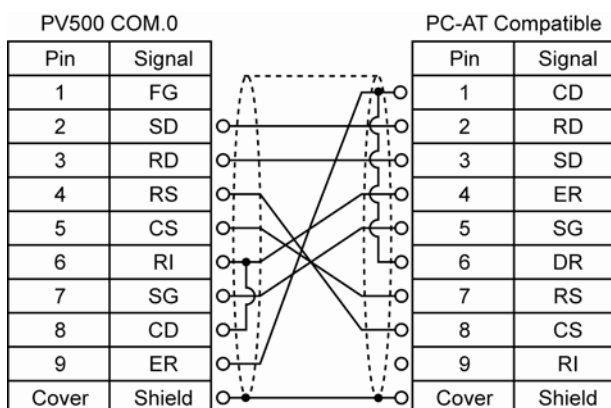
When you use a FP2 or FP2SH from Matsushita Electric Works, Ltd., set a baud rate of 57600 bit/s or lower.

2.6.1.2 Pin Assignment of the 9-Pin Sub-D Connector

A 9-pin Sub-D connector is used as the COM port on the Imagechecker.

Sub-D connector	Pin No.	Signal
	1	FG
	2	SD
	3	RD
	4	RS
	5	CS
	6	RI
	7	SG
	8	CD
	9	ER

2.6.1.3 Connection with an IBM PC-AT Compatible



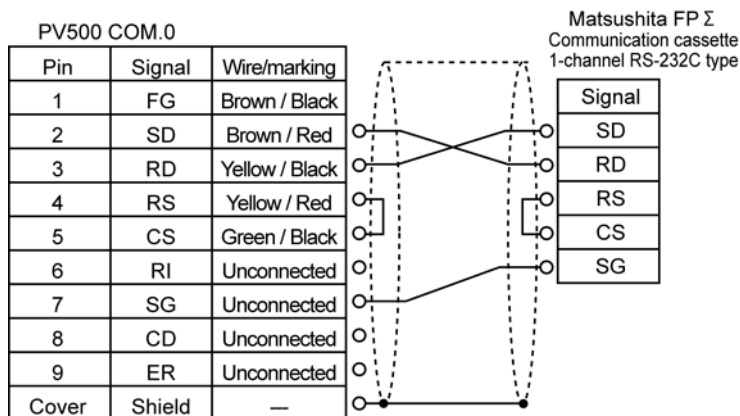
Please use the 9-pin RS232C cable provided (order number AFB85853). You do not need to prepare anything.

2.6.1.4 Connection with a PLC

Please make the connection using the RS232C cable (order number AIP81842) according to the following wiring example.



Cable AIP81842 with 9-pin Sub-D connector and discrete wires



Wiring example with a FPΣ

2.6.2 The Ethernet Port

Use the Ethernet port for the following operations:

- To connect to Image Receiver in order to back up or restore settings or image data to/from the Imagechecker.
- To output inspection results.

2.6.2.1 Specifications of the Communication via Ethernet

Make the settings for communication via the COM.0 port in **ENVIRONMENT** → **Input/Output** → **General Output/Image Output**.

Item	Specification
Connector	RJ-45
Media	10-BASE-T / 100BASE-TX / 1000BASE-T (see note)
Protocol	TCP/IP
Port numbers	<ul style="list-style-type: none"> • General output: 8601 • Image output: 8602 • Sending/receiving commands: 8604



◆ NOTE

Depending on the network adapter on 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, even network adapter that can use 1000BASE-T require a change to their settings. For details, please refer to the documentation included with the network adapter.

2.7 Electric Power Wiring

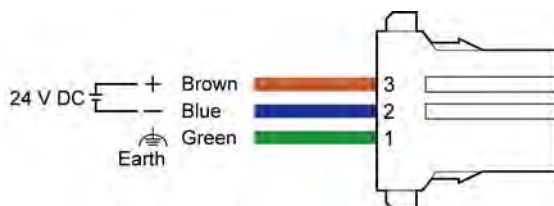
Use the power cable included with the Imagechecker to supply 24V DC.



◆ NOTE

- Do not supply power until every connection has completed.
- Use separate power supplies for the Imagechecker and peripheral devices.
- Switch the power ON and OFF at the primary side (230V AC). If you switch the power ON and OFF at the secondary side (24V DC), the fuses may blow.

The cable arrangement is as shown below. The wire size is AWG18.



To connect the power supply, please proceed as follows.



◆ Procedure

1. Connect the power supply with the power cable.

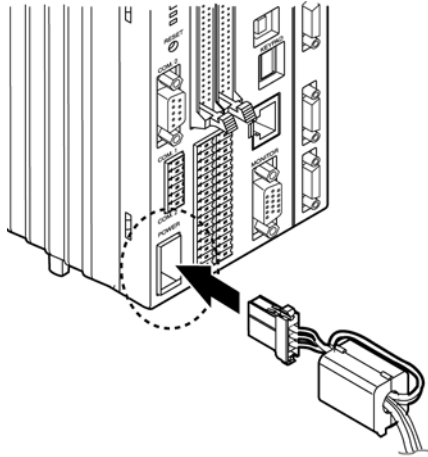
The power supply must have a built-in protection circuit and meet the following requirements:

Power voltage	24V DC +/- 10%
Current capacity	3.0A or more

2. Ground the Imagechecker

See the notes on grounding (see page 43).

3. Connect the power cable with the Imagechecker



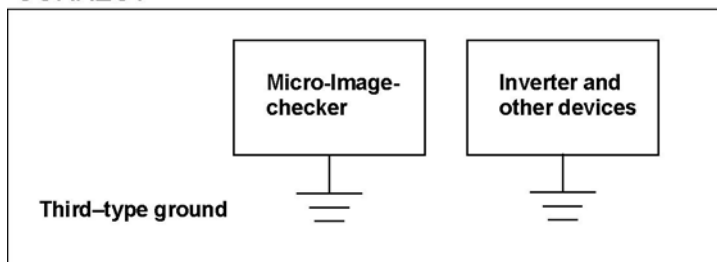
2.7.1 Notes on Grounding



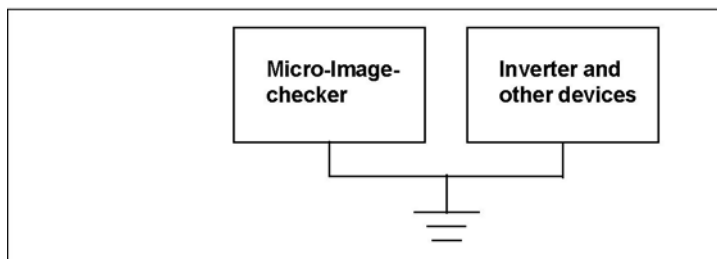
◆ NOTE

- Locate the ground as close as possible to the Imagechecker and minimize the length of the ground wire.
- Use a dedicated ground in order to avoid negative effects from ground wires shared with other devices.

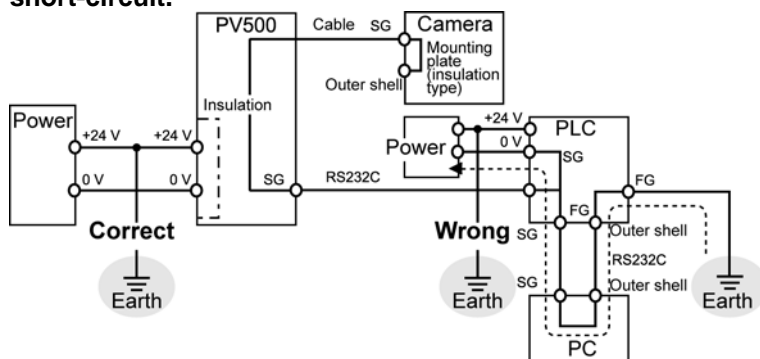
CORRECT



INCORRECT



- When connecting the Imagechecker with other devices such as a PLC, do not ground the positive terminal of the power supply of the other device. If the power supply circuit of the other device is not insulated, the connection between the outer shell of the PC and the 0V power supply may cause a short-circuit.



2.7.2 Starting the Imagechecker for the First Time

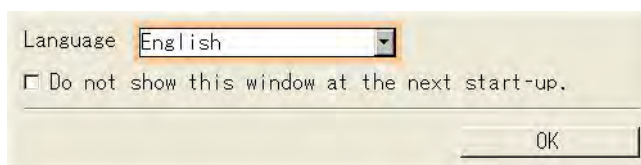
Before you start the Imagechecker for the first time, you need to connect the battery (see page 3). Then follow the procedure below to check everything is in working condition.



◆ Procedure

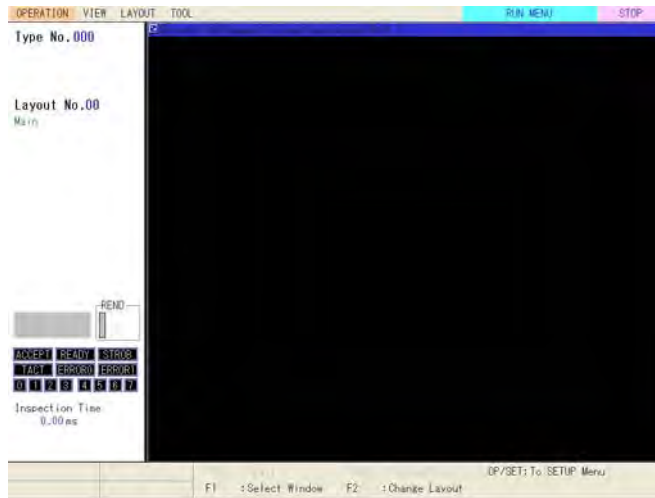
1. Switch the power supply on

The splash screen appears. You can use a different splash screen (see page 483), if desired. Next, the dialog box for selecting the menu language appears.



2. Select [OK] and press <ENTER> or press <ENTER> to select a different language

You can select a different menu language (see page 473) anytime by using the button "Language" in the "Configuration" settings in the **TOOL** menu. Next, the default operation window is displayed.



◆ NOTE

If the monitor displays nothing, check the following:

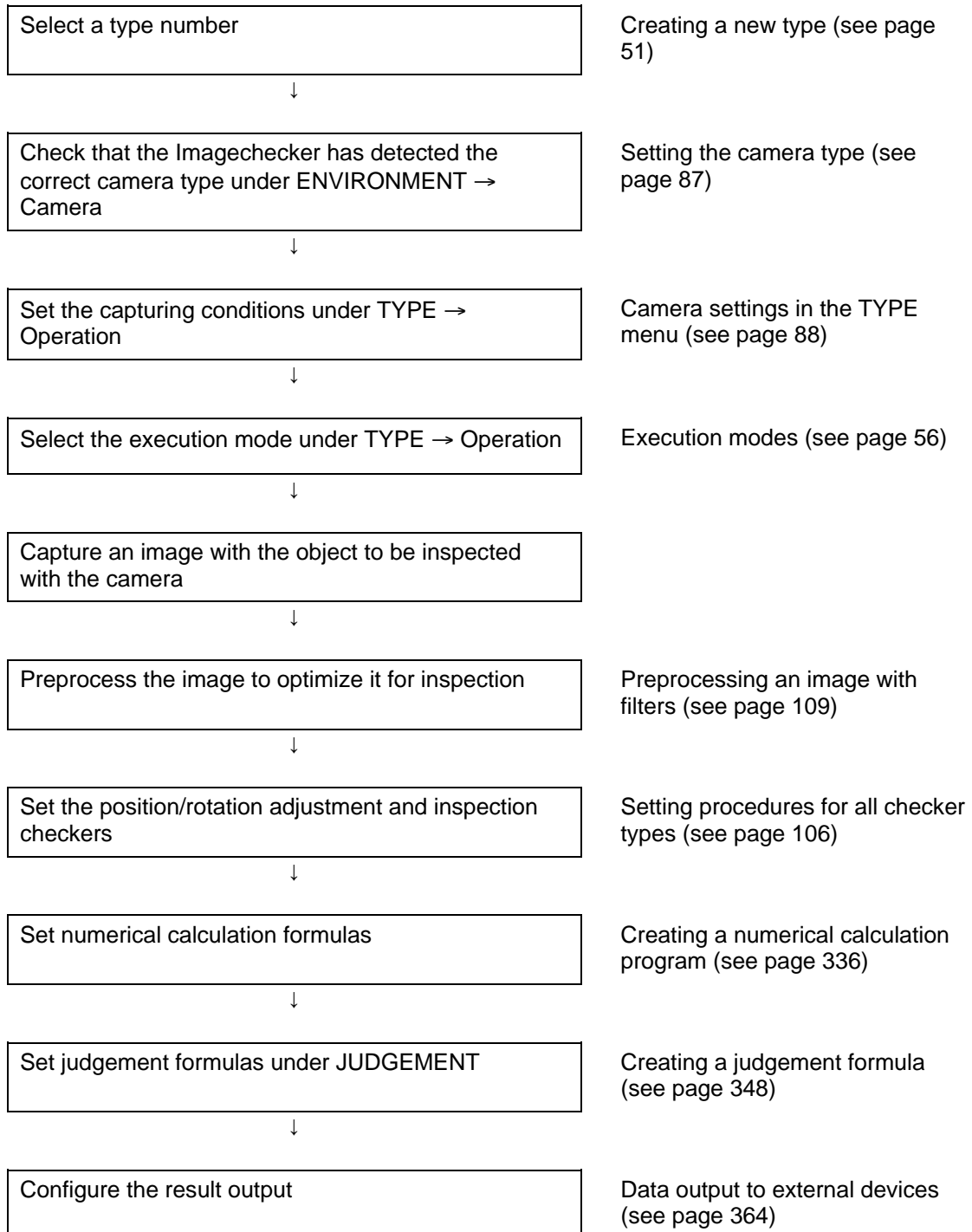
- Does the power supply work correctly?
- Is the power switch of the monitor ON?
- Is the monitor cable connected correctly?

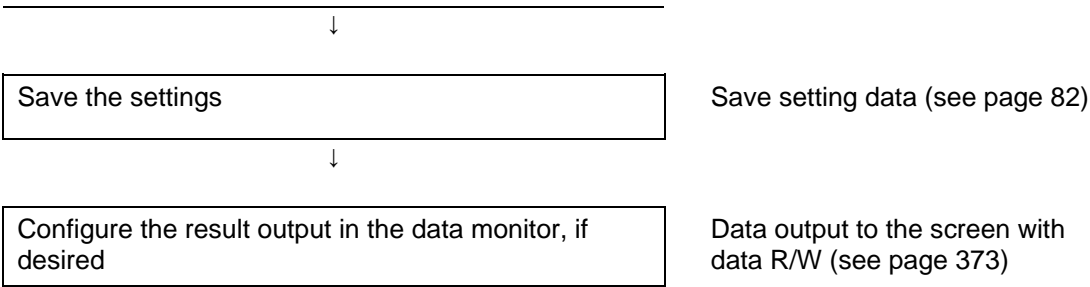
Chapter 3

Inspection Workflow and Types

3.1 Workflow for Setting up the Inspection

Use the workflow below for setting up the inspection in the SETUP menu.





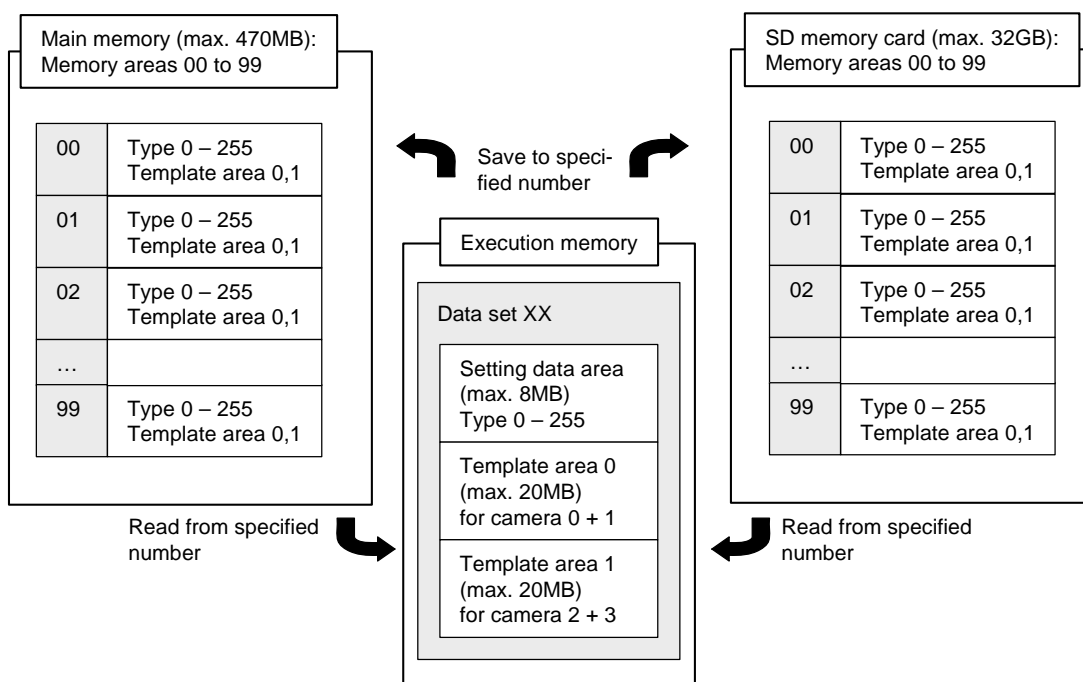
3.2 Working with Types

The Imagechecker administrates all information and settings in what is called a type. Types are sometimes also referred to as product type, because types differ according to the product inspected.

A type contains parameters for the checkers, which are for example detecting, measuring or counting objects. A type also contains camera and environment settings, for example to define the screen display, the save mode for images, the parameters for serial communication, etc. You can set up to 256 types with type number 0 to 255.

Internally, the Imagechecker works with two memories, the **main memory** and the **execution memory**. The Imagechecker saves the data in the main memory. Alternatively, you can also save type data on a SD memory card.

Every time you switch on the Imagechecker, the Imagechecker transfers the contents from one memory area from the main memory to the execution memory (see page 83) and loads a type (see page 54).



◆ NOTE

- For information on how to save / read the setting data (see page 82).
- The following functions can be executed via the keypad or by sending a command from an external device: Switching types, transferring data from the main to the execution memory, and saving data to the main memory or to a SD memory card.
- Type switching, data calling up to the execution memory, and data saving from the execution memory to the main memory or a SD memory card can

be executed by inputting I/O signal or sending a command from an external device.

- When the capacity of the memory area for setting data is exhausted, you cannot set any more types, even if you have not created the maximum number of types yet). You can check the remaining capacity by selecting TOOL → Information → Free Space for Setting Data (see page 470).

3.2.1 Creating a New Type

Please proceed as follows to create a new type on the Imagechecker.



◆ Procedure

1. In the **SETUP** menu, select **"TYPE"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.

2. Select **"Select Type"** and press **<ENTER>**

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ
Select Type	Type Setting	Marker Displ		
Current Type No.		000		
Type No. at Startup		Last Type No.		
Type Title		Feature Extract		

Type No.	Common Setting	Type Title
000	Yes	Feature Extract
001		
002		
003		

3. Use the keypad to position the cursor on a type number and press **<ENTER>**

If the "Type Title" field is empty, the type has not been set yet. Once you have made settings for a type, the text in the "Type Title" field reads "<Enter Title>". We recommend assigning a meaningful title to each type for easy identification. The entry in the column "Common Setting" refers to whether all types use the same camera settings (= common (see page 89)) or whether each type uses its own individual camera settings (**TYPE** → **Type Setting** → **Camera**).

3.2.2 Entering a Type Title with the Virtual Keyboard

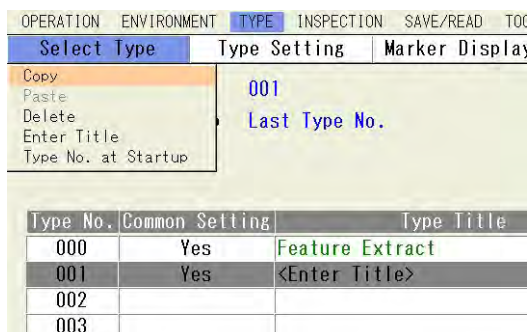
Please proceed as follows to assign a type title.



◆ Procedure

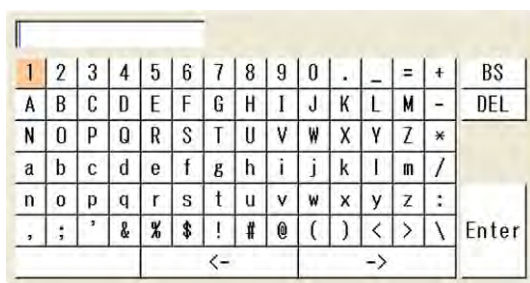
1. Press **<FUNC>** in the **"Select Type"** window

To access the "Select Type" window, use this procedure (see page 51). A pop-up menu appears in the top left corner.



2. Select "Enter Title" and press <ENTER>

The Imagechecker displays the virtual keyboard.



3. Select the first character of the type name and press <ENTER>

To select characters, move the cursor onto the desired character. To enter a space, select the blank key at the bottom left of the keyboard. To delete characters, select the right/left arrows and move the cursor onto the character to delete. Selecting "DEL" deletes the character, selecting "BS" (Backspace) deletes the character to the left of the selected character.

4. Enter the type name character by character

5. When the type name is complete, select "Enter" and press <ENTER>

3.2.3 Copying Types

Once you have set a type, you can copy all the settings to another type. Please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"TYPE"** from the menu bar and press <ENTER>
If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.
2. Select **"Select Type"** and press <ENTER>

The list of the types you have already created appears.

- 3. Use the keypad to position the cursor on a type you wish to copy
- 4. Press <FUNC>

The Imagechecker displays a pop-up window.



- 5. Press <ENTER> on "Copy"
Move the cursor to the type number you wish to copy the data to.
- 6. Press <FUNC>
- 7. Press <ENTER> on "Paste"
The copied type data is pasted. If you have entered a type name in the "Comment" column, the name is copied as well.

3.2.4 Deleting Types

You can delete one or more types individually or all types in one step. Choose the appropriate procedure.

3.2.4.1 Deleting One Type



◆ Procedure

- 1. In the SETUP menu, select "TYPE" from the menu bar and press <ENTER>
If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.
- 2. Select "Select Type" and press <ENTER>
The list of the types you have already created appears.
- 3. Select the type you wish to delete with the cursor
- 4. Press <FUNC>
The Imagechecker displays a pop-up window.

5. **Select "Delete" from the submenu and press <ENTER>**

A message asking for confirmation is displayed.

6. **Select "Yes" and press <ENTER>**

The selected type is deleted and its title will disappear from the list.

3.2.4.2 Deleting All Types



◆ Procedure

1. **In the SETUP menu, select "TYPE" from the menu bar and press <ENTER>**

If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

2. **Select "Initialize" from the submenu and press <ENTER>**

A message asking for confirmation is displayed.

3. **Select "Yes" and press <ENTER>**

All types are deleted.



◆ NOTE

Deleted types cannot be restored.

3.2.5 Setting the Type to Be Read at Startup

The startup type number can be set in two places.

- **ENVIRONMENT → System Settings → Startup Setting**, option "Select Type No." (see page 395)
- Pop-up menu in the TYPE menu

No matter where you make your setting, the other setting will be updated accordingly.

To set the type to be read in the TYPE menu, please proceed as follows:



◆ Procedure

1. **In the SETUP menu, select "TYPE" from the menu bar and press <ENTER>**

If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

2. **Select "Select Type" and press <ENTER>**

3. **Press <FUNC>**

The Imagechecker displays a pop-up window.

4. Select "Type No. at Startup" from the submenu and press <ENTER>

A setting window is displayed.

OPERATION

ENVIRONMENT

TYPE

INSPECTION

SAVE/READ

TOOL

Select Type

Type Setting

Marker Display

Data R/W

Current Type No.

001

No. 000

Type No. at Startup

000

act

Type Title

No. 001

Type No.

Common Setting

Type Title

000	Yes	Feature Extract
001	Yes	<Enter Title>
002		
003		
004	Yes	
005	Yes	
006	Yes	

Type No. at Startup

Selected Type No.

Select Type No.

0

- 5. Set "Type No. at Startup" to "Selected Type No."**

If this option is set to "Last Type No.", the option where you can select a type number is grayed out.

6. Set "Select Type No." to the type number you want to use at startup
7. Close the setting window with <CANCEL>

3.3 Checker Blocks and Execution Modes

The configuration of the Imagechecker allows you to divide the checkers by checker numbers into blocks. With the help of the blocks, you can execute just one checker, multiple checkers or all checkers. The block handling is determined by the execution mode.

3.3.1 Checkers Blocks

Internally, the Imagechecker divides checkers into blocks. Checkers are divided in units of 100 per block beginning from checker No. 0. The maximum block number is 10.

When you set the number of blocks to "2", for example, checker No. 0 to 99 are in block No. 0 and checker No. 100 to 199 are in block No.1 respectively. When you set the number of blocks to "2", you cannot set checkers beyond checker No. 199.

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



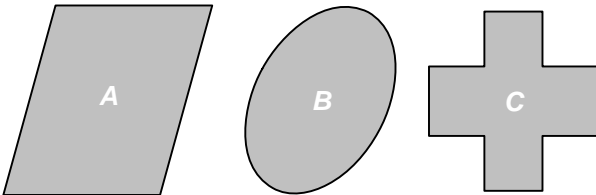
◆ NOTE

- If you set the number of blocks to "10", you can set checker numbers from 0 to 999. However, depending on the type of checkers you set and their memory requirements, you may not be able to use the full amount of blocks and checkers.
- When you use the execution mode "Execute all", all checkers are in one block, so you need not make any block settings.

3.3.2 Execution Modes

You can select from three execution modes to find the most suitable mode for your inspection situation:

Execution mode	Description and usage
Execute all (default) (see page 57)	<ul style="list-style-type: none"> • Executes all checkers, numerical calculations and judgements in one type. • When you only have to set up one type. • When you have enough time to switch types • When you need to execute many checkers on many parts at the same time within the same image • When you need to perform complicated calculations with many checkers, numerical calculation and judgement formulas

Execution mode	Description and usage																				
Automatic switch (see page 57)	<p>The checkers are divided in blocks. The first block is executed and the execution result determines which block will be executed next or whether the inspection is complete.</p> <ul style="list-style-type: none">• When you need to identify an object before you can inspect it.• When you need to execute different checkers and formulas depending on the type and the status of the detected object <p>Example:</p> <div></div>																				
User-defined (see page 58)	<p>The checkers are divided in blocks. To determine which block should be executed, you need to send a signal from an external device.</p> <ul style="list-style-type: none">• When you only need a few checkers per type, but you would need to set more than 256 types.• When there is not enough time for type switching, <p>Example:</p> <div><div><p>Define to execute</p><table><tr><td>Condition 0</td><td>Condition 5</td></tr><tr><td>Condition 1</td><td>Condition 6</td></tr><tr><td>Condition 2</td><td>Condition 7</td></tr><tr><td>Condition 3</td><td>Condition 8</td></tr><tr><td>Condition 4</td><td>Condition 9</td></tr></table></div><div><table><tr><td>Condition 0</td><td>Condition 5</td></tr><tr><td>Condition 1</td><td>Condition 6</td></tr><tr><td>Condition 2</td><td>Condition 7</td></tr><tr><td>Condition 3</td><td>Condition 8</td></tr><tr><td>Condition 4</td><td>Condition 9</td></tr></table><p>Define to execute</p></div></div>	Condition 0	Condition 5	Condition 1	Condition 6	Condition 2	Condition 7	Condition 3	Condition 8	Condition 4	Condition 9	Condition 0	Condition 5	Condition 1	Condition 6	Condition 2	Condition 7	Condition 3	Condition 8	Condition 4	Condition 9
Condition 0	Condition 5																				
Condition 1	Condition 6																				
Condition 2	Condition 7																				
Condition 3	Condition 8																				
Condition 4	Condition 9																				
Condition 0	Condition 5																				
Condition 1	Condition 6																				
Condition 2	Condition 7																				
Condition 3	Condition 8																				
Condition 4	Condition 9																				

3.3.2.1 Execute All Mode

This mode is active by default. In "Execute All" mode, all set checkers are executed.

3.3.2.2 Automatic Switch Mode

In automatic switch mode, multiple blocks are executed in sequential order depending on the execution result of the first block, block No. 0. The result of block 0 determines which block to execute next or whether to end the inspection, see the example (see page 59). The execution conditions are set in the Judgement setting window (see page 344).

3.3.2.3 User-Defined Mode

In this mode, inspections are executed by block. When you send the start signal from an external device (parallel interface, serial command, or Ethernet command), you need to specify which block should be executed. Only the checkers, the numerical calculations and the judgement belonging to the specified block will be executed and output.

Checker block No.	Command for the parallel interface STA0 - 3 +			
	IN0	IN1	IN2	IN3
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON

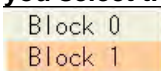


◆ NOTE

- For the serial commands to execute checker blocks refer to how to start an inspection (see page 433).
- When you are using the execution mode "User-Defined", you cannot set an individual trigger per camera.
- The executed block No. is displayed above the total judgement field of the status display area.

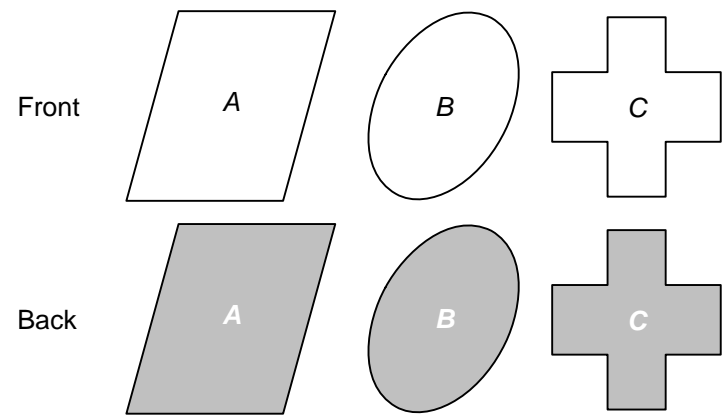


- When you start the inspection with the keypad, a window appears where you select the block number you wish to execute.

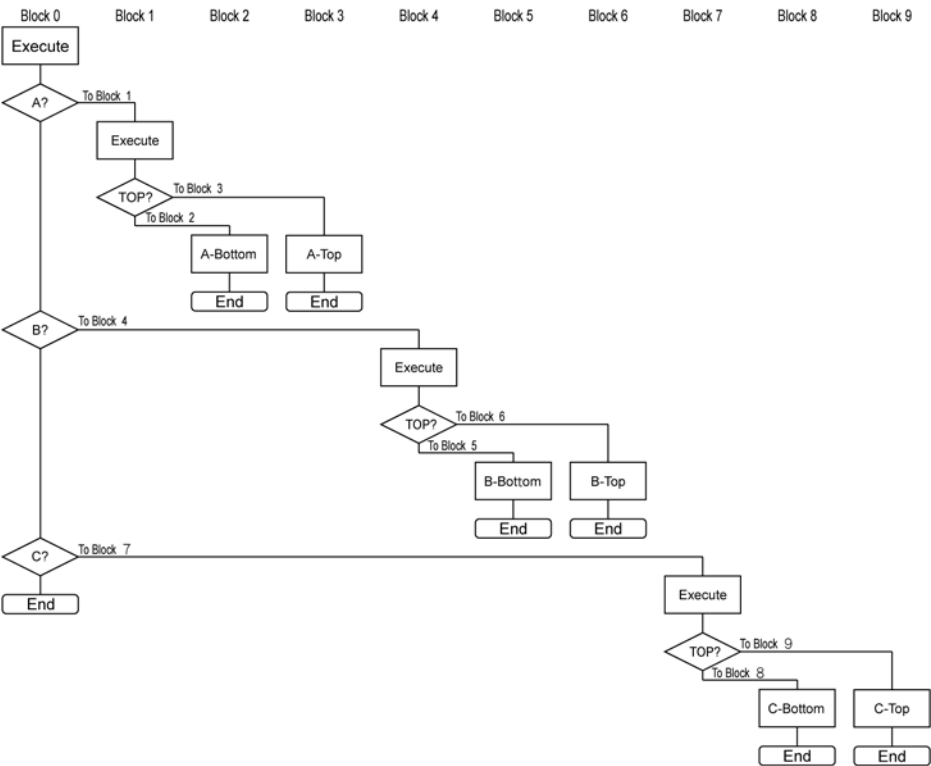


3.3.3 Setting Example for Execution Mode and Checker Blocks

There are three different kinds of objects to inspect. All objects have a different front and back. During inspection, the Imagechecker identifies the object type and whether the front or back is visible and executes the appropriate checker block.



The flow diagram below illustrates how the inspection is carried out in automatic switch mode.



Setting the Execution Mode and Number of Blocks

To set the execution mode and checker blocks, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"TYPE"** from the menu bar and press **<ENTER>**
If the RUN menu is active, press **<OPE/SET>** to activate the SETUP menu.
2. Select **"Type Setting"** from the submenu bar and press **<ENTER>**
3. Select **"Execution Condition"** and press **<ENTER>**
A setting window appears.
4. Set **"Execution Mode"** to **"Automatic Switch"** and press **<ENTER>**
5. Set **"Number of Blocks"** to **10** and press **<ENTER>**



The next step is to set up the branch conditions for each checker block so that the three different kinds of objects can be differentiated and inspected.

Setting the Branch Conditions for Each Checker Block

To set the branch conditions for each checker block, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the RUN menu is active, press **<OPE/SET>** to activate the SETUP menu.
2. Select **"Judgement"** from the submenu bar and press **<ENTER>**

3. Select [Setting] next to "Branch Condition" and press <ENTER>

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETUP	MENU	STOP
Checker	Slice Level	Preprocess	Num. Calcu.	Judgement				

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		
JDC007	Unset		

Condition Set

Set Branch Condition Set

	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

A setting window appears. By default, configuration starts with the first block, block 0. 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, block 0 is used to determine the kind of object to be inspected.

4. Select "Branch 0" and press <ENTER>

5. Select the condition and press <ENTER>

Select whether to use the result of a external output register (JDC) or an internal register (JRC) as the branch condition (see page 348).

6. Select the checker number and press <ENTER>

7. Select the judgement result and press <ENTER>

8. Select the block which should be executed when the condition is true

In the example, three branch conditions are set to distinguish between the three kinds of objects that need to be checked. The destination blocks are then set up with two branches to determine whether the front or the back of the object will be inspected.

OPERATE	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETUP
Slice Level	Preprocess	Num. Calcu.	Judgment	Checker		
Block No.	0					
	Condition	Checker No.	Judgment	Destination		
Branch 0	JDC	050	OK	Block1		
Branch 1	JDC	051	OK	Block4		
Branch 2	JDC	052	OK	Block7		
Branch 3	No					
Branch 4	No					
Branch 5	No					
Branch 6	No					
Branch 7	No					
Branch 8	No					
False				End		

9. Set branch conditions and destination blocks as required
10. When you have set all branch conditions and blocks, press <CANCEL> to close the setting window



◆ NOTE

The block number entered in the column "Destination" has to be higher than the block number you are setting (shown at the top left in "Block Nr."). For example, you cannot select block 0 as a destination for block 1. Alternatively, the destination has to be "End".

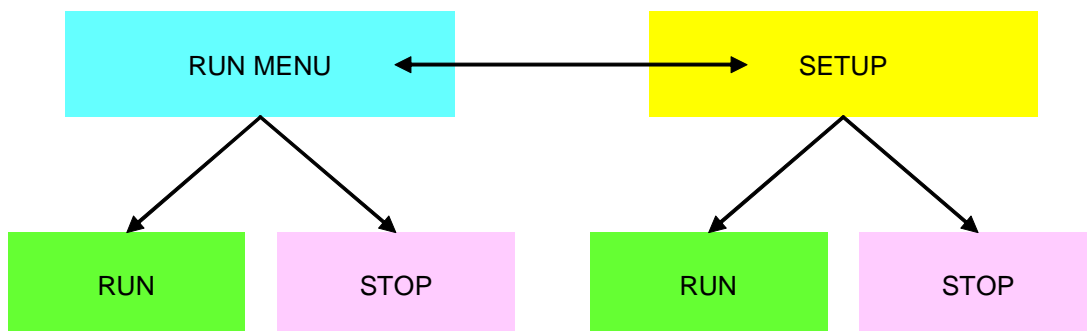
Chapter 4

Basic Operation

4.1 Modes, Menus and Types

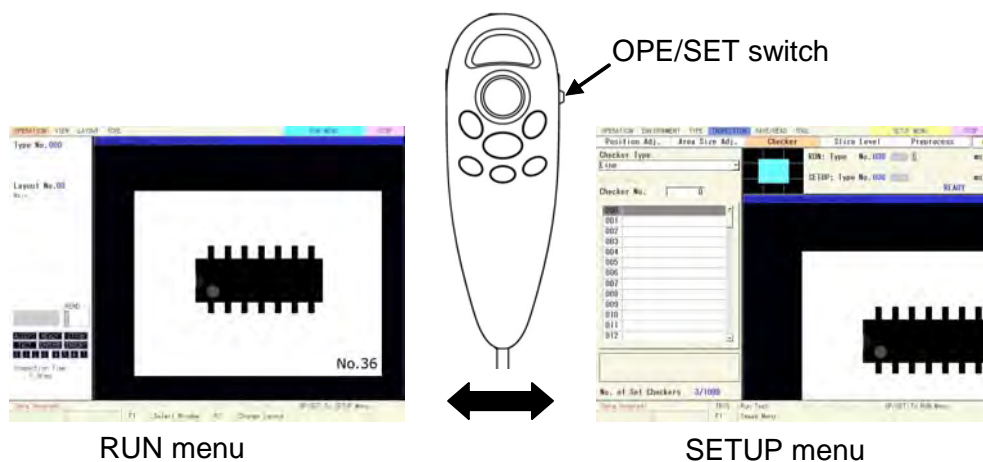
When you switch the Imagechecker on, the Imagechecker automatically starts the RUN menu. There are two menus available, RUN or SETUP. The run menu is colored in cyan, the setup menu in yellow. Both menus work with two modes, RUN and STOP. The RUN mode is indicated by a green color, the STOP mode by pink.

To switch from RUN MENU to SETUP, use the OPE/SET switch at the side of the keypad or the menu



Use SETUP to make the main configuration settings (environment, type, camera, etc.). In the RUN menu, you can make some limited settings (screen layout, window transparency). In both menus, the Imagechecker can either be in RUN mode (the Imagechecker executes the current type) or in STOP mode (the Imagechecker is paused).

To switch between the RUN and the SETUP menu and vice versa, use the OPE/SET switch on the keypad.

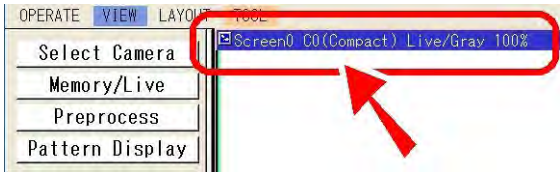


Switching menus with the special keypad switch



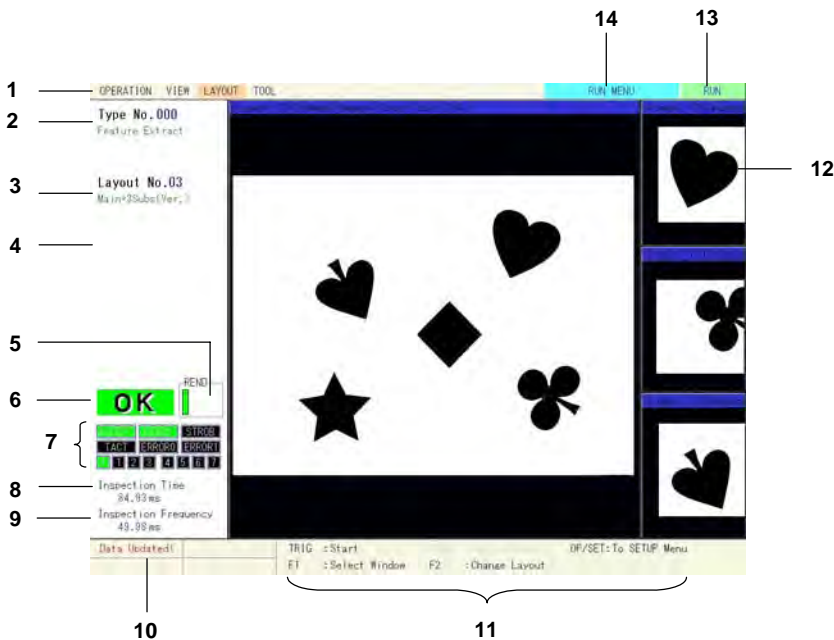
◆ NOTE

- When a password has been defined, you will be requested to enter it when you switch from RUN to SETUP menu (see page 69).
- The screen window displays the following information in the title bar: the screen number, camera number, camera type in brackets, image type and zoom factor.



4.1.1 The RUN Menu

The RUN menu offers four menu options.



1	Menu bar	Displays the currently available menu options.
2	Type information	Displays the currently selected type number and type title, if you have assigned one.
2	Layout information	Displays the currently selected layout number and layout title.
4	Information area	Displays error codes when an error has occurred.
5	Read End signal status	Displays the status of Read End (REND) signal: <ul style="list-style-type: none">• ON: Green• OFF: Black
6	Total judgement result	Displays the total judgement of the type if a JDC formula has been set up for total judgement (see page 353).

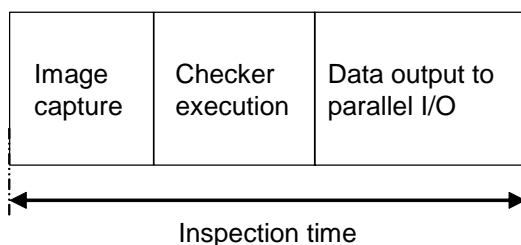
7	I/O terminal status	Displays the status of the outputs 0 - 7: • ON: Green • OFF: Black
8	Inspection time	Displays the inspection time in ms.
9	Inspection frequency	Only displayed when the option "Inspection Process" is set to "Parallel" (ENVIRONMENT → System Settings → Operation (see page 397)) Displays the time between the completion of the data output of the last inspection to the completion of the data output of the current inspection (see page 67).
10	Message area	Displays information, e.g. when settings have been changed or the battery power is low.
11	Key guide	Displays which key functions are currently available on the keypad.
12	Screen windows	In this area, the camera images are displayed.
13	Active mode	Displays the currently active mode: operating (RUN) or pausing (STOP).
14	Active menu	Shows which of the two menus is active, RUN or SETUP

4.1.1.1 Inspection Time

At the bottom left you always see the inspection time in ms.

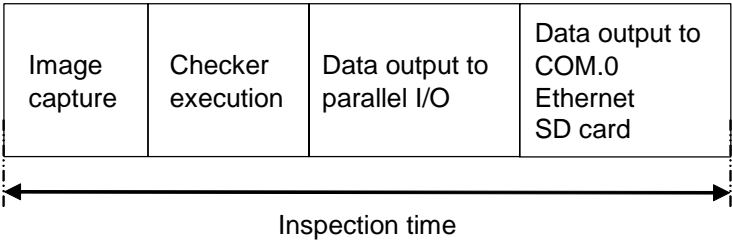


When "Inspection Process" = "Serial", the inspection time equals the Ready signal OFF time, which is the time from the start signal input to the end of I/O output.



Inspection time for parallel data output only

When you output data to COM.0, Ethernet or SD card or when you output images ("Image Output" = "Synchronous"), the inspection time is longer:



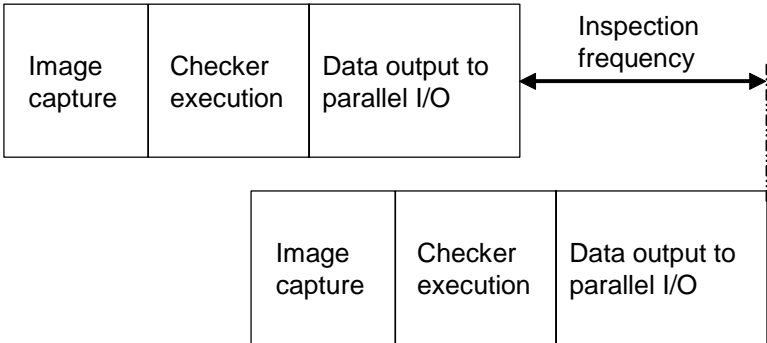
Inspection time for data output to multiple destinations

4.1.1.2 Inspection Frequency

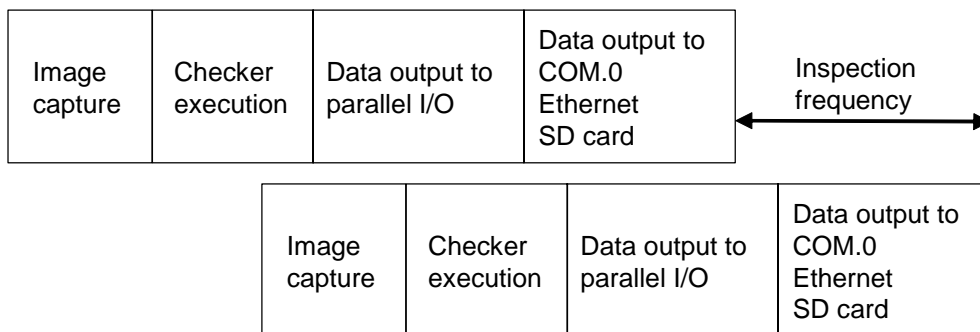
If you have set the option "Inspection Process" to "Parallel" (**ENVIRONMENT** → **System Settings** → **Operation**), the inspection frequency is displayed below the inspection time.



Inspection frequency is the time between the completion of the data output of the last inspection and the completion of the data output of the current inspection.



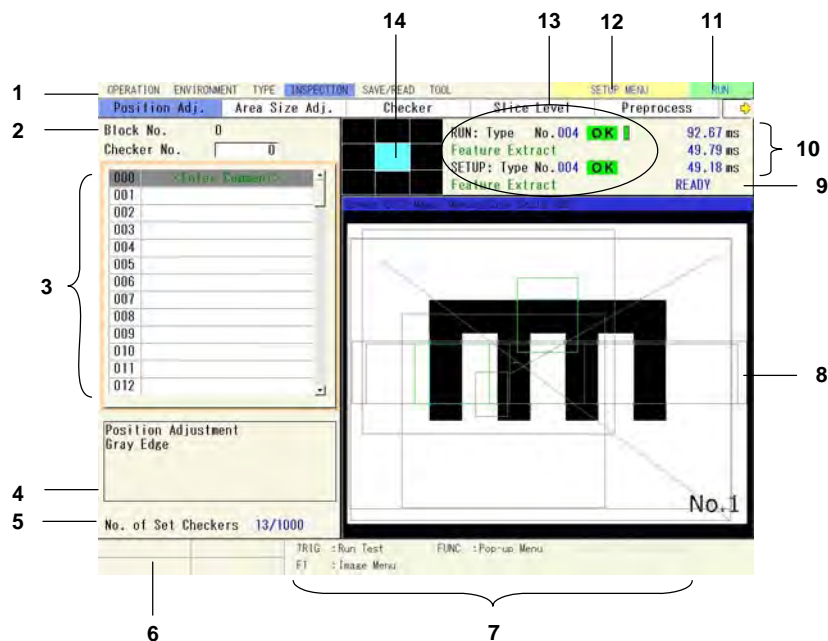
Inspection frequency for parallel data output only



Inspection frequency for data output to multiple destinations

4.1.2 The SETUP Menu

The SETUP menu offers six menu options.



1	Main menu and submenu bar	Displays the RUN or SETUP menu (the figure above shows the SETUP menu) and the submenus available in the main menu item selected above.
2	Checker and block information	Displays the currently active block and checker number (see page 56).
3	List of checkers	Displays all checkers that have been set. Green print = checker is OK, red print = checker is NG.
4	Checker information area	For position and area size adjustment checkers, this box displays the checker type, e.g. "Position Adjustment Gray Edge", and information when an error has occurred, e.g. "No target detect position".
5	Number of checkers	Displays the number of checkers you have set so far.
6	Message area	Displays information, e.g. when settings have been changed or the battery power is low.

7	Key guide	Displays which key functions are currently available on the keypad.
8	Screen windows	In this area, the camera image is displayed. Use the image menu (<F1>) to change to a different image (see page 76).
9	Status	Inspection status of the Imagechecker
10	Inspection time and frequency	<ul style="list-style-type: none"> Top line: inspection time of the type selected in the RUN menu (number and name displayed to the left) Middle line: inspection frequency of the type selected in the RUN menu (number and name displayed to the left). Only displayed when the option "Inspection Process" is set to "Parallel" (ENVIRONMENT → System Settings → Operation (see page 397)). Bottom line: inspection time of the type selected in the SETUP menu (number and name displayed to the left)
11	Active mode	Displays the currently active mode: operating (RUN) or pausing (STOP).
12	Active menu	Shows which of the two menus is active, RUN or SETUP
13	Information display area	<ul style="list-style-type: none"> Top line: Number of type that is currently running in the background, total judgement, the status of Read End (REND) signal. Type title (if assigned) in green print below. Bottom line left: Number of type that is currently being configured, total judgement. Type title (if assigned) in green print below.
14	Screen navigator	Displays the currently visible image range in cyan.

4.1.3 Protecting the SETUP Menu with a Password

It is possible to protect the parameter and environment settings against modifications so that they can only be changed with a password.



◆ NOTE

In order to use this function, you need to set a password in the Environment menu and activate the password request (###QVPassword (see page 413)).

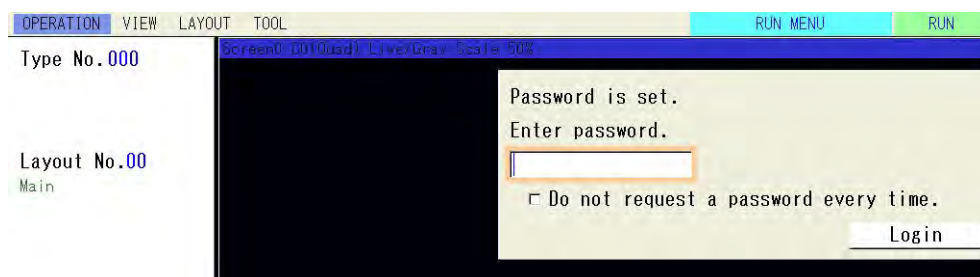
When the SETUP menu has been protected with a password, proceed as follows to switch from the RUN to the SETUP menu:



◆ Procedure

1. Move the OPE/SET switch

The Imagechecker displays a window with the request to enter the password.



2. Enter the password

Use the virtual keyboard displayed on the screen. If you do not want to enter a password again, activate the option "Do not request a password every time."

3. Select [Login]

4.2 RUN Menu Options

The RUN menu offers 4 menu options. Some of these menus are available also in the SETUP menu and will be explained in detail there.

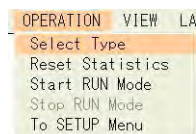
- Operation
- View
- Layout
- Tool

The following functions are available in the RUN menu:

Key	Function	Further information
Trig	Starts an inspection	
FUNC	Options for the display of data R/W sheets	Function key options for Data R/W sheets (see page 377)
OP/SET	Switches from RUN to SETUP menu and vice versa	Modes, menus and types (see page 64)
F1	Allows you to select a screen or data R/W sheet.	
F2	Allows you to change to another screen layout	LAYOUT menu (see page 72)

4.2.1 OPERATION Menu

The OPERATION menu allows you to switch from the RUN to the SETUP menu and back and to start/stop operation (run mode and stop mode).



◆ NOTE

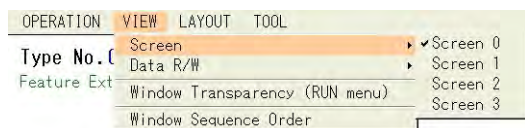
Whether the run mode is available in the SETUP mode depends on the setting of the option "Run Mode in SETUP Menu" (ENVIRONMENT → System Settings → Operation).

The following functions are available in the OPERATION menu:

Option	Description
Select Type	Displays the list of types. To switch to a different type, select it and press <ENTER>.
Reset Statistics	Resets all statistics values to 0.
Start RUN Mode	Starts the RUN mode.
Stop RUN Mode	Stops the RUN mode.
To SETUP Menu	Switches from the RUN to the SETUP menu.

4.2.2 VIEW Menu

The VIEW menu allows you select the items to be displayed on the screen and to set their transparency and order.



The following functions are available in the VIEW menu:

Option	Description
Screen	Shows which screens are visible at the moment. For every screen you can select via the image menu (see page 75) which camera image should be displayed.
Data R/W	Allows you to select which data R/W sheets to display.
Window Transparency (RUN Menu)	By default, windows like the data R/W sheet are displayed opaque, i.e. with 0% transparency. Choose a different value here if you find it difficult to see the camera image (see page 77, see page 72).
Window Sequence Order	Allows you to select which screen (camera image) should be in the foreground. The user-defined order can be saved as a layout in the LAYOUT menu (see page 72).




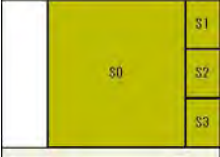
◆ NOTE

View settings will be reset to the default values when you use the command ENVIRONMENT → Initialize.

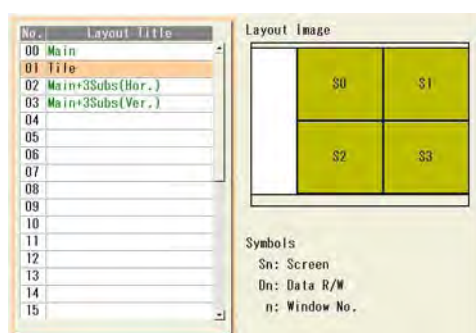
4.2.3 LAYOUT Menu

The LAYOUT menu allows you to switch to a different layout of the screens. There are 4 layouts available. A preview of the layout is shown on the right of the window.

Option	Description	Preview
Main	The currently selected camera image is displayed full screen. Press <F1> to open the image menu to switch to a different camera image (see page 75).	
Tile	Displays all four camera images starting from the top left.	

Option	Description	Preview
Main+3Subs(Hor.)	Displays the image of camera 0	
Main+3Subs(Ver.)		

When you use the command **LAYOUT** → **Layout**, the layout window is displayed.



The following functions are available in the layout window

Key	Option	Description
FUNC	Copy	Copies the currently selected layout
	Paste	Pastes the copied layout at the selected position
	Delete	Deletes the currently selected layout
	Enter Title	Assign a name to the currently selected layout
	Select Preset	Select one of the four predefined layouts
F1	Save Layout	Save the currently selected layout. This includes the information about window transparency and sequence order (see page 77, see page 72).
F2	Select Preset	Display the four predefined layouts in a pop-up window.
ENTER	Switch Layout	Switches to the currently selected layout and closes the layout window.



◆ NOTE

- **Layout settings will be reset to the default values when you use the command ENVIRONMENT → Initialize.**
- **When you start the Imagechecker, the layout to be used is the one set in ENVIRONMENT → System Settings → Startup Setting.**

4.2.4 TOOL Menu

The TOOL menu allows you to perform the following functions:

Option	Description
Eject SD Card	Allows you to remove the SD card safely from the Imagechecker.
Save Setting Data	Allows you to save the setting data. Note: This option is not available when you have protected the Imagechecker with a password and the option "Save Changes in RUN Menu" is set to "No" (ENVIRONMENT → Password (see page 413)).
Save Image Memory	Saves the images in the image memory to an SD card (you need to switch from RUN to STOP mode to use this function (see page 461)).
Clear Image Memory	Deletes all images from the image memory (see page 462).
Information	Provides information about the Imagechecker in a pop-up window (close by pressing <CANCEL>): <ul style="list-style-type: none">• Model• Version of the software• Free space for setting data• Free space for templates• Free storage space in the Imagechecker• Total capacity of the SD card• Free storage space on the SD card• Name of the Imagechecker

4.3 Image Menu

The image menu is accessible from the RUN and the SETUP menu by pressing <F1> on the keypad when "F1: Image Menu" is displayed in the key guide. Depending on whether you open the image menu when RUN or SETUP is active, you will have to select a screen number first before the menu appears.

The image menu differs slightly depending on whether RUN or SETUP is active (see tables).

4.3.1 RUN Menu

In the RUN menu, you need to select a screen number before the image menu is displayed.

Option name	Suboptions	Function
Select Camera	Camera No.0 to 3	Select the camera image (when more than one camera is connected to the Imagechecker). Note that in the RUN menu you first need to select a screen number (even if your layout (see page 72) only contains one screen)
Memory/Live	Memory/Live	Select whether to display a live or a memory image
	NG Image	Only available when you have selected "NG Image" under "Memory/Live". Select which NG image you want to display: <ul style="list-style-type: none"> • Latest: the last captured NG image • Previous: the NG image captured before the last NG image • Before the Previous: the second but last NG image
	Gray/Binary	Select the image type to display: <ul style="list-style-type: none"> • Gray-value image • Binary image binarized with slice level A - H (see page 117)
Preprocess	No, A - E	Select whether to preprocess the camera image or not (see page 112).
Pattern Display	Marker	Select whether or not to display markers.
	Calibration Scale	Select whether or not to display the calibration scale.
	Pattern Display	Select what to display on the screen: <ul style="list-style-type: none"> • All checkers and results • All checkers • NG checkers and results
Scroll	---	When a zoomed image is displayed, often only a part of the image is visible. To see other parts of the image, use the scroll function. With the <Shift> key, you can scroll faster. To stop scrolling, press <CANCEL>.
Magnification	Magnification	You can set a zoom factor of between 2% and 400% in steps of 1%. A zoom factor of 100% corresponds to the following image size depending on the camera: <ul style="list-style-type: none"> • Quad-speed / ultra Compact Camera: 640 x 480 pixels • 2 Mega camera: 1600 x 1200 pixels When you have set the zoom factor, press <CANCEL> to close the setting window.

Option name	Suboptions	Function
Full Screen	---	This function displays an image full screen regardless of the size of the screen window. As the size of the screen window can be changed, the aspect ratio of a window may be different from the aspect ratio of the image. In this case, the image will be displayed adjusted to the smaller side.
Move Window	---	Changes the position of the window.
Change Size	---	Changes the window size.
Optimize Size	---	The window size is adjusted so that it displays an image 100% for a quad-speed / ultra compact camera and 50% for 2 mega camera.
Close	---	Closes the image menu.

4.3.2 SETUP Menu

Option name	Suboptions	Function
Select Camera	Camera No.0 to 3	Select the camera image (when more than one camera is connected to the Imagechecker).
Memory/Live	Memory/Live	Select whether to display a live or a memory image
	Gray/Binary	Select the image type to display: <ul style="list-style-type: none"> • Gray-value image • Binary image binarized with slice level A - H (see page 117)
Preprocess	No, A - E	Select whether to preprocess the camera image or not (see page 112).
	Step 1 - 5	Select which step to carry out in the preprocessing (see page 112).
Pattern Display	Marker	Select whether or not to display the marker (see page 78).
	Calibration Scale	Select whether or not to display the calibration scale (see page 95).
	Pattern Display	Select the type of checker shape display: <ul style="list-style-type: none"> • All checkers and results: Displays checker shapes and inspection results in the shape of marks and lines. • All checkers: Displays checker shapes only. • NG checkers and results: Displays checker shapes and inspection results in the shape of marks and lines of NG checkers only.
Scroll	---	Allows you to scroll a zoomed image with the cursor lever.
Magnification	Magnification	You can set a zoom factor of between 2% and 400% in steps of 1%. A zoom factor of 100% corresponds to the following image size depending on the camera: <ul style="list-style-type: none"> • Quad-speed / ultra Compact Camera: 640 x 480 pixels • 2 Mega camera: 1600 x 1200 pixels
Full Screen	---	This function displays an image full screen regardless of the size of the screen window. The display shows 100% of the quad-speed / ultra-compact camera and 39% for the 2 Mega camera.
Save Image		You can save an image from the test image memory to the SD memory card (see page 441).
Read Image		You can read an image from the image memory, the test image memory, or the SD memory card (see page 463).

4.4 Window Transparency

The transparency of windows makes it easier to see all items when several windows are open. The transparency can be set separately for the RUN and the SETUP menu.

4.4.1 RUN Menu

To set the window transparency for the RUN menu, please proceed as follows:



◆ Procedure

1. **In the RUN menu, select "VIEW" from the menu bar and press <ENTER>**
If the SETUP menu is active, press <OPE/SET> to activate the RUN menu.
2. **Select "Window Transparency (RUN menu)" and press <ENTER>**
A pop-up window appears. By default, the windows are set to 100% transparency.
3. **Select a value and press <ENTER>**
Every time you select a value, the effect is visible in the currently displayed windows.
4. **Press <CANCEL> to close the pop-up window**

4.4.2 SETUP Menu

To set the window transparency for the SETUP menu, please proceed as follows:



◆ Procedure

1. **In the SETUP menu, select "ENVIRONMENT" from the menu bar and press <ENTER>**
If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.
2. **Select "Color" from the submenu and press <ENTER>**
3. **Select "Window Transparency (SETUP menu)" and press <ENTER>**
4. **Select a value and press <ENTER>**
Every time you select a value, the effect is visible in the currently displayed windows.
5. **Press <CANCEL> to return to the submenu**

4.5 Marker Display

The "Marker" function allows you to draw lines and shapes such as rectangles, polygons and ellipses in 8 different colors in the image display area during inspection. You can use these markers as guides for positioning objects for inspection. You can set up to 8 markers per camera.



◆ NOTE

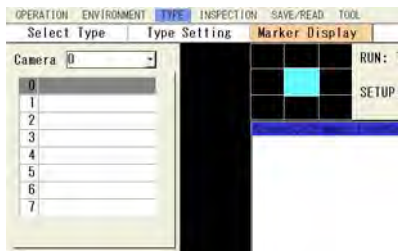
- You need to activate marker display for run mode. In the Environment menu, select "RUN mode Image Settings" and set the option "Marker" to "On".
- Markers are displayed in run mode only.
- You cannot use the coordinates of the markers for numeric calculation, etc.

4.5.1 Creating a Marker



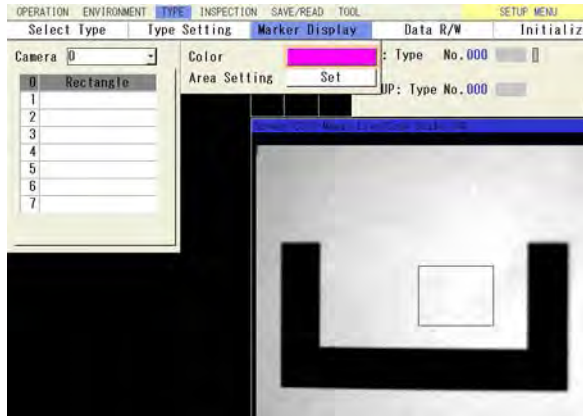
◆ Procedure

1. In the **SETUP** menu, select **"TYPE"** from the menu bar and press **<ENTER>**
If the RUN menu is active, press **<OPE/SET>** to activate the SETUP menu.
2. Select **"Marker Display"** from the submenu and press **<ENTER>**



3. Select a camera number and press **<ENTER>**
4. Select the list of markers and press **<ENTER>**
5. Select a marker number from 0 - 7 and press **<ENTER>**

The default marker (pink rectangle) is displayed in the center of the image display area.



6. Press <ENTER> to change the color

There are eight colors to choose from. Next, you need to set the area of the marker.

7. Select the button [Set] next to "Area Setting" and press <ENTER>

If you need a different shape than the default rectangle, select "Change Shape" first and select "Ellipse", "Polygon" or "Line" from the menu, then proceed to "Change" to set the area.



8. Press <ENTER> on "Change"

The setting procedure for the marker is the same as that for setting checkers and masks (see page 124).

9. Press <CANCEL> to return to the checker-setting window

10. Press <CANCEL> to close the submenu for color and area setting

The marker appears with the shape name in the list.

OPERATION	ENVIRONMENT	TYPE
Select	Type	Type
Camera	0	
0	Ellipse	
1		
2		
3		
4		
5		
6		
7		

11. Press <OPE/SET> to activate the RUN menu

If you do not see any markers in the RUN menu, you need to activate their display, see notes above.

4.5.2 Copying a Marker



◆ Procedure

1. In the **SETUP** menu, select **"TYPE"** from the menu bar and press <ENTER>
If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.
2. Select **"Marker Display"** from the submenu and press <ENTER>
3. Select a camera number and press <ENTER>
4. Select the list of markers and press <ENTER>
5. Select the marker number you want to copy and press <FUNC>
A pop-up menu appears in the top left corner.
6. Press <ENTER> on **"Copy"**
Move the cursor to the marker number you wish to copy the data to.
7. Press <FUNC>
8. Press <ENTER> on **"Paste"**

The copied marker data is pasted. Change the marker settings as required (see procedure on marker creation above).

OPERATION ENVIRONMENT TYPE	
Select Type	Type
Camera 0	
0	Ellipse
1	
2	
3	Ellipse
4	
5	
6	
7	

4.5.3 Deleting a Marker

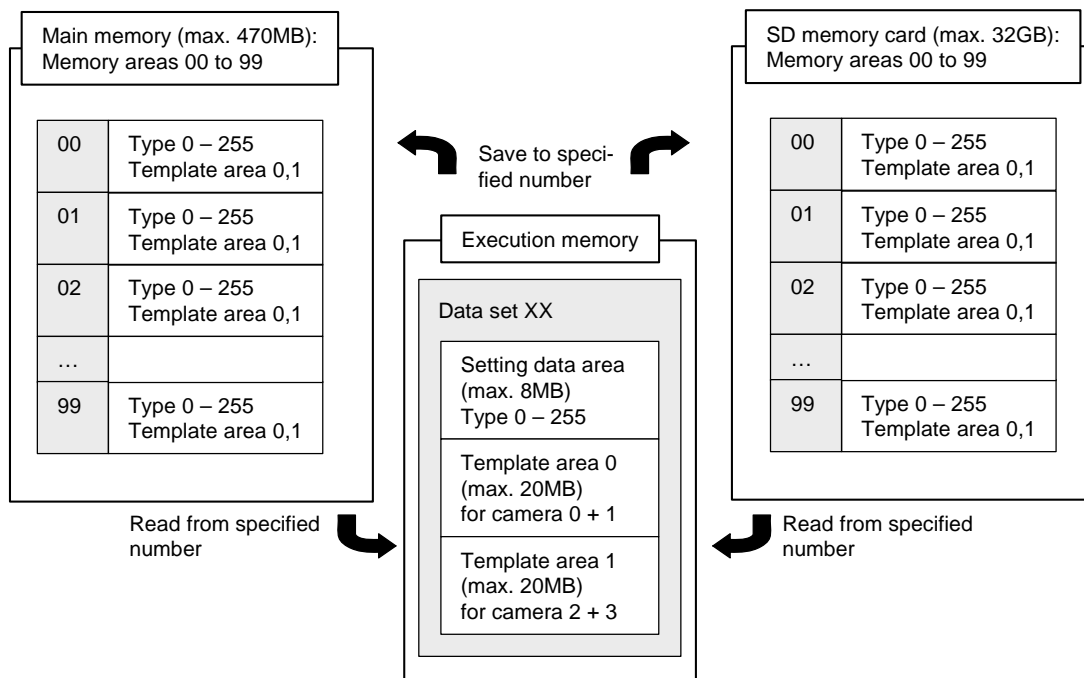


◆ Procedure

1. In the **SETUP** menu, select **"TYPE"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Marker Display"** from the submenu and press **<ENTER>**
3. Select a camera number and press **<ENTER>**
4. Select the list of markers and press **<ENTER>**
5. Select the marker number you want to delete and press **<FUNC>**
A pop-up menu appears in the top left corner.
6. Select **"Delete"** and press **<ENTER>**
A message asking for confirmation is displayed.
7. Select **"Yes"** and press **<ENTER>**
The selected marker is deleted from the list.

4.6 Saving and Reading Setting Data

All settings you make in the SETUP or OPERATION menu can be saved either on the Imagechecker or on a SD memory card. Every time you switch on the Imagechecker, the Imagechecker transfers the contents from one memory area from the main memory to the execution memory (see page 83) and loads a type (see page 54).



◆ NOTE

The settings in TOOL → Configuration are specific to the Imagechecker and are not saved in the main memory, but in a different memory area.

4.6.1 Save Setting Data

Use this function to save the type data (up to 256) from the execution memory to a memory area of the main memory or of the SD memory card.



◆ Procedure

1. In the SETUP menu, select "SAVE/READ" from the menu bar and press <ENTER>
If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.
2. Select "Save Setting Data " from the submenu and press <ENTER>#

3. Select the destination under "Save to"

You can save to the main memory or to the SD memory card.

4. Select the memory area number from the table and press <ENTER>

If data exists in the selected memory area, a message asks you to confirm that you want to overwrite the existing data.

When the data is saved, the table is updated and displays the following information: Size of the saved setting data (KB), version used to create the data and date and time when the data was saved (taken from the built-in calendar (see page 472) of the Imagechecker).

4.6.2 Read Setting Data

All data stored in the memory areas of the main memory or on the SD memory card can be transferred into the execution memory. Any existing data in the execution memory will be overwritten, so make sure to save settings before you load data from a memory area.

**◆ Procedure**

1. In the SETUP menu, select "SAVE/READ" from the menu bar and press <ENTER>

If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

2. Select "Read Setting Data " from the submenu and press <ENTER>**3. Select the source under "Read from"**

You can read from the main memory or the SD memory card.

4. Select the memory area number from the table and press <ENTER>

A message asking for confirmation is displayed.

5. Select "Yes" and press <ENTER>**◆ NOTE**

It is not possible to read data which was created with a newer Imagechecker version than the one you are using to read the data (see page 84).

4.6.3 Delete Setting Data

To delete the setting data registered in the main memory or a SD memory card, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"SAVE/READ"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Save Setting Data "** from the submenu and press **<ENTER>**
3. Select the source under **"Read from"**
You can delete data from the main memory or the SD memory card.
4. Select the memory area number from the table and press **<FUNC>**
A pop-up menu appears in the top left corner.
5. Select **"Delete"** and press **<ENTER>**
A message asking for confirmation is displayed.
6. Select **"Yes"** and press **<ENTER>**

4.6.4 Compatibility of Setting Data

If you are using SD memory cards to exchange setting data between different Imagecheckers, make sure that the Imagechecker are compatible with each other or you will not be able to read the setting data.



◆ NOTE

- Imagecheckers with version 1.02 can only read data created by version 1.02 or before. Imagecheckers with version 1.10 can read all data.
- The camera type used for a type does not influence data compatibility. It is possible to read setting data from a 2-camera type with a 4-camera type and vice versa.

Chapter 5

Camera Settings

5.1 Overview of the Camera Settings

There are three types of camera available for the Imagechecker. You can connect two or four cameras. It is possible to mix different camera types. There are two different places where you need to make camera settings:

- The global camera settings (camera type, flash polarity) are made in the **ENVIRONMENT** Menu (see page 87)
- The type-related camera settings in the **TYPE** menu (see page 88)

By default, the Imagechecker is configured so that all types use the same camera settings (common). The following settings are available for common setting or per camera (see page 91):

- Shutter speed
- Camera gain
- Capture delay
- Flash delay and duration
- Partial imaging
- Calibration



◆ NOTE

For time-sensitive applications, it may be useful to use an Imagechecker with 4 camera connectors and plug one camera into connector 0 and one in connector 2, because connector 0 and 1 share one processor and connector 2 and 3.

5.2 Camera Settings in the Environment Menu

5.2.1 Setting the Camera Type

The Imagechecker automatically recognizes the cameras connected at startup and displays them under **ENVIRONMENT** → **Camera** → **Camera** in the "Connected Camera" field.

You only need to change the settings if "Connected Camera" and "Camera Type" contain different camera types as shown below.

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETU
System Settings	Input/Output	Camera				
Camera		Camera	Connected Camera	Camera Type		
FLASH Polarity		Camera No.0	2-Mega	2-Mega		
		Camera No.1	Not connected	Unused		



◆ NOTE

- Set the correct camera types before setting capturing conditions. When you change the camera type, the capturing conditions of cameras are initialized.
- If the settings for "Connected Camera" and "Camera Type" differ, image capturing will not work correctly. It is possible to use different settings for the configuration to decrease the size of the camera image. However, you cannot switch to the RUN menu as long as the settings for "Connected Camera" and "Camera Type" differ.

5.2.2 Setting the Flash Polarity

The Imagechecker sends a flash trigger signal to a strobe. There are four terminals (FLASH 0 - FLASH 3) for four cameras. You can set the polarity of the flash signal for each camera under **ENVIRONMENT** → **Camera** → **FLASH Polarity**.

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL
System Settings	Input/Output	Camera			
Camera		FLASH 0 Polarity	ON at Low		
FLASH Polarity		FLASH 1 Polarity	ON at Low		

Setting	Explanation
Light at ON	Strobe is triggered at the rising edge of the flash signal along with the timing of image capturing
Light at OFF	Strobe is triggered at the falling edge of the flash signal.

5.3 Camera Settings in the Type Menu

You can make trigger and capturing settings individually per type (see page 88) or use common settings for all types. By default, all types use the same camera settings (Common).

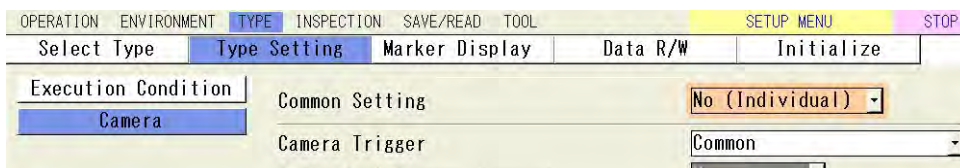
5.3.1 Activating Capturing Settings by Type (Individual) / Cam Settings TYPE menu

To make individual capturing settings per type, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"TYPE"** from the menu bar and press **<ENTER>**
If the RUN menu is active, press **<OPE/SET>** to activate the SETUP menu.
2. Select **"Type Setting"** from the submenu and press **<ENTER>**
3. Select **"Camera"** and press **<ENTER>**
4. Select **"No (Individual)"** and press **<ENTER>**



5. Make the other settings as appropriate



◆ NOTE

When you have activated **"No (Individual)"** for a type, but decide to return to **"Yes (Common)"** later, the independent settings will be overwritten with the common settings.

5.3.2 Trigger Settings for Capturing the Image

When you use more than one camera, it is important to time the moment when the cameras capture the image correctly. There are three options to trigger the image capture:

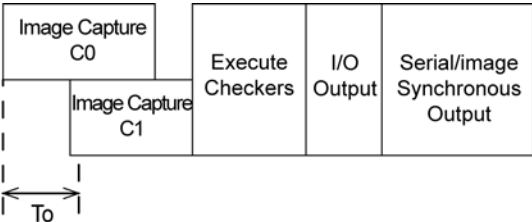
Setting	Explanation
Common (default setting)	All cameras capture an image at the same time.
Individual	Each camera captures an image individually when the camera has received a trigger signal. You may set an independent trigger timeout from 1 to 10000ms (default: 5000ms).

Setting	Explanation
Detect Trigger (common)	All cameras capture an image at the same time. If the position adjustment checker No. 0 is OK, all other checkers are executed and the results are output. If the position adjustment checker No. 0 is NG, the Imagechecker repeats capturing an image and executing the position adjustment checker No. 0 until the position adjustment checker becomes OK.

The two figures below explain the differences in the image processing when you have two cameras connected and use either the trigger setting "Common" or "Individual".

5.3.2.1 Trigger Setting "Individual"

The image processing with the independent camera trigger signal works as shown below:



The connected cameras are triggered by a start signal each. When all cameras have captured an image, the checkers are executed and the results are output.

You can set a timeout time (T_o) for the independent trigger. After the first start signal has been input, the start signals for all the other cameras need to be given within the specified time range, otherwise a timeout error occurs (the Error0 signal is output) and the inspection is terminated.

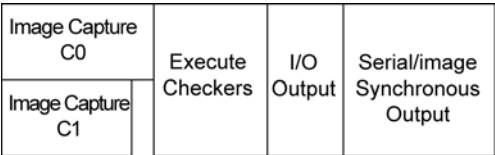


◆ NOTE

All connected cameras have to be triggered once for the inspection process to complete and the data to be output.

5.3.2.2 Trigger Setting "Common"

The image processing with the common camera trigger signal works as shown below:



One start signal triggers all connected cameras to capture an image. The times for image capturing may differ when you have connected different types of cameras. The checkers are executed and the results are output.

5.3.2.3 Trigger Setting "Detect Trigger (Common)"

The image processing with the common camera trigger signal works as shown below:

Image Capture	Pos. Adj. No.0 Execute	Image Capture	Pos. Adj. No.0 Execute	Image Capture	Pos. Adj. No.0 Execute	Checker etc. Execute	I/O Output	Serial/image Synch. Output
	NG		NG		OK			

With this setting, the Imagechecker first executes the position adjustment checker No. 0. When the position adjustment checker No. 0 detects an object and is judged OK, then the other checkers are executed and the results are output. If the position adjustment checker No. 0 does not detect an object or is judged NG, the Imagechecker repeats capturing an image and executing the position adjustment checker No. 0 until the position adjustment checker becomes OK.

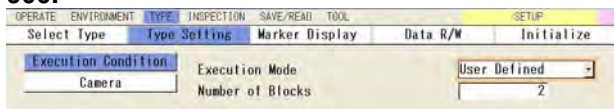


◆ NOTE

- The option "Detect Trigger (Common)" is not available when the parameter "Operation Mode" is set to "Parallel" (ENVIRONMENT → System Setting → Operation).



- When the option "Execution Mode" is set to "User Defined" (TYPE → Type Setting → Execution Condition), it is the position adjustment checker with the smallest number in the execution block that is executed repeatedly. For example, for block 2, the position adjustment checker with the smallest number is No. 100. For block No. 10 it is position adjustment checker No. 900.



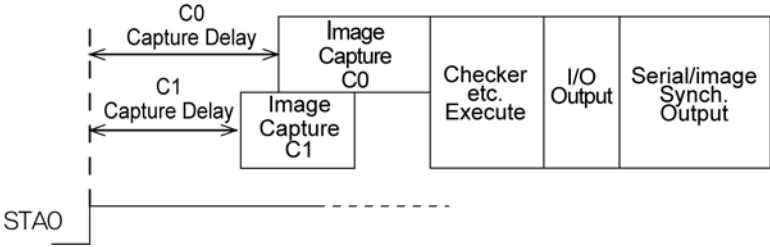
5.3.3 Parameter Settings for Each Camera

Under **TYPE** → **Type Setting** → **Camera**, you make all parameter settings for the image capture. First, you need to select the camera number for which you want to make settings under "Camera No. to Set".

OPERATION		ENVIRONMENT		TYPE	INSPECTION	SAVE/READ	TOOL	SETUP MENU	
Select Type	Type Setting	Marker Display	Data R/W	Initialize					
Execution Condition		Common Setting		No (Individual) ▾					
Camera		Camera Trigger		Common					
		Individual Trigger (1/1000)		No ▾					
		Trigger Delay (ms)		5000					
		Error if Checker Area outside image		No ▾					
		Camera No. to Set		0 ▾					
		Connected Camera		2-Mega					
		Shutter Speed		10ms ▾					
		Gain		0.50					
		Capture Delay (ms)		0.0					
		FLASH Delay (ms)		0.0					
		FLASH Span (ms)		0.2					
		Partial Imaging		Set					
		Calibration		Set					

You can set the following parameters for each camera connected separately:

Setting	Explanation
Detects Error Outside Search Area (see page 92)	Defines whether a checker should be executed when its shape is outside the image area.
Connected Camera	Displays the camera type of the camera selected in "Camera No. to Set". If the type displayed here differs from the actual camera type, change the setting in "Connected Camera" under ENVIRONMENT → Camera → Camera (see page 87).
Shutter Speed	The following shutter speeds are available regardless of camera type: 30μs, 100μs, 250μs, 500μs, 1ms, 5ms, 10ms (default), 50ms, 100ms, 500ms, 1000ms. When you set the image display to "Live" (see page 75), you can see the image captured with the specified shutter speed. In case you cannot see the image easily because the user interface is in the way, set the option "Window Transparency" (see page 77) to a larger value.
Gain	The camera gain refers to the sensitivity of the camera. Adjust the option "Gain" when you cannot obtain a good image even though you have adjusted the lens aperture and the lighting, for example, when you are using a high shutter speed fast and the image is too dark even though lighting is used. You can set a value in the range from 0.25 to 1.00 (default: 0.50) in steps of 0.01. Note: When you increase the gain value, the image becomes lighter and also rougher due to increased noise.

Setting	Explanation
Capture Delay (ms)	<p>Here you can specify a time delay between inputting the start signal and the actual image capturing, if necessary. The default value is "0". Set a value in the range between 0.0 and 999.9ms.</p>  <p>The figure shows the image processing when 2 cameras are connected and the trigger setting is "Common".</p>
FLASH Delay (ms)	<p>Here you can specify a time delay between inputting the start signal and the output of the flash trigger signal to the external strobe, if necessary. The default value is "0". Set a value in the range between 0.0 and 999.9ms. Use the setting "FLASH Span (ms)" to specify the duration of the flash light (see page 427).</p>
FLASH Span (ms)	<p>Here you can specify the duration of the flash light (see page 427). The default value is "0.2". Set a value in the range between 0.2 and 999.9ms.</p> <p>Note: To make sure that the flash lights up while the camera captures the image, take into account the capture delay of the camera and the shutter speed when you set this option.</p>
Partial Imaging	<p>Here you can specify which part of the image should be captured by the camera (see page 93).</p>
Calibration (see page 95)	<p>Here you can:</p> <ul style="list-style-type: none"> • Convert pixel values into real measurements (see page 96) • Move the point of origin of the coordinate system to a different position from the default top left position (see page 97) • Change the direction of the coordinate system (see page 97)

5.3.3.1 Detects Error Outside Search Area

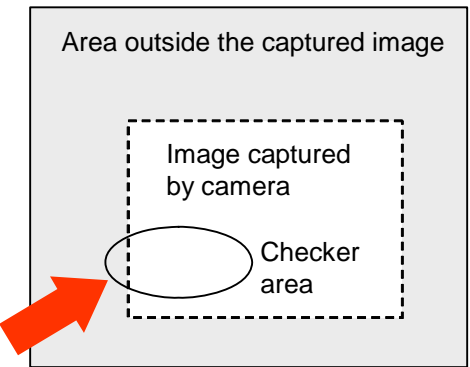
By default, this parameter is set to "No". This means the checker is executed even if its shape is moved outside the image area, e.g. because it has been adjusted by a position or area size adjustment.

When the parameter is set to "Yes", checker execution is cancelled when the checker shape is outside the image area. In this case the checker result is NG. Both the list of checkers and the checker list (see page 359) show the checker marked as ERROR.



◆ **EXAMPLE**

The checker shape is outside the image area.



◆ **NOTE**

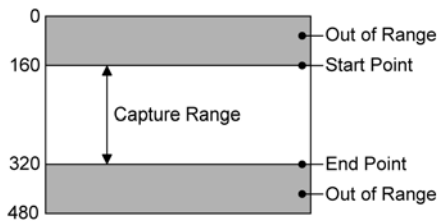
When the parameter is set to "Yes", be careful when setting checker shapes. If the shape extends beyond the image area, the checker result will be NG, even if no adjustment checker is used.

5.3.3.2 Partial Imaging

Under **TYPE** → **Type Setting** → **Camera Setting**, you make all parameter settings for the image capture. First, you need to select the camera number for which you want to make

With Here you can specify which part of the image should be captured by the camera. When you decrease the image area, the image capturing time becomes shorter. The image size is 640 x 480 pixels for the quad-speed and the ultra-compact camera, and 1600 x 1200 pixels for the 2 mega camera.

The part to be captured is defined by a start line and an end line. The example shows a partial image to be captured from start point at 160 to end point at 320.



◆ **NOTE**

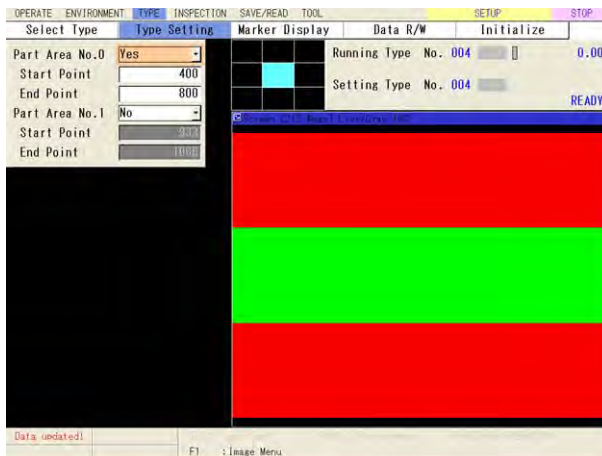
- You can set up to two partial areas per camera.

- When the option "Common Setting" is set to "Yes (Common)", the partial imaging settings you make for any of the cameras will be valid for all other types as well. If you do not want to use partial imaging in other types, set the option "Common Setting" to "No (Individual)" (see page 88).
- The gray value of the area outside the image part selected for capture will be zero.
- The following minimum values apply when you set the capturing area:
1 line for the quad-speed camera ANPVC1040 and the ultra compact camera ANPVC1021.
100 lines for the 2 Mega camera ANPVC1210.



◆ Procedure

1. In the **SETUP** menu, select **"Type"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Type Setting"** from the submenu and press **<ENTER>**
3. Select **"Camera"** and press **<ENTER>**
4. If you do not wish to use partial imaging for all types, set the option **"Common Setting"** to **"No (Individual)"** and press **<ENTER>**
5. Select a camera number under **"Camera No. to Set"**
6. Select button **"Set"** next to **"Partial Imaging"** and press **<ENTER>**
The **"Partial Imaging"** window is displayed with the default settings.



7. Set **"Part Area No. 0"** to **"Yes"** and press **<ENTER>**
8. Select **"Start Point"** and press **<ENTER>**
9. Move the starting line of the capturing area to the desired position

The area that will not be captured or inspected is displayed in red in the image on the screen.

10. Select "End Point" and press <ENTER>
11. Move the ending line of the capturing area to the desired position
12. If necessary, configure the second area to be excluded from image capturing accordingly

5.3.3.3 Calibration

The calibration function allows you to do several things.

- Convert pixel values into real measurements (see page 96)
- Move the point of origin of the coordinate system to a different position from the default top left position (see page 97)
- Change the direction of the coordinate system (see page 97)

You can set the calibration function for each camera separately.



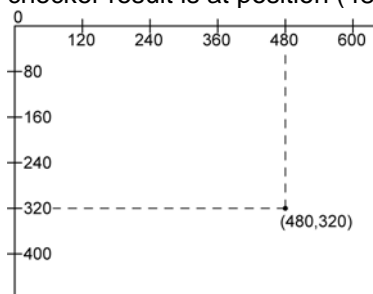
◆ NOTE

When you have activated the calibration function, the checker results will be calibrated. Bear this in mind when you set judgement limits.

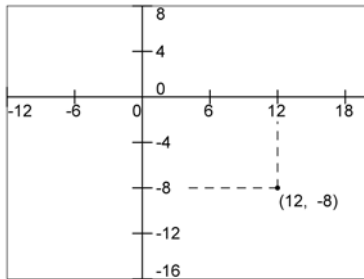


◆ EXAMPLE

With the default settings, the coordinate system looks like below. The detected checker result is at position (480, 320).



The example uses position (240, 160) as the point of origin. The positive direction of the coordinate system is set to rightward and upward. The actual measurement of 10mm corresponds to 200 pixels (a coefficient of 0.05).



After calibration, the detected checker result is at position (12, -8).

5.3.4 Converting Pixel Values to Real Measurements

To convert pixel values into real measurements, please proceed as follows:



◆ Procedure

1. **Use a measuring checker to measure the object's length in pixel**
Use an object of which the real measurements are known and tested.
2. **If the RUN menu is active, press <OPE/SET> to activate the SETUP menu**
3. **Select "TYPE" from the menu bar and press <ENTER>**
4. **Select "Type Setting" from the submenu bar and press <ENTER>**
5. **Select "Camera" and press <ENTER>**
6. **Select "Set" next to "Calibration " and press <ENTER>**

The "Calibration" window is displayed.

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL
Select Type	Type Setting	Marker Display	Data R/W		
Comment	<input type="text"/>				
Calibration	No				
Origin X	<input type="text" value="0"/>				
Origin Y	<input type="text" value="0"/>				
Coordinate Axis (positive direction)	Rightward - Downward				
Real Length X (e.g.: [mm])	<input type="text" value="1"/>				
Real Length Y (e.g.: [mm])	<input type="text" value="1"/>				
Length X in Pixels	<input type="text" value="1"/>				
Length Y in Pixels	<input type="text" value="1"/>				
Factor X	1.0000				
Factor Y	1.0000				

7. **Set "Calibration" to "Yes"**

Further options become available.

OPERATION		ENVIRONMENT		TYPE		INSPECTION		SAVE/READ		TOOL	
Select Type		Type Setting		Marker Display		Data R/W					
Comment											
Calibration		Yes									
Origin X		0									
Origin Y		0									
Coordinate Axis (positive direction)		Rightward - Downward									
Real Length X (e.g. [mm])		1									
Real Length Y (e.g. [mm])		1									
Length X in Pixels		1									
Length Y in Pixels		1									
Factor X		1.0000									
Factor Y		1.0000									

8. Enter the values for "Real Length X/Y"

In the example, the object's length is 10mm.

9. Enter the actual measurement result under "Length X/Y in Pixels"

In the example, the object is measured as 200 pixels. The Imagechecker automatically calculates and displays the calibration factor at the bottom of the window.

OPERATION		ENVIRONMENT		TYPE		INSPECTION		SAVE/READ		TOOL	
Select Type		Type Setting		Marker Display		Data R/W					
Comment											
Calibration		Yes									
Origin X		0									
Origin Y		0									
Coordinate Axis (positive direction)		Rightward - Downward									
Real Length X (e.g. [mm])		10									
Real Length Y (e.g. [mm])		10									
Length X in Pixels		200									
Length Y in Pixels		200									
Factor X		0.0500									
Factor Y		0.0500									

10. Close the setting window with <CANCEL>

5.3.5 Changing Point of Origin and Direction of the Coordinate System

By default, the coordinate system uses the top left corner as its point of origin (0,0). The default direction is downward as shown below.

Direction setting	Orientation of the Coordinate System
Rightward - Downward (default)	
Rightward - Upward	
Leftward - Downward	
Leftward - Upward	

To change the point of origin and/or the direction of the coordinate system, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"TYPE"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Type Setting"** from the submenu bar and press **<ENTER>**
3. Select **"Camera"** and press **<ENTER>**
4. Select **"Set"** next to **"Calibration "** and press **<ENTER>**

The "Calibration" window is displayed.

OPERATION ENVIRONMENT TYPE INSPECTION SAVE/READ TOOL	
Select Type	Type Setting Marker Display Data R/W
Comment	
Calibration	Yes
Origin X	0
Origin Y	0
Coordinate Axis (positive direction)	Rightward - Downward
Real Length X (e.g. [mm])	10
Real Length Y (e.g. [mm])	10
Length X in Pixels	200
Length Y in Pixels	200
Factor X	0.0500
Factor Y	0.0500

5. Enter "Origin X" and "Origin Y"

The example uses position (240,160) as the point of origin.

6. Set "Coordinate Axis (positive direction)" to "Rightward - Upward"

OPERATION ENVIRONMENT TYPE INSPECTION SAVE/READ TOOL	
Select Type	Type Setting Marker Display Data R/W
Comment	
Calibration	Yes
Origin X	0
Origin Y	0
Coordinate Axis (positive direction)	Rightward - Upward
Real Length X (e.g. [mm])	10
Real Length Y (e.g. [mm])	10
Length X in Pixels	200
Length Y in Pixels	200
Factor X	0.0500
Factor Y	0.0500

7. Close the setting window with <CANCEL>

Chapter 6

Introduction to Checker Setting

6.1 Available Checker Types

There are three groups: position/rotation adjustment checkers, area adjustment checkers and inspection checkers.

6.1.1 Position and Rotation Adjustment Checkers

Position/rotation adjustment checkers are used to ensure that the inspection checkers inspect the correct object or area of the object. Setting a position or rotation adjustment is necessary when the objects inspected do not always have the same position under the camera.

6.1.1.1 Position Adjustment Checkers

There are four checker types available for position adjustment:

Position Adjustment	▶ Binary Edge
Pos/Rot Adjustment	▶ Gray Edge
Rotation Adjustment	▶ Feature Extraction
	▶ Matching

	Pos. Adj. (Binary Edge)	Pos. Adj. (Gray Edge)	Pos. Adj. (Feature Extraction)	Pos. Adj. (Matching)
Functionality	Calculates the horizontal and/or vertical adjustment with two binary edge-detection checkers	Calculates the horizontal and/or vertical adjustment with two gray edge-detection checkers	Calculates the horizontal and/or vertical adjustment with a feature extraction	Position adjustment with matching the contours of an object with a template
Shapes	Line Plane (Rectangle)	Line Plane (Rectangle)	Rectangle Ellipse Circle Polygon	<ul style="list-style-type: none"> For template area: Rectangle Ellipse Circle Polygon For search area: Rectangle
Masks	---	---	Rectangle Ellipse Circle Polygon	For template area only: Rectangle Ellipse Circle Polygon
Result	Base position for adjusting inspection checkers with: <ul style="list-style-type: none"> Adjustment in X direction Adjustment in Y direction Judgement Time in ms			Base position for adjusting the inspection checkers with: <ul style="list-style-type: none"> Detect Angle Correlation Adjustment in X direction Adjustment in Y direction Judgement Time in ms

6.1.1.2 Position/Rotation Adjustment Checkers

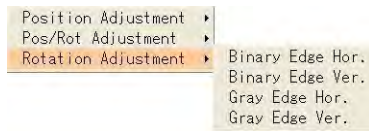
There are four checker types available for position/rotation adjustment:

Position Adjustment	▶	
Pos/Rot. Adjustment	▶	Feature Extraction (Principal Axis Angle)
Rotation Adjustment	▶	Matching (360-degree)
		Feature Extraction (2 checkers)
		Matching (2 checkers)

	Feature Extraction (Principal Axis Angle)	Matching (360° Degrees)	Feature Extraction (2 Checkers)	Contour Matching (2 Checkers)
Functionality	Position/Rotation adjustment with a feature extraction checker using the angle of the principle axis (+/- 90° degrees)	Position/Rotation adjustment with contour matching (360° degrees)	Position/Rotation adjustment with 2 feature extraction checkers	Rotation adjustment with 2 contour matching checkers
Shapes	Rectangle Ellipse Circle Polygon	<ul style="list-style-type: none"> For template area: Rectangle Ellipse Circle Polygon For search area: Rectangle 	Rectangle Ellipse Circle Polygon	<ul style="list-style-type: none"> For template area: Rectangle Ellipse Circle Polygon For search area: Rectangle
Masks	Rectangle Ellipse Circle Polygon	For template area only: Rectangle Ellipse Circle Polygon	Rectangle Ellipse Circle Polygon	For template area only: Rectangle Ellipse Circle Polygon
Result	Base position for adjusting inspection checkers with: <ul style="list-style-type: none"> Adjustment in X direction Adjustment in Y direction Adjustment Theta Judgement Time in ms			

6.1.1.3 Rotation Adjustment Checkers

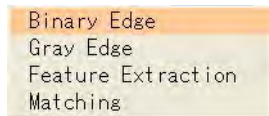
There are four checker types available for rotation adjustment:



	Binary Edge Horizontal/ Vertical	Gray Edge Horizontal/ Vertical
Functionality	Rotation adjustment with two binary edge-detection checkers scanning in horizontal/vertical direction	Rotation adjustment with two gray edge-detection checkers scanning in horizontal/vertical direction
Shapes	Line Plane (Rectangle)	Line Plane (Rectangle)
Masks	---	---
Result	Base position for adjusting inspection checkers with: <ul style="list-style-type: none"> • Adjustment in X direction • Adjustment in Y direction • Adjustment Theta Judgement Time in ms	

6.1.2 Area Size Adjustment Checkers

There are four types of checkers available.



Area size adjustment checkers are used to ensure that the inspection checkers are expanded or contracted when the object to be inspected varies in size. Setting an area is necessary when the objects inspected do not always have the same size.

6.1.3 Inspection Checkers

There are eleven types of checkers available.

Checker	Main application	Description
Line	<ul style="list-style-type: none"> • Presence/absence inspection • Counting 	Binarizes the camera image counts white or black pixels on the checker line. Judges as OK or NG on the measured value.
Binary window	<ul style="list-style-type: none"> • Measurement of size • Presence check 	Binarizes the camera image and measures an area or the number of white or black pixels. Judges as OK or NG on the measured value.

Checker	Main application	Description
Gray window	<ul style="list-style-type: none"> Measurement of brightness Orientation recognition 	Measures the average gray value of the checker area.
Binary edge	<ul style="list-style-type: none"> Position detection Length measurement (high speed) 	Binarizes the camera image and detects edges (transitions from black to white or vice versa).
Gray edge	<ul style="list-style-type: none"> Position detection Length measurement (high accuracy) 	Detects edges (user-definable changes in the gray value) in a gray-value image.
Feature extraction	<ul style="list-style-type: none"> Position detection Angle detection Counting 	Detects and counts objects in black or white in a binary image. Calculates features such as the center of gravity or the angle of the principal axis of an object.
Smart matching	<ul style="list-style-type: none"> Position detection Angle detection Type recognition 	Detects an object similar to a registered template by overlapping the image and the template and comparing gray values. Outputs the detected position and angle and degree of similarity (correlation value).
Flaw detection	Detection of: <ul style="list-style-type: none"> Missing edges Burrs on the surface Dirt 	Detects flaws by calculating the average gray value in an area segmented into cells and searching for gray-value differences that exceed a user-definable threshold.
Connector (binary window)	Pin measurement	Measures the area of pins by counting the number of black or white pixels.
Connector (gray window)	<ul style="list-style-type: none"> Pin check Measurement of brightness 	Checks pins by calculating the average gray value and searching for gray-value differences that exceed a user-definable threshold.
Connector (gray edge)	<ul style="list-style-type: none"> Measurement of pitch of lead pins, float check Connector gap Width Measurement 	Measures connectors and checks for correct pitch, float, gaps, height, width etc.

You can set up to 999 checkers per type and checker type (when the number of used blocks is 10). The maximum number of checkers available for a type is 1000.



◆ NOTE

When you have set a checker, you cannot change it to a different checker type. For example, you cannot change a binary edge-detection checker to a gray edge-detection checker. If you need to change the checker type, you must delete it and create a new one.

6.2 Setting Procedures for All Checker Types

All checkers have at least three pages in the checker-setting window. The options displayed in the checker-setting windows may differ. For more details, refer to the corresponding section of the individual checkers

Select	Parameter	Description	Used by
Area setting	Comment	Enter a comment to describe the checker's purpose. Comments are helpful when you have many checkers of the same type.	All checkers
	Camera	Select the camera image	All checkers
	Position adjustment	Select a position adjustment checker number to adjust the checker (only available if you have already defined a position adjustment checker).	All checkers
	Area setting	Select to open the setting window for the inspection, template, or search area	All checkers
	Area size adjustment	Select an area size adjustment checker number to adjust the checker (only available if you have already defined an area size adjustment checker).	All checkers except smart matching and connector (gray edge)
Inspection condition	Preprocess	Select a preprocessing group. Up to 5 filter operations can be executed to preprocess the image before inspection.	All checkers
	Slice level	Slice levels are used to create a binary image. You can define up to 8 slice level groups (A - H).	All checkers except checkers using a gray-value image
Judgement limits	Max/Min	Upper/lower limit for judging the checker result	All checkers

Independent of their functionality, all checkers are created in the same manner. The following sections explain setting procedures common to all checkers. For checker-specific settings, refer to the corresponding section of the individual checkers.

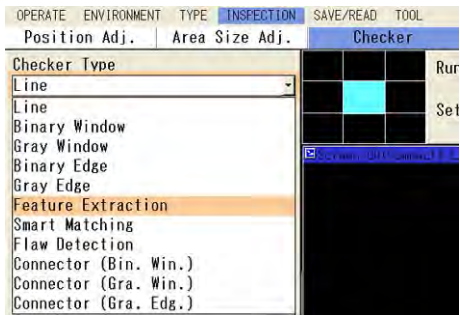
6.2.1 Selecting the Checker Type



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Checker"** from the submenu bar and press **<ENTER>**

3. **Select the checker type you wish to create in "Checker Type" and press <ENTER>**



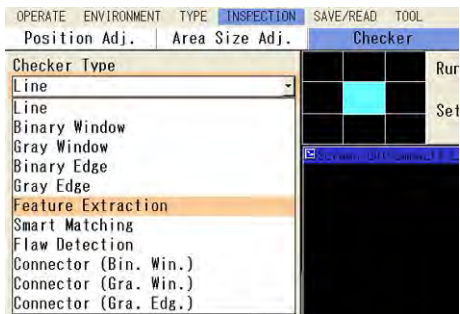
The next step is to assign the checker number (see page 107).

6.2.2 Assigning the Checker Number

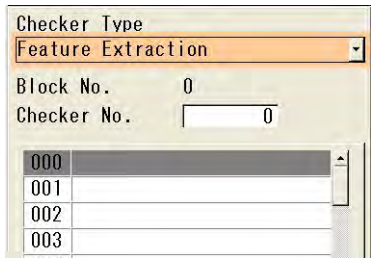


◆ Procedure

1. **Select the checker type you wish to create in "Checker Type" and press <ENTER>**



2. **Select the checker list and press <ENTER>**



The block number is displayed when you use execution mode "Automatic Switch" or "User-defined" (see page 56). The block number depends on the checker number you select for the checker.

3. Select a checker number from the list

Checker Type
Feature Extraction

Block No. 0
Checker No. 10

000
001
002
003
004
005
006
007
008
009
010
011
012

If you want to set a checker number higher than the ones displayed in the list, scroll down the list or enter the desired number in the field "Checker No." and press <ENTER>.

4. Press <ENTER>

The setting window for the selected checker type is displayed. The next step is to select the camera image you want to inspect.

6.2.3 Selecting the Camera Image



◆ Procedure

1. In the checker-setting window, select "Camera" and press <ENTER>

Area Setting

Inspection Condition
Judgment Condition

Judgment NG
Dot Judgment NG
Land Judgment NG
Dot Count 0
Land Count 0
Time(ms) 0.00

Comment
Camera 0
Area Setting
Set

Checker 010
Start Point
End Point
Offset

2. Set the camera number







The next step is to select a position adjustment checker to adjust the inspection checker if the object to be inspected varies in its location and orientation.





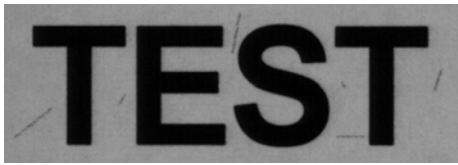
6.2.4 Preprocessing an Image with Filters


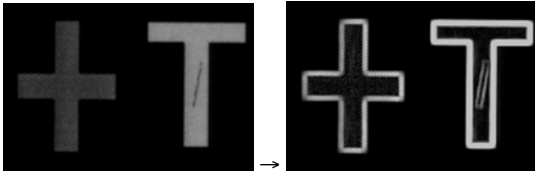
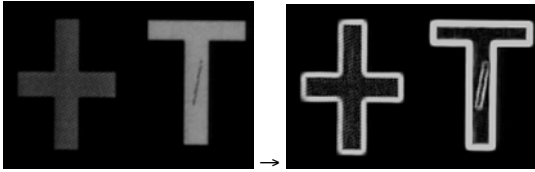


Up to 5 preprocessing groups (A to E) can be set up per type and camera. Every group may contain up to five steps, i.e. filters.



6.2.4.1 List of Filters Available for Preprocessing

The following filters can be used for image preprocessing:

Filter name and description	Original image → Image after preprocessing
Dilation Removes dark (or black) noises. Black areas in the image of the object contract. White areas in the image of the object expand.	 → 
Erosion Removes light (or white) noises. White areas in the image of the object contract. Black areas in the image of the object expand.	 → 

Filter name and description	Original image → Image after preprocessing
Erosion -> Dilation After removing light (or white) noises, returns the contracted area to its original size.	
Dilation -> Erosion After removing dark (or black) noises, returns the expanded area to its original size.	
Median Removes light or fine noises.	
Smoothing Smoothens an out-of-focus image to help measuring the position of the object by decreasing noises.	
Gray Cut Reorganizes the gray-value range into the one between 0 and 255. This function helps to remove light or dark noises in the background, or if the contrast of the	

Filter name and description	Original image → Image after preprocessing
image of the object is low.	
Prewitt Extracts the areas where the gray value changes. This emphasizes the outlines and edges of an object in the image.	
Sobel Similar to the Prewitt filter, but extracts areas of lower contrast more easily.	
Edge Extr. X Extracts areas where the gray value changes in X direction.	
Edge Extr. Y Extracts areas where the gray value changes in Y direction.	

Filter name and description	Original image → Image after preprocessing
Laplacian Extracts areas where the gray value changes.	Extracts areas where the gray value changes. 
Sharpen Enhances the areas where the gray value changes. The image becomes sharper. Note that noises may also be enhanced.	Enhances the areas where the gray value changes. The image becomes sharper. Note that noises may also be enhanced. 

6.2.4.2 Configuring the Preprocessing Groups

To configure image preprocessing, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. In the checker-setting window, select **"Inspection Condition"** and press **<ENTER>**
3. Select a camera image from **"Camera"**

The camera image from the selected camera is displayed.

Step	Filter	Param.
1ST	None	
2ND	None	
3RD	None	
4TH	None	
5TH	None	

4. Select a preprocess group from "Preprocess"

The table displays the current settings for steps 1 to 5.

5. Select "1ST" and press <ENTER>

6. Select a filter from the dropdown list under "Type"

7. Select a filter size

You can set a filter size of 3x3, 5x5, 7x7 or 9x9 for all filters except the median and the gray-cut filter.

8. If you have selected the gray-cut filter, also specify the maximum and minimum gray value

9. Set steps 2ND to 5TH accordingly if you want to execute several filters one after another

10. Close the setting window with <CANCEL>



◆ NOTE

- As an image displayed in SETUP, an image in the mid-course phase of preprocess can be selected. Press the <F1> key and select "Preprocess" from the displayed Image menu.
- You can set or modify a preprocessing group directly in the checker-setting window.

6.2.4.3 Assigning a Preprocessing Group

If you want to execute an inspection checker on a preprocessed image, please proceed as follows:



◆ Procedure

1. In the checker-setting window, select "Inspection Condition" and press <ENTER>

Area Setting		Preprocess	
Inspection Condition		No	
Judgement Limits		Slice Level: A	
Judgement		Count Pixel Color: White	
Pixel Judgement: NG		Count Object Color: White	
Objects Judgement: NG		Min. Object Size: 5	
No. of Pixels: 0		Min. Gap Size: 3	
No. of Objects: 0		Filter: No	
Time(ms): 0.00			

2. Select "Preprocess" and press <ENTER>

The "Preprocessing" window is displayed.

Step	Filter
1ST	None
2ND	None
3RD	None
4TH	None
5TH	None

3. Select a preprocessing group

When you select a group letter, the steps configured for this preprocessing group are displayed in the table below.

Step	Filter	Param.
1ST	Dilation	3x3
2ND	Median	3x3
3RD	Gray Cut	100-255
4TH	Smothing	3x3
5TH	Sharpen	3x3

You can edit the preprocessing group here the same way you created it (see page 112).

4. Press <CANCEL> to return to the checker-setting window

6.2.5 Additional Filters

All checkers can use preprocessing. Some checkers can use additional, checker-specific filters, both work differently:

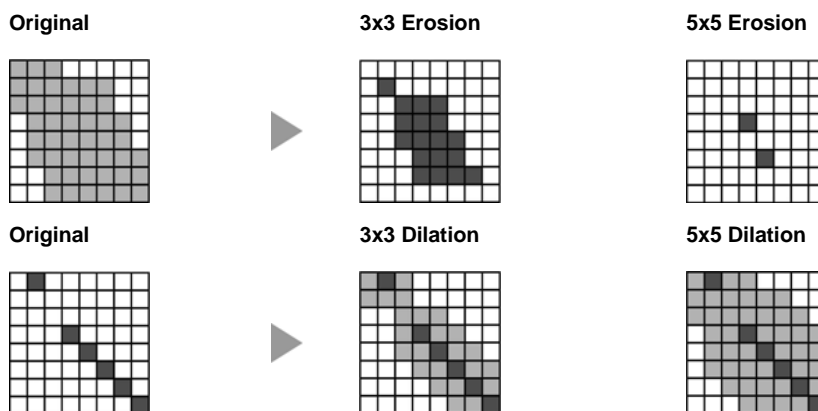
1. Erosion and dilation filters
2. Edge filters for checkers working with edges

The table shows which checker type uses which filter(s).

Checker	Erosion/Dilation filter	Edge filter
Line	yes	yes
Binary window	yes	no
Gray window	no	no
Binary edge	yes	yes
Gray edge	no	yes
Feature extraction	yes	no
Smart matching	for subtraction only	no
Flaw detection	no	no
Connector (binary window)	yes	no
Connector (gray window)	no	no
Connector (gray edge)	no	yes

6.2.5.1 Erosion and Dilation Filters

You can use the filters to eliminate unwanted parts (erosion) or to close gaps (dilation). Two levels of filtering, 3x3 and 5x5, are available for both dilation and erosion filters. The filters have the following effect on the original image:



Filter Setting	Filter Type	Effect on Image
3x3	Erosion	Removes a rim of 1 pixel width from the object
5x5	Erosion	Removes a rim of 2 pixels width from the object
3x3	Dilation	Adds a rim of 1 pixel width to the object
5x5	Dilation	Adds a rim of 2 pixels width to the object

This is how you apply a filter to an existing checker:

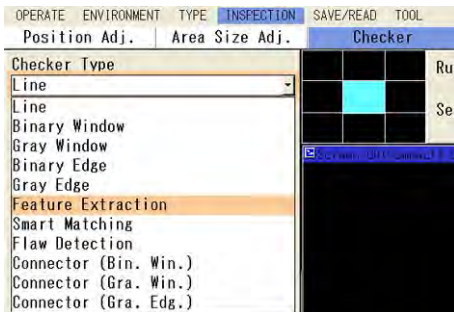


◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**

If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

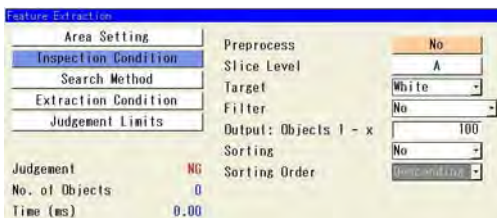
2. **Select "Checker" from the submenu bar and press <ENTER>**
3. **Select the checker type in "Checker Type" and press <ENTER>**



4. **Select the checker list and press <ENTER>**
5. **Select a checker from the list and press <ENTER>**

Please remember that not all checkers use erosion and dilation filters.

6. **In the checker-setting window, select "Inspection Condition" and press <ENTER>**



7. **Select "Filter" and press <ENTER>**



When you select one of the filter options from the menu, you see the filter effect on the image

8. **Select the optimum filter setting for your purposes and press <ENTER>**

You return to the checker-setting window.

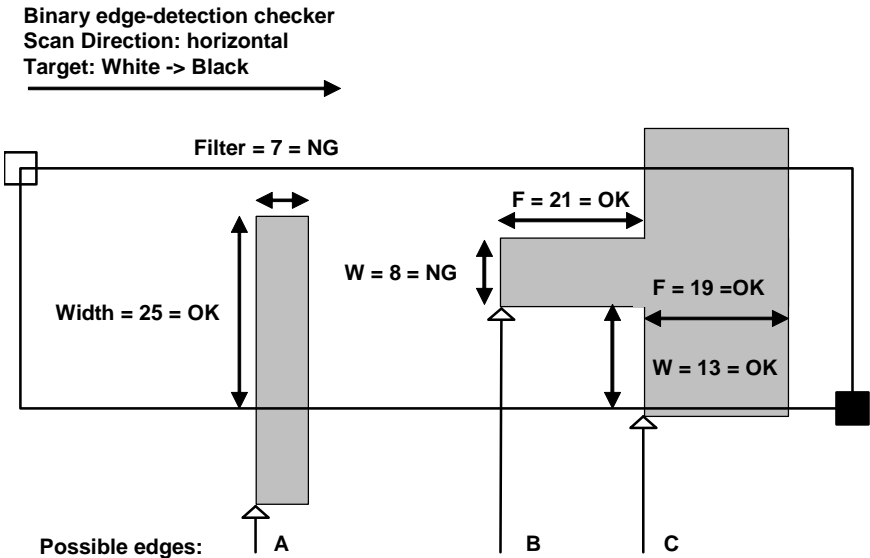
6.2.5.2 Edge Filters

You can use edge filters to ignore unwanted parts resembling an edge or an object by setting size conditions. If an object does not fulfill the minimum limits, it is not considered an edge and

will be ignored. The minimum limits are defined by an edge's width (parameter "Width") and depth (parameter "Filter").



◆ **EXAMPLE**



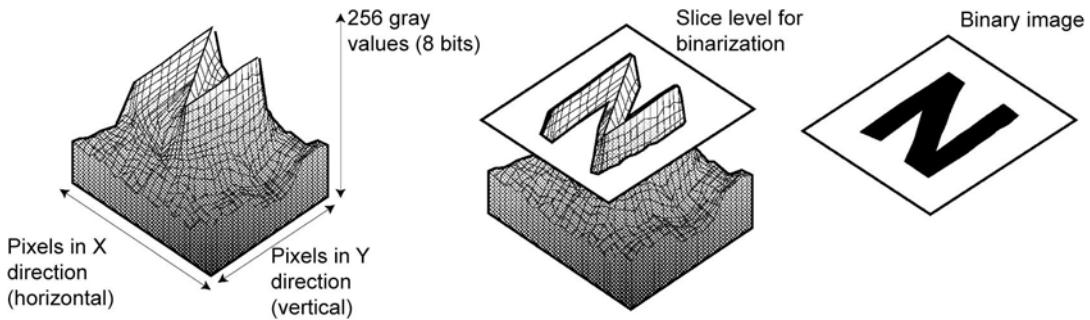
When you wish to detect edge C only, you need to set the parameters as follows:
Filter = 15, Width = 10:

Possible Edge	Filter Value	Width Value
A	7	25
B	21	8
C	19	13

6.2.6 Preprocessing an Image with Slice Levels (Binarization)

In the Imagechecker, the image signal from the camera is stored in the memory in the form of a gray-scale image (i.e. a set of image data including brightness data) with 256 gray values.

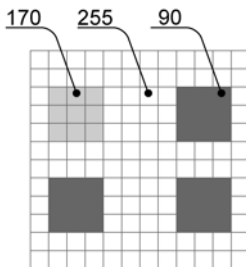
Feature extraction and edge detection checkers need binary images for processing. While gray-value images contain all gray values, binary images only contain black and white. This makes processing easier because objects can be easily separated into foreground and background.



To create a binary image, pixels brighter than a specified brightness level (slice level) are regarded as white, while pixels darker than the specified level are regarded as black.

The Imagechecker offers eight slice level groups (an upper and a lower limit form a group) that can be set individually (A, B, C, D, E, F, G, H). This makes it possible to use different slice levels for feature extraction and edge detection checkers. All gray values within the upper and the lower limit are displayed as white, all gray value outside the upper and the lower limit are displayed as black.

Gray-value image

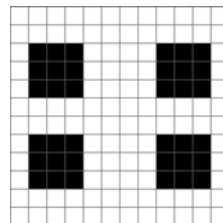


The gray-values of the objects and the background are displayed for information.

Setup of slice level A:

Upper limit = 255

Lower limit = 200



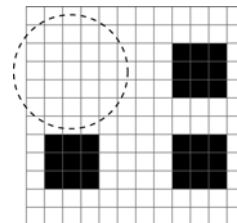
Pixels with gray values from 200 to 255 are regarded as white.

Pixels with gray values from 0 to 199 are regarded as black.

Setup of slice level B

Upper limit = 255

Lower limit = 150



Pixels with gray values from 150 to 255 are regarded as white. This is why the top left object is disregarded.

Pixels with gray values from 0 to 149 are regarded as black.

6.2.6.1 Configuring the Slice Level Groups

In order to set a slice level, please proceed as follows:



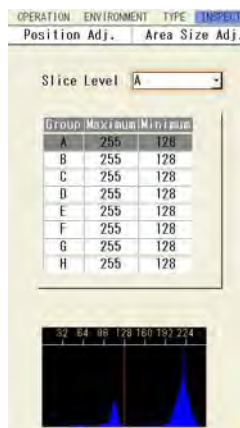
◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**

If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.

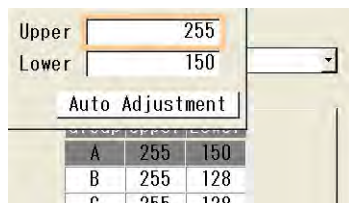
2. Select **"Slice Level"** from the submenu bar and press **<ENTER>**

On the left the setting area displays a table with all slice level groups A - H. Beneath the table, a histogram is displayed. The two red lines indicate the lower and the upper limit of the slice level.



3. Select a line and press **<ENTER>**

A setting window appears.



4. Enter the maximum and minimum with the keypad

or

Select the button **[Auto Adjustment]**

Refer to the histogram to see the effect of the select slice level.

5. Close the setting window with <CANCEL>



◆ NOTE

You can set or modify a slice level directly in the setting window of checkers working with binary images.

6.2.6.2 Assigning a Slice Level

If you want to execute an inspection checker on a preprocessed image, please proceed as follows:



◆ Procedure

1. In the checker-setting window, select "Inspection Condition" and press <ENTER>

Area Setting		Preprocess	
Inspection Condition		Preprocess	No
Judgement Limits		Slice Level	A
Judgement	NG	Count Pixel Color	White
Pixel Judgement	NG	Count Object Color	White
Objects Judgement	NG	Min. Object Size	5
No. of Pixels	0	Min. Gap Size	3
No. of Objects	0	Filter	No
Time(ms)	0.00		

2. Select "Slice Level" and press <ENTER>

The "Slice Level" window is displayed.

3. Select a slice level and press <ENTER>

When you select a group letter, the cursor jumps to the corresponding limits in the table below.

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

You can edit the slice level here the same way as you created it (see page 119).

4. Press <CANCEL> to return to the checker-setting window

6.2.7 Assigning a Position/Rotation Adjustment Checker

If the object to be inspected varies in its location and orientation, you need to adjust the inspection checker accordingly. Before you can assign a position adjustment checker, you need to set it up first (see page 275).

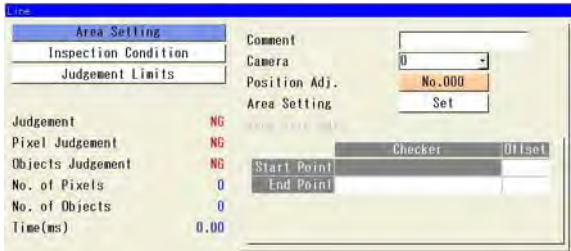


◆ Procedure

- 1. In the checker-setting window, select "Position Adj." and press <ENTER>



- 2. Select the checker number and press <ENTER>



This option is only available if a position or rotation adjustment checker has been set before (see page 275).

6.2.8 Assigning an Area Size Adjustment Checker

If the object to be inspected varies in size, you need to adjust the inspection checker accordingly. Before you can assign an area size adjustment checker, you need to set it up first (see page 275).



◆ NOTE

Area size adjustment is not available for:

- Smart matching checkers
- Connector (gray edge) checkers



◆ Procedure

1. In the checker-setting window, select "Area Size Adj." and press <ENTER>

This option is only available if an area size adjustment checker has been set before (see page 275).

Area Setting	
Inspection Condition	Comment
Judgement Limits	Camera
	Position Adj.
	Area Setting
	Area Size Adj.
Judgement	OK
Pixel Judgement	OK
Objects Judgement	OK
No. of Pixels	114
No. of Objects	1
Time(ms)	0.01

Checker	Offset
Start Point	
End Point	

The row "Start Point" of the table is highlighted.

2. Press <ENTER>

The "Area Size Adjustment" window opens with a list of all the area size adjustment checkers you have set so far. When you select a checker, the checker type is displayed in the box below for your information. In the example, checker 001 is a binary edge-detection checker.

Block No.	Checker No.	Checker Type
0		No
001	AA1	Gray Edge
002	AA2	
012	AA3	

Gray Edge

3. Select the checker number and press <ENTER>

Area Setting	
Inspection Condition	Comment
Judgement Limits	Camera
	Position Adj.
	Area Setting
	Area Size Adj.
Judgement	OK
Pixel Judgement	OK
Objects Judgement	OK
No. of Pixels	114
No. of Objects	1
Time(ms)	0.01

Checker	Offset
Start Point	No.000 AA1
End Point	

You return to the inspection checker-setting window. The selected area size adjustment checker is entered in the table.

4. Move the cursor to the right, if you want to enter an offset

The offset value modifies the result of the area size adjustment checker ([see page 321](#)).

5. Repeat the last three steps for the end point

6.3 Creating Checker Shapes

The following sections explain how to set shapes and masks. Depending on the checker type you have selected different shapes are available: line, broken line, arc, rectangle/plane, ellipse, circle, and polygon. The checker shapes are also referred to as "patterns".



◆ NOTE

The flaw detection and all types of connector checkers use a different kind of checker shape. Please refer to the checker description for details.

Checker type	Available shapes	Available masks
Line	Line Broken Line Ellipse (Arc)	---
Binary window	Rectangle Ellipse Circle Polygon	Rectangle Ellipse Circle Polygon
Gray window	Rectangle Ellipse Circle Polygon	Rectangle Ellipse Circle Polygon
Binary edge	Line Plane (Rectangle)	---
Gray edge	Line Plane (Rectangle) Ellipse (Arc)	---
Feature extraction	Rectangle Ellipse Circle Polygon	Rectangle Ellipse Circle Polygon
Smart matching	Template: Rectangle only	---
	Search area: Rectangle Ellipse Circle Polygon	Rectangle Ellipse Circle Polygon
Flaw detection	Line Plane (Rectangle) Ellipse (Arc)	Yes, but no shapes available, only complete cells can be masked.
Connector (binary window)	Line only	---
Connector (gray window)	Line only	---
Connector (gray edge)	Line only	---


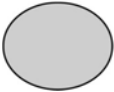


6.3.1 Color Scheme for Checker and Mask Shapes




In order to help you distinguish between the different checker and mask shapes, the Imagechecker uses a color scheme:

Color	Used for	Condition
Green	Checker shapes	In run and setup menu
Orange	Checker shapes and mask shapes	In setup menu when selected. Press <ENTER> for editing.
Blue	Mask shapes	In run and setup menu
Red	Checker and mask shapes	In run menu when the checker is judged to be NG

6.3.2 Creating Different Shapes

Here you find step-by-step procedures for creating or editing each of the shapes available for checkers and masks. The procedures apply regardless of the type of checker you wish to create (position or rotation adjustment or inspection checker).

Rectangle (Plane)	Ellipse	Circle	Polygon
 Procedure (see page 125)	 Procedure (see page 127)	 Procedure (see page 127)	 From 3 nodes (triangle) to 64 nodes (see page 129).

Line	Broken line	Elliptic arc
 Procedure (see page 131)	 Procedure (see page 131)	 Procedure (see page 134)



◆ NOTE

- Whenever you change the shape after setting a checker, the Imagechecker will always display the new shape in the default size and keep as close as possible to the position where you have set the last checker shape. If the last checker shape was very big, the Imagechecker positions the new shape in the image center.
- To speed up cursor movements, you can use the <SHIFT> key on the keypad. Pressing the <SHIFT> key moves the selected object (point or shape) by 10 pixel. When you rotate a rectangle, the <SHIFT> key allows you to rotate the rectangle by 0.01 degrees. Whenever the <SHIFT> key is available, you see a bright green message at the bottom right of your screen.

- Pressing <CANCEL> during the shape setting process takes you back one step in the procedure. You have finished setting the shape when it turns green in the display.

6.3.2.1 How to Create or Edit a Rectangle/Plane

The rectangular shape is used as a default for many checkers and masks.



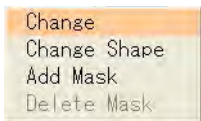
◆ Procedure

1. In the checker-setting window, select "Area Setting"



2. Select the button [Set] next to "Area Setting" and press <ENTER>

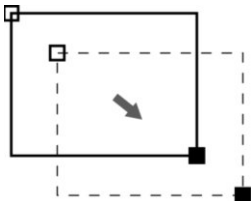
The screen displays the default shape (a green rectangle). At the same time, the "Area" menu appears on the left side of the screen.



3. Press <ENTER> on "Change"

The shape turns orange. A table appears below the "Area Setting" menu with the coordinates for the shape's start (ST) and end point (ED). Below the table there is a line for setting an angle.

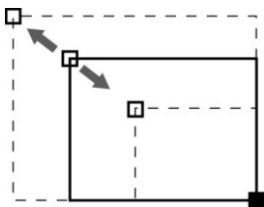
As long as you see both the start and the end point displayed, you move the complete checker by moving the cursor lever. Use the <SHIFT> key together with the cursor lever to move the shape by 10 pixels at once.



4. Press <ENTER> to move only the start point

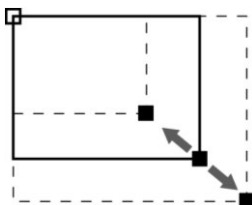
The start point is always displayed as a contoured square. In the table, the start point row is highlighted.

5. Tilt the cursor lever to move the start point from its current position



6. Press <ENTER> when the start point is in the desired position

Now only the end point of the checker shape is displayed. The end point is always displayed as a filled square. In the table, the end point row is highlighted.

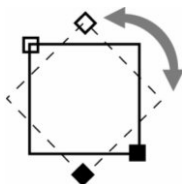


7. Tilt the cursor lever to move the end point from its current position

8. Press <ENTER> when the end point is in the desired position

The cursor moves to "Angle 0.00°" below the table with coordinates. The checker shape can be turned in a range of -45° to 45°.

9. Tilt the cursor lever to set the angle of the shape



Moving the cursor lever up or down rotates the shape by 1 degree. When you press the <SHIFT> key and move the cursor lever, you rotate the shape by 0.01 degree.

10. Press <ENTER>

The checker shape turns green again and the table with coordinates disappears.

11. Press <CANCEL> to return to the checker-setting window



◆ NOTE

Pressing <CANCEL> during the shape setting process takes you back one step in the procedure.

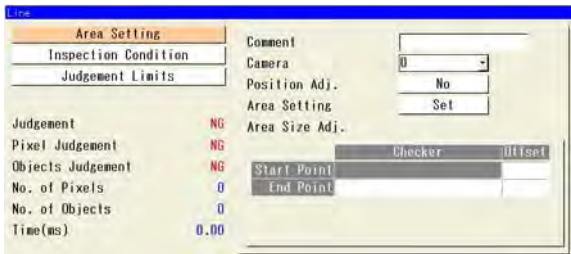
6.3.2.2 How to Create or Edit a Circle or Ellipse

The procedure describes how to create and edit an ellipse for a checker working on areas, e.g. the feature extraction checker or the gray window checker. For edge-detection checkers, please refer to the section on how to create an elliptic arc (see page 131). You can create a circle the same way, just substitute "circle" with "ellipse" in the procedure.



◆ Procedure

- 1. In the checker-setting window, select "Area Setting"



- 2. Select the button [Set] next to "Area Setting" and press <ENTER>

The screen displays the default shape (a green rectangle). At the same time, the "Area" menu appears on the left side of the screen.

- 3. Select "Change Shape" and press <ENTER>

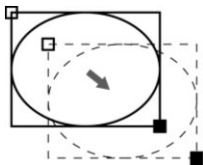
- 4. Select "Ellipse" and press <ENTER>

The default ellipse is displayed in green.

- 5. In the "Area" menu select "Change" and press <ENTER>

The shape turns orange. A table appears below the "Area Setting" menu with the coordinates for the shape's start (ST) and end point (ED). Below the table there is a line for setting an angle.

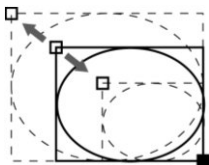
As long as you see both the start and the end point displayed, you move the complete checker by moving the cursor lever. Use the <SHIFT> key together with the cursor lever to move the shape by 10 pixels at once.



- 6. Press <ENTER> to move only the start point

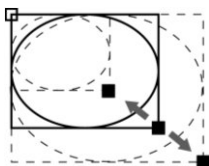
The start point is always displayed as a contoured square. In the table, the start point row is highlighted.

7. Tilt the cursor lever to move the start point from its current position



8. Press <ENTER> when the start point is in the desired position

Now only the end point of the checker shape is displayed. The end point is always displayed as a filled square. In the table, the end point row is highlighted.

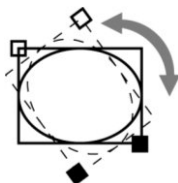


9. Tilt the cursor lever to move the end point from its current position

10. Press <ENTER> when the end point is in the desired position

When you create a circle, the setting is complete. When you create an ellipse, you can set an angle. The cursor moves to "Angle 0.00°" below the table with coordinates. The checker shape can be turned in a range of -45° to 45°.

11. Tilt the cursor lever to set the angle of the shape



Moving the cursor lever up or down rotates the shape by 1 degree. When you press the <SHIFT> key and move the cursor lever, you rotate the shape by 0.01 degree.

12. Press <ENTER>

The checker shape turns green again and the table with coordinates disappears.

13. Press <CANCEL> to return to the checker-setting window



◆ NOTE

Pressing <CANCEL> during the shape setting process takes you back one step in the procedure.

6.3.2.3 How to Create or Edit a Polygon

Polygon shapes are more complex than the other shapes. A polygon may have up to 64 points (vertexes). The default polygon shape is a rectangle with four points.



◆ Procedure

1. In the checker-setting window, select "Area Setting"

The screen displays the default shape (a green rectangle). At the same time, the "Area" menu appears on the left side of the screen.

2. Select the button [Set] next to "Area Setting" and press <ENTER>

3. Select "Change Shape" and press <ENTER>

4. Select "Polygon" and press <ENTER>

The screen displays the default shape for a polygon, a green rectangle.

5. Select "Change " and press <ENTER>

The rectangle turns orange to indicate that this is the shape you are currently editing. The polygon shape differs from the rectangle shape because there are no start and end points visible now. As long as you do not see any points displayed, you move the complete checker by moving the cursor lever. Use the <SHIFT> key together with the cursor lever to move the shape by 10 pixels at once.



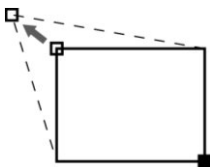
The shape turns orange. A table appears below the "Area Setting" menu with the coordinates for the shape's current 4 points.

N	X	Y
0	270	200
1	369	200
2	369	279
3	270	279

6. Press <ENTER> to display and edit the start point of the polygon

The currently active point is displayed as a contoured square. In the table, the corresponding row is highlighted.

7. **Tilt the cursor lever to move the start point from its current position**



8. **Press <ENTER> when the start point is in the desired position**

The start point is fixed at the position and displayed as a filled square. The cursor moves to the next polygon point.

9. **Repeat the steps for moving a point and confirming the new position with <ENTER> for all remaining polygon points**

The start point remains visible all the time. When you confirm the position of the last polygon point, the shape turns green and the table with coordinates disappears.

Adding Points to a Polygon Shape

When you need more than the standard 4 points for your polygon, please follow the procedure.



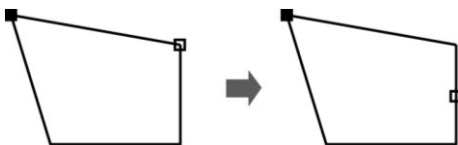
◆ Procedure

1. In the checker-setting window, select "Area Setting"
2. Select the button [Set] next to "Area Setting" and press <ENTER>
3. Press <ENTER> on "Change"
4. Press <ENTER> repeatedly until you reach the point after which you wish to add a point
5. Press <FUNC>

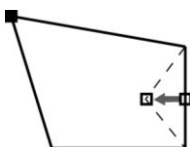
A submenu appears.

6. **Select "Add Vertex"**

The new point is inserted halfway between the last active point and the next point.



7. **Tilt the cursor to move the new point into the desired position**



8. Confirm the position of the new point with <ENTER>

The cursor jumps to the next point. If you need another point, repeat from step 4.

9. To finish editing the shape, press <ENTER> until the polygon shape turns green

or

Press <FUNC> and select "End" from the submenu

Deleting Points from a Polygon Shape

When you need to delete a point from a polygon shape, please follow this procedure.

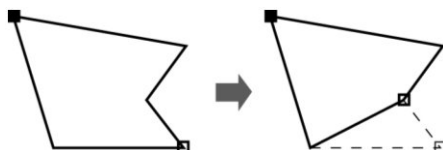
**◆ Procedure**

1. In the checker-setting window, select "Area Setting"
2. Select the button [Set] next to "Area Setting" and press <ENTER>
3. Press <ENTER> on "Change"
4. Press <ENTER> repeatedly until you reach the point to be deleted
5. Press <FUNC>

A submenu appears.

6. Select "Delete Vertex"

The point is deleted and the cursor jumps to the last point before the deleted point.

**◆ NOTE**

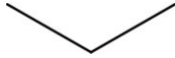
You do not have to confirm each polygon point with <ENTER> when there are many points and you have finished changing the polygon. To save the changes and return to the "Area Setting" menu, press <FUNC> and select "End".

6.3.2.4 How to Create or Edit a Line

There are three types of lines. Not all line types are available for all checker types. Refer to the corresponding section of the individual checkers for details on the shapes available

- Straight line —————

- Broken line



- Elliptic line (arc) (see page 134)



Straight line

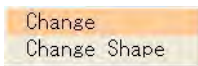


◆ Procedure

1. In the checker-setting window, select "Area Setting"

2. Select the button [Set] next to "Area Setting" and press <ENTER>

The screen displays the default shape (a green line). At the same time, the "Area" menu appears on the left side of the screen.



3. Press <ENTER> on "Change"

The shape turns orange. A table appears below the "Area Setting" menu with the coordinates for the line's start (ST) and end point (ED).

As long as you see both the start and the end point displayed, you move the complete checker by moving the cursor lever. Use the <SHIFT> key together with the cursor lever to move the shape by 10 pixels at once.



4. Press <ENTER> to move only the start point

5. Tilt the cursor lever to move the start point from its current position



6. Press <ENTER> when the start point is in the desired position

Now only the end point of the checker shape is displayed.

7. Tilt the cursor lever to move the end point from its current position



8. Press <ENTER> when the end point is in the desired position

The checker shape turns green again and the table with coordinates disappears.

9. Press <CANCEL> to return to the checker-setting window



◆ NOTE

Pressing <CANCEL> during the shape setting process takes you back one step in the procedure.

Broken line

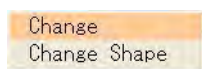


◆ Procedure

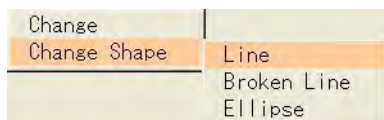
1. In the checker-setting window, select "Area Setting"

2. Select the button [Set] next to "Area Setting" and press <ENTER>

The screen displays the default shape (a green line). At the same time, the "Area" menu appears on the left side of the screen.



3. Select "Change Shape" and press <ENTER>



4. Select "Broken Line" and press <ENTER>

5. Select "Change" and press <ENTER>

The shape turns orange. A table appears below the "Area Setting" menu with the coordinates for the shape's current 2 points. This means currently the shape is still a straight line.

	X	Y
N	2	
0	270	240
1	369	240

6. Press <ENTER> to display and edit the start point of the broken line

The currently active point is displayed as a contoured square. In the table, the corresponding row is highlighted.

7. Tilt the cursor lever to move the start point from its current position

8. Press <ENTER> when the start point is in the desired position

The start point is fixed at the position and displayed as a filled square. The cursor moves to the next polygon point.

9. Press <FUNC>

A submenu appears.

10. Select "Add Vertex"

The new point is inserted halfway between the first point and the second point and highlighted.

N	X	Y
0	270	240
1	319	240
1	369	240

11. Tilt the cursor to move the new point into the desired position**12. Confirm the position of the new point with <ENTER>**

The cursor jumps to the end point. If you need another point, repeat from step 9.

13. Tilt the cursor to move the end point into the desired position**14. Confirm the position of the end point with <ENTER>**

The checker shape turns green again and the table with coordinates disappears.

15. Press <CANCEL> to return to the checker-setting window**6.3.2.5 How to Create an Elliptic Line (Arc)**

This shape is used only by the line checker and by the gray-value edge-detection checker. For the gray-value edge-detection checker you also need to set the scan direction clockwise or counterclockwise.

**◆ Procedure****1. In the checker-setting window, select "Area Setting"****2. Select the button [Set] next to "Area Setting" and press <ENTER>**

The screen displays the default shape (a green line). At the same time, the "Area" menu appears on the left side of the screen.

3. Select "Change Shape" and press <ENTER>**4. Select "Ellipse" and press <ENTER>**

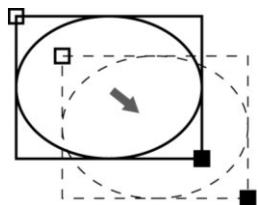
The default ellipse is displayed in green.

5. In the "Area" menu select "Change" and press <ENTER>

The shape turns orange. A table appears below the "Area Setting" menu with coordinates for four points. ST and ED are the start and end point of the rectangle surrounding the ellipse, SP and EP are the start and end point of the elliptic arc.

	X	Y
ST	271	201
ED	369	279
SP	369	240
EP	369	240

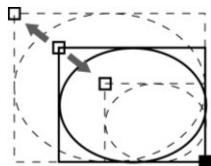
You need to define the ellipse before you can set the start and end point of the arc. As long as you see both the start and the end point displayed, you move the complete checker by moving the cursor lever. Use the <SHIFT> key together with the cursor lever to move the shape by 10 pixels at once.



6. Press <ENTER> to move only the start point

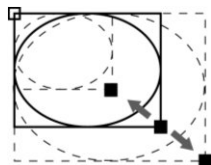
The start point is always displayed as a contoured square. In the table, the start point row is highlighted.

7. Tilt the cursor lever to move the start point from its current position



8. Press <ENTER> when the start point is in the desired position

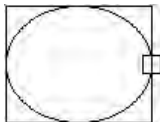
Now only the end point of the checker shape is displayed. The end point is always displayed as a filled square. In the table, the end point row is highlighted.



9. Tilt the cursor lever to move the end point from its current position

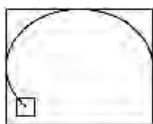
10. Press <ENTER> when the end point is in the desired position

Next, you set the start point of the arc. By default, the arc is the complete contour of the ellipse. In the table, the start point row is highlighted.



11. Tilt the cursor lever left or right to move the arc's start point from the current position

Tilting the cursor lever to the right moves the arc's start point clockwise. Tilting the cursor lever to the left moves the arc's start point counterclockwise.



12. Press <ENTER> when the arc's start point is in the desired position

Now only the end point of the arc is displayed. In the table, the end point row is highlighted.



13. If you are creating a gray-value edge-detection checker, press <FUNC>

If you are creating a line checker, the scan direction will automatically be from start to end point. For the gray-value edge-detection checker you can select which point will be the start point and thus you determine the scan direction as necessary.

14. Select the scan direction and press <ENTER>

You can choose to search clockwise or counterclockwise for edges.

15. Tilt the cursor lever to move the end point from its current position

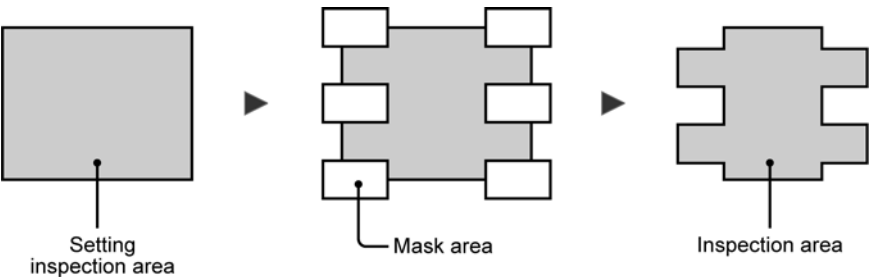
16. Press <ENTER> when the end point is in the desired position

When you confirm the position of the arc's end point, the shape turns green and the table with coordinates disappears.



6.4 Working with Masks

A mask is an area within an inspection area where inspection is not performed. Setting a mask is one way of adapting a checker's inspection area to a complex shape.



Using masks to exclude image areas from inspections



◆ NOTE

Masks are available for the following checker types only. You may set up to 16 masks per checker with the exception of the flaw-detection checker, where mask setting works differently (see page 222).

- Binary window
- Gray window
- Feature extraction
- Smart matching
- Flaw detection

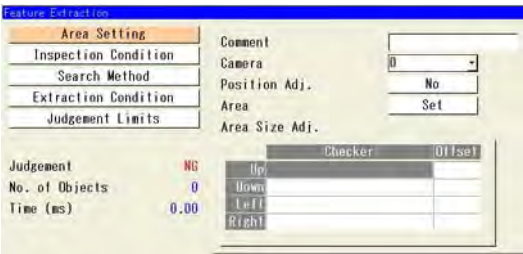
6.4.1 How to Create a Mask

The procedure explains how to add a mask to an existing feature extraction checker.



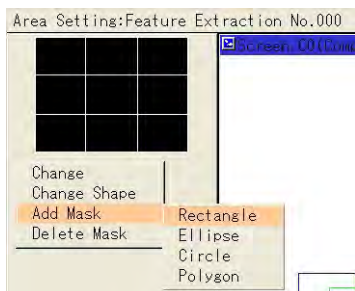
◆ Procedure

1. Create a feature extraction checker
2. In the checker setting menu, select "Area Setting" and press <ENTER>



The screen displays the memory image and the "Area" menu appears in the top left corner of the screen.

3. **Set the checker area as required**
4. **Select "Add Mask" and press <ENTER>**



5. **Select the mask shape you would like to use**

The selected shape appears in blue on the screen. You can edit the size and position of the mask shape (see page 138).

6.4.2 How to Change the Size and Position of a Mask Shape

The procedure below assumes that the "Area Setting" menu is still open at the left of the screen. If it is not open, select "Area Setting" from the checker-setting window first.



◆ Procedure

1. **Select "Change" from the "Area Setting" menu and press <ENTER>**
The currently active checker shape appears in orange, the mask shape in blue.
2. **Tilt the cursor lever up or down until the mask shape you wish to edit turns orange**
Only the shape displayed in orange is activated and can be changed in size and position. Green and blue shapes are inactive. This is important when you have set more than one mask shape.
3. **Press <ENTER>**
The table with coordinates appears below the "Area" menu.
4. **Edit the mask size and position**
The procedure is the same as for checker shapes (see page 124).



◆ NOTE

There are two differences between checker shape editing and mask shape editing:

- You can only change the shape of a mask by deleting the mask and creating it again.
- The mask shape does not return to its default color blue when you have edited all points. Instead, you need to pay attention to whether the start and/or end point is visible. If they are not, you have completed the editing cycle and may return to the "Area Setting" menu by pressing <CANCEL>. Then the table with coordinates disappears. Be careful with polygon mask shapes because they do not display start and end points until you have pressed <ENTER> a second time.

6.4.3 How to Delete a Mask Shape

In case you need to delete a mask, please proceed as follows:



◆ Procedure

1. In the checker-setting window, select "Area Setting"
2. Select "Delete Mask" and press <ENTER>
The mask shape turns orange. If you have set more than one mask, the first mask shape turns orange, while the other mask shapes remain blue.
3. If you have set more than one mask, select the mask to be deleted by tilting the cursor lever up and down until the desired mask shape turns orange
4. Press <ENTER>
The orange mask shape is deleted from the screen and you return to the "Area Setting" menu.

6.5 Managing Checkers

All existing checkers can be copied, pasted or deleted. Furthermore, it is possible to limit the checker display so that only the checkers judged with NG are visible.

6.5.1 Copying Checkers

This feature saves you work when you need to set up multiple checkers of the same type and with almost identical settings.



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**

If the RUN menu is active, press **<OPE/SET>** to activate the SETUP menu.

2. Select **"Checker"** from the submenu bar and press **<ENTER>**

3. Select the checker you wish to copy

4. Press **<FUNC>**

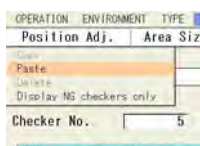
A pop-up menu appears in the top left corner.

5. Select **<Copy>** and press **<ENTER>**

6. Select the number where you wish to copy the checker

7. Press **<FUNC>**

A pop-up menu appears in the top left corner.



8. Select **"Paste"** and press **<ENTER>**

The copied checker is inserted at the selected checker number. If you paste the checker at a position where you have already set a checker, a message asks you to confirm that you want to overwrite the existing checker.

9. **Edit the checker copy as necessary**

For further information see the corresponding section on the checker type.

6.5.2 Deleting Checkers



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Checker"** from the submenu bar and press **<ENTER>**
3. Select the checker you wish to copy
4. Press **<FUNC>**
A pop-up menu appears in the top left corner.
5. Select **<Delete>** and press **<ENTER>**
A message asking for confirmation is displayed.
6. Select **"Yes"** and press **<ENTER>**
The checker is deleted and disappears from the checker list.

6.5.3 Limiting the Display to NG Checkers

You can filter the checker display to show only the checkers which have been judged as NG at the last inspection. The filter works per checker type. Please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Checker"** from the submenu bar and press **<ENTER>**
3. Press **<FUNC>**
A pop-up menu appears in the top left corner.
4. Select **"Display NG checkers only"**
Only the checkers that are judged as NG are listed and displayed. When **"None"** is displayed, no checkers of the selected checker type is judged as NG.
5. To return to the normal display, repeat steps 1 to 4

6.5.4 Group Move

Group move is a function for moving a group of checkers which are either of the same type or which use the same position or rotation adjustment checker. The Imagechecker uses two colors to indicate which checker shapes will be moved or not:

- Red shapes will be moved
- Green shapes will not be moved

6.5.4.1 Moving Checkers depending on a Position Adjustment Checker

To move a group of checkers using the same position or rotation adjustment checker, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**

If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.

2. Select **"Group Move"** from the submenu bar and press **<ENTER>**

3. Set the camera number for which you want to move checkers

4. Select the number of the position adjustment checker

All checker shapes depending on the selected position adjustment checker are displayed in red.

5. Deselect the types of checkers excluded from moving (if any)

By default, all checker types will be moved. If you wish to exclude a certain type of checker, set that type to "No." and it will not be moved.

6. Select **"Move"** and press **<ENTER>**

Use the cursor lever to move the checker shapes to the new position.

7. Press **<ENTER>**

A confirmation message appears asking whether you wish to register the new checker positions.

8. Select **"Yes"** and press **<ENTER>**

You return to the "Group Move" dialog window.

9. Press **<CANCEL>** twice to close the **"Group Move"** dialog window

**◆ NOTE**

- **Position and rotation adjustment checkers cannot be moved by "Group Move".**
- **If the option "Move" is grayed out, it means there are no checkers available for the selected checker type or position or rotation adjustment checker.**
- **All results are cleared for checkers which have been moved with the "Group Move" function.**

6.6 Error Codes

When the ERROR 0 or ERROR 1 signal goes on, processes such as image inspection or type switching have not been completed correctly.

The following error codes may be displayed when you are using the Imagechecker:

Error No.	Problem	Troubleshooting	Signal
E0100	<ul style="list-style-type: none"> BCC (Block check code) error The Imagechecker has received an undefined command. 	Check the command and correct it.	ERROR 1
E0151	Calculation result has overflowed. The result of the numerical calculation is outside the valid range for calculations. -2147483648 to $+2147483647$ $= -2^{31}$ to $2^{31} - 1$	Check the expression of the numerical calculation or judgement formula which is displayed with an "E" sign in the Checker List.	ERROR 0
E0152	Division by 0 attempted. The numerical calculation contains a denominator that is or becomes 0.	Check the expression of the numerical calculation or judgement formula which is displayed with an "E" sign in the Checker List.	ERROR 0
E0153	Missing settings. The formula contains an unspecified checker or formula result (the referred item may have been deleted after the formula was created).	Check the expression of the numerical calculation or judgement formula which is displayed with an "E" sign in the Checker List.	ERROR 0
E0160	The position adjustment checker for the detect trigger has not been set (when "Camera Trigger" = "Detect Trigger (common)").	Set position adjustment checker No. 0 as the detect trigger.	ERROR 0
E0200	The Imagechecker is in stop mode, and the Imagechecker has received one of the following commands: <ul style="list-style-type: none"> Start trigger for executing an inspection Register template for a smart matching checker 	Switch to RUN mode.	ERROR 0
E0200	The Imagechecker is in stop mode, and the Imagechecker has received one of the following commands: <ul style="list-style-type: none"> Switch type Change layout Read or write parameters Save or read type or images to or from a SD memory card. Print screen Clear the save image memory Read or save data from or to the Imagechecker Reset statistics 	Switch to RUN mode.	ERROR 1
E0201	The Imagechecker has received a command specifying a block number, but the execution mode is set to "Execute All" or "Automatic Switch".	Send an inspection start command without a block number.	ERROR 0

Error No.	Problem	Troubleshooting	Signal
E0201	<p>The Imagechecker has received a command specifying a camera number, but this is incompatible with the setting of "Camera Trigger" to "Common".</p> <p>The Imagechecker has received a command without a camera number, but this is incompatible with the setting of "Camera Trigger" to "Individual".</p>	Send a command that matches the setting of "Camera Trigger".	ERROR 0
E0202	<p>This error can occur when execution mode is set to "User-Defined".</p> <ul style="list-style-type: none"> The specified block number does not exist. An inspection start command was sent without block number. 	Send an inspection start command specifying a block number.	ERROR 0
	<p>This error can occur when execution mode is set to "User-Defined" and "Camera Trigger" is set to "Individual".</p> <ul style="list-style-type: none"> An inspection start command was sent with different block numbers. 	Send inspection start commands specifying the same block number.	ERROR 0
E0203	<ul style="list-style-type: none"> An image capturing error has occurred. There is no camera connected. The camera cable is disconnected or loose. A timeout has occurred for the individual trigger: When "Camera Trigger" is set to "Independent" and the "Individual Trigger Timeout" has been set, all image capturing signals have to be input within the specified timeout period. When "Camera Trigger" is set to "Independent": The inspection start command contained the number of a camera that is not connected. A reinspection command has been sent, but there is no image in the image memory (the Imagechecker has just been switched on and there has been no start command before). 	<ul style="list-style-type: none"> Check the connections Check the command signals <p>If the error reoccurs, try the following:</p> <ul style="list-style-type: none"> Switch off the power and reconnect the camera cable. Replace the camera cable. 	ERROR 0
E0212	The specified area number for saving data to or reading data from the Imagechecker or SD memory card was outside the valid range of 00 to 99.	Send an inspection start command specifying a correct area number.	ERROR 1
E0213	<p>This error can occur when you try to read setting data from a SD memory card.</p> <ul style="list-style-type: none"> SD memory card not inserted. SD memory card cannot be read. No data file in the specified area on the SD memory card. 	<ul style="list-style-type: none"> Check the SD memory card slot. Check the contents of the SD memory card 	ERROR 1

Error No.	Problem	Troubleshooting	Signal
E0214	<ul style="list-style-type: none"> The data file is not a valid data file for the Imagechecker. The data file is incompatible (e.g. later version, etc.). The number and types of cameras connected to the Imagechecker is different from the settings of the data file. 	Prepare a correct data file.	ERROR 1
E0216	<p>This error can occur when you try to save setting data to a SD memory card.</p> <ul style="list-style-type: none"> SD memory card not inserted. SD memory card cannot be read. SD memory card capacity is used up. SD memory card is write-protected. 	Insert a SD memory card with enough free space and without write-protection..	ERROR 1
E0230	The Imagechecker received a template setting command when the SETUP menu was active.	Switch to the RUN menu.	ERROR 0
E0230	<ul style="list-style-type: none"> The Imagechecker received a template setting command when "Camera Trigger" is set to "Detect Trigger (common)". The Imagechecker received a template setting command when "Continuous Inspection" is set to "Automatic" (repeated start). 	Select a different setting for "Camera Trigger" or "Continuous Inspection" and then send the template setting command.	ERROR 0
E0230	<p>Wrong order of commands when setting the template via the serial interface:</p> <ul style="list-style-type: none"> While "Area Display" is set to "Yes", the command %A was sent when %Accc,?? was expected . While "Area Display" is set to "Yes", the command %Accc,?? was sent when %A was expected . 	Enter the commands in the correct order: First %Accc,??, then %A.	ERROR 0
E0231	<ul style="list-style-type: none"> The specified checker or template number does not exist. The command contains a checker number outside the range of 000 to 999 or a template number outside the range of 00 to 63. 	Specify a correct checker number or template number.	ERROR 0
E0232	The template cannot be registered because "Template Setting" = "Use the Last Image", but no image has been captured since the Imagechecker has been switched on.	Execute an inspection, or set "Template Setting" to "Capture New Image".	ERROR 0
E0233	The image to be used for template registration has no features.	Check the captured image.	ERROR 0
E0245	The Imagechecker is in RUN mode, but the SETUP menu is active. You cannot switch the layout.	Switch to OPERATION window,	ERROR 1
E0246	<ul style="list-style-type: none"> The command contains a layout number outside the range of 00 to 31. No layout has been registered The specified layout number does not exist. 	Send an inspection start command specifying a correct layout number.	ERROR 1
E0250	The Imagechecker is in the SETUP menu so it is not possible to write parameters.	Switch to the RUN menu.	ERROR 1

Error No.	Problem	Troubleshooting	Signal
E0251	The specified parameters are not correct: <ul style="list-style-type: none"> The parameter is undefined. The parameter values are such that the maximum value is smaller than the minimum value. 	Specify correct parameters.	ERROR 1
E0252	The specified parameters are not correct: <ul style="list-style-type: none"> The specified parameter does not exist. The specified parameter value is outside the valid range, e.g. upper value for slice level greater than 255). 	Specify correct parameters.	ERROR 1
E0255	This error can occur when you try to output images to a SD memory card. <ul style="list-style-type: none"> SD memory card not inserted. SD memory card capacity is used up. SD memory card is write-protected. 	Insert a SD memory card with enough free space and without write-protection.	ERROR 1
E0256	The option "Output Conditions" is not set to "Command Reception" (ENVIRONMENT → Input/Output → Image Output).	Set "Output Conditions" to "Command Reception".	ERROR 1
E0260	This error can occur when you try to save images on a SD memory card. <ul style="list-style-type: none"> SD memory card not inserted. SD memory card capacity is used up. SD memory card is write-protected. 	Insert a SD memory card with enough free space and without write-protection.	ERROR 1
E0260	When you try to save the Image memory on a SD memory card, there is no empty folder. All the folders from 00 to 99 are used.	Delete all or some folders in the "Backup" folder of the SD memory card.	ERROR 1
E0265	This error can occur when you try to save a screenshot on a SD memory card. <ul style="list-style-type: none"> SD memory card not inserted. SD memory card capacity is used up. SD memory card is write-protected. 	Insert a SD memory card with enough free space and without write-protection.	ERROR 1
E0266	This error can occur when you try to save a screenshot on the PC: <ul style="list-style-type: none"> Ethernet communication cannot be established. Image Receiver is not activated. 	Check the connections and whether the Image Receiver software is running.	ERROR 1



◆ NOTE

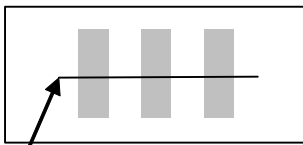
To turn off the Error 1 signal, send the correct signal.

Chapter 7

Inspection Checker Details

7.1 Line Checker

In a binary image, use this checker to count black or white pixels. You may set a limit for the obtained number of pixels and if the measured result is within the range, the object is judged OK, otherwise it is judged NG.



Checker area

The checker has the following properties:

Checker properties		Additional information
Checker shapes available	Line Broken line Ellipse	
Masks available	Not available	
Results	Judgement	This is the total judgement result. It combines the dot and land judgement results. If both are OK, the total judgement is OK. If one of them or both are NG, the total judgement is NG.
	Pixel judgement	If the dot count is within the minimum and maximum limits you have set, the dot judgement is "OK", if it exceeds the limits, the dot judgement is "NG".
	Objects judgement	If the land count is within the minimum and maximum limits you have set, the land judgement will be judged as "OK", if it exceeds the limits, the land judgement is "NG".
	Dot count	Outputs the number of pixels with the target color on the line.
	Land count	Outputs the number of objects (lands). A land or object is a string of neighboring pixels of the target color.



◆ EXAMPLE

Checker area: 

Target color: black

Dot count = 7

Land count = 2

7.1.1 Special Checker Parameters

The following parameters are specific to this checker:

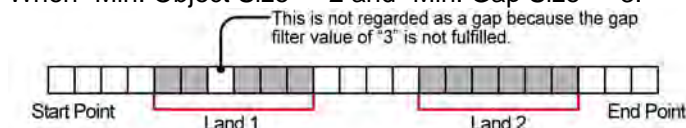
Select	Parameter	Description
Inspection condition	Count pixel color	Target color of the pixels to be counted (white or black)
	Count object color	Target color of the objects (lands) to be counted (white or black)
	Min. object size	Determines how many pixels of the target color must be detected as a minimum to be regarded as an object (land)
	Min. gap size	Determines how many pixels of a color different from the target color must be detected between objects (lands) to qualify as a gap.
	Filter	Use a dilation or erosion filter (see page 115).
Judgement limits	No. of pixels max./min.	Upper/lower limit for the number of pixels in the target color to be detected
	No. of objects max./min.	Upper/lower limit for the number of objects (lands) in the target color to be detected



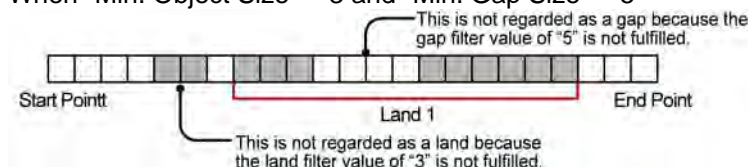
◆ EXAMPLE

The options "Count Pixel Color" and "Count Object Color" are set to "Black". Depending on the settings of "Min. Object Size" and "Min. Gap Size", the Imagechecker counts more or less objects.

When "Min. Object Size" = 2 and "Min. Gap Size" = 3:



When "Min. Object Size" = 3 and "Min. Gap Size" = 5:



7.1.2 Setting Procedure

In order to set up this checker, please proceed as follows:

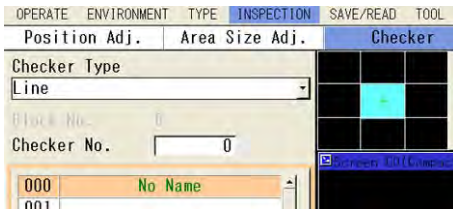


◆ Procedure

1. In the **SETUP** menu, select "**INSPECTION**" from the menu bar and press **<ENTER>**

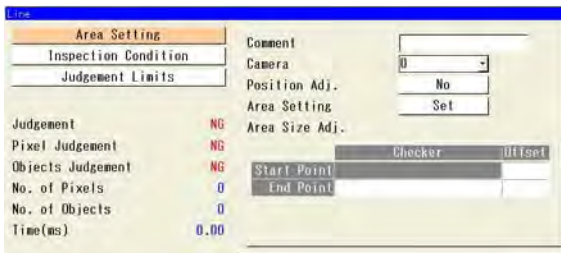
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.

2. Select "Checker" from the submenu and press <ENTER>
3. Select "Line" under "Checker Type" and press <ENTER>
4. Select a checker number and press <ENTER>



The setting window appears. The displayed camera image is binary.

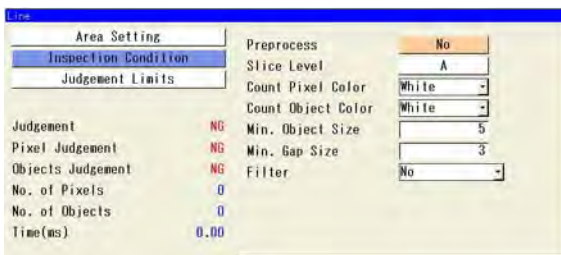
5. Press <ENTER> on "Area Setting"



6. Set the camera number

The image from the selected camera is displayed as a binary image. Next, set preprocessing tools such as filters and slice levels. You can select to see the gray-value image via the image menu (see page 76).

7. Press <CANCEL>
8. Select "Inspection Condition" and press <ENTER>



9. Select a preprocessing group if you want to preprocess the image

You can define up to 5 preprocessing groups (see page 109).

10. Select a slice level

The slice levels are used to create a binary image. You can define up to 8 slice level groups (A - H) (see page 114).

11. Under "Count Pixel Color" select the target color for the pixels to be detected

The default setting is "White".

12. Under "Count Object Color" select the target color for the pixels to be detected

The default setting is "White".

13. Set the "Min. Object Size" to define the minimum size of an object

14. Set the "Min. Gap Size" to define the minimum gap size between objects

15. Set a filter under "Filter", if necessary

In addition to the filters available under preprocessing (see page 109) you can add erosion and dilation filters (see page 115). The image display is updated automatically.

16. Press <CANCEL>

17. Select "Area Setting" and press <ENTER>

18. Under "Position Adj." you can enter the number of a position or rotation adjustment checker

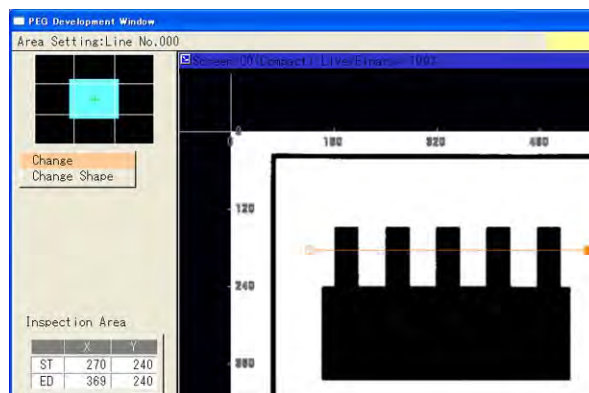
This option is only available if a position or rotation adjustment checker has been set before (see page 275).

Next, you need to select and set the shape of the checker.

19. Select the button [Set] next to "Area Setting" and press <ENTER>

The default shape is displayed on the screen.

20. Set the inspection area of the checker



The shapes available are line, broken line, and arc (see page 131).

21. When you have finished setting the checker shape, press <CANCEL> to return to the checker-setting window

22. Use an area-size adjustment, if necessary

This option is only available if you have already configured an area-size adjustment checker (see page 314).

23. Press <CANCEL>**24. Select "Judgement Limits" and press <ENTER>**

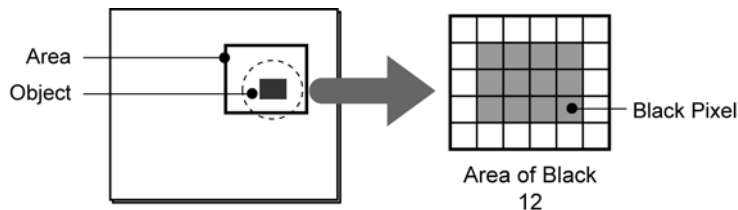
The options on this page are used to enter the limits for judging the detected number of pixels and objects.

25. Set the maximum and minimum values**26. Press <TRIG> to execute the checker for testing**

When a live image is displayed, the Imagechecker captures a new image first and then executes the checker. When a memory image is displayed, the Imagechecker runs a test using the current memory image. The checker results are displayed on the left side of the checker-setting window.

7.2 Binary Window Checker

In a binary image, use this checker to count black or white pixels. You may set a limit for the obtained number of pixels and if the measured result is within the range, the object is judged OK, otherwise it is judged NG.



The checker has the following properties:

Checker properties		Additional information
Checker shapes available	Rectangle Ellipse Circle Polygon	
Masks available	Rectangle Ellipse Circle Polygon	You can set up to 16 masks.
Results	Judgement	If the pixel count is within the minimum and maximum limits you have set, the judgement is "OK", if it exceeds the limits, the judgement is "NG".
	Area	Outputs the number of pixels with the target color.

7.2.1 Special Checker Parameters

The following parameters are specific to this checker:

Select	Parameter	Description
Inspection condition	Target	Determines the target color for the pixel count (white or black).
	Filter	Use a dilation or erosion filter (see page 115).

7.2.2 Setting Procedure

In order to set up this checker, please proceed as follows:

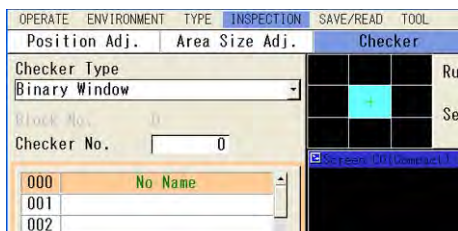


◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**

If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

2. Select "Checker" from the submenu and press <ENTER>
3. Select "Binary Window" under "Checker Type" and press <ENTER>
4. Select a checker number and press <ENTER>



The setting window appears. The displayed camera image is binary.

5. Select "Area Setting"

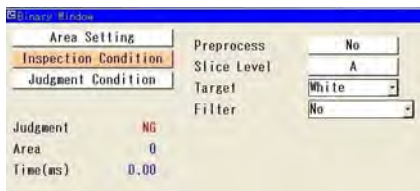


6. Set the camera number

The image from the selected camera is displayed as a binary image. Next, set preprocessing tools such as filters and slice levels. You can select to see the gray-value image via the image menu (see page 76).

7. Press <CANCEL>

8. Select "Inspection Condition" and press <ENTER>



9. Select a preprocessing group if you want to preprocess the image

You can define up to 5 preprocessing groups (see page 109).

10. Select a slice level

The slice levels are used to create a binary image. You can define up to 8 slice level groups (A - H) (see page 114).

11. Set the color to be detected under "Target"

The default setting is "White".

12. Set a filter under "Filter", if necessary

In addition to the filters available under preprocessing (see page 109) you can add erosion and dilation filters (see page 115). The image display is updated automatically.

13. Press <CANCEL>

14. Select "Area Setting" and press <ENTER>

15. Under "Position Adj." you can enter the number of a position or rotation adjustment checker

This option is only available if a position or rotation adjustment checker has been set before (see page 275).

Next, you need to select and set the shape of the checker.

16. Select the button [Set] next to "Area Setting" and press <ENTER>

The default shape is displayed on the screen.

17. Set the inspection area of the checker

The shapes available are rectangle, ellipse, circle, and polygon (see page 124).

18. When you have finished setting the checker shape, press <CANCEL> to return to the checker-setting window

19. Add one or more masks, if necessary

Masks allow you to exclude parts of the checker area from the inspection. You can set up to 16 masks (see page 137).

20. Use an area-size adjustment, if necessary

This option is only available if you have already configured an area-size adjustment checker (see page 314).

21. Press <CANCEL>

22. Select "Judgement Limits" and press <ENTER>

The options on this page are used to enter the limits for judging the detected number of pixels.

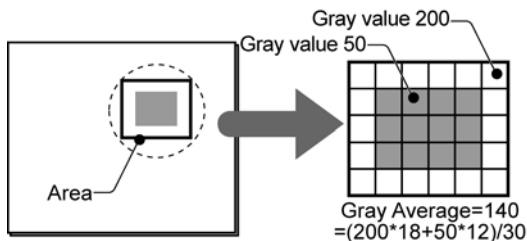
23. Set the maximum and minimum values in pixels

24. Press <TRIG> to execute the checker for testing

When a live image is displayed, the Imagechecker captures a new image first and then executes the checker. When a memory image is displayed, the Imagechecker runs a test using the current memory image. The checker results are displayed on the left side of the checker-setting window.

7.3 Gray Window Checker

Use this checker to calculate the gray average of the pixels within the checker shape. If the gray average is within the range you have defined under "OK Judge Max./Min.", it will be judged "OK". If the gray average is outside the range, it will be judged "NG". Use this checker if you wish to inspect or compare the brightness of different areas.



The checker has the following properties:

Checker properties		Additional information
Checker shapes available	Rectangle Ellipse Circle Polygon	
Masks available	Rectangle Ellipse Circle Polygon	You can set up to 16 masks.
Results	Judgement	If the average gray-value is within the minimum and maximum limits you have set, the judgement is "OK", if it exceeds the limits, the judgement is "NG".
	Gray average	Average gray value of the pixels in the checker shape

7.3.1 Setting Procedure

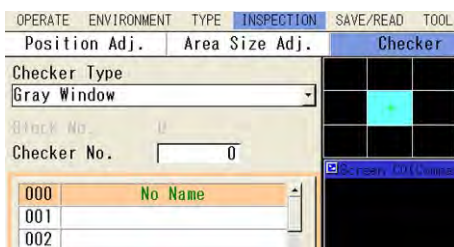
In order to set up this checker, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
 If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Checker"** from the submenu and press **<ENTER>**
3. Select **"Gray Window"** under **"Checker Type"** and press **<ENTER>**

4. Select a checker number and press <ENTER>



The setting window appears.

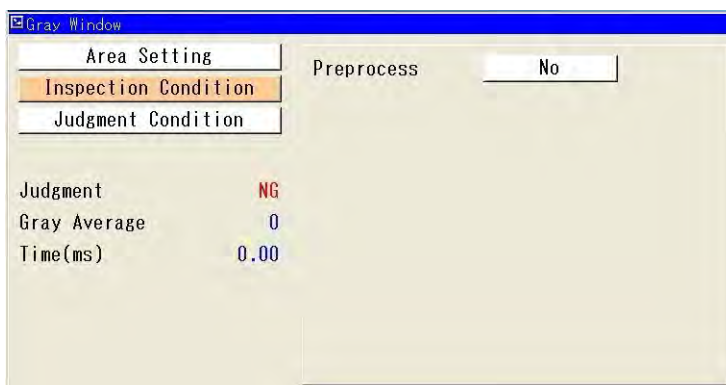
5. Select "Area Setting"

6. Set the camera number

The image from the selected camera is displayed as a binary image. Next, set preprocessing tools such as filters and slice levels. You can select to see the gray-value image via the image menu (see page 76).

7. Press <CANCEL>

8. Select "Inspection Condition" and press <ENTER>



9. Select a preprocessing group if you want to preprocess the image

You can define up to 5 preprocessing groups (see page 109).

10. Press <CANCEL>

11. Select "Area Setting" and press <ENTER>

12. Under "Position Adj." you can enter the number of a position or rotation adjustment checker

This option is only available if a position or rotation adjustment checker has been set before (see page 275).

Next, you need to select and set the shape of the checker.

13. Select the button [Set] next to "Area Setting" and press <ENTER>

The default shape is displayed on the screen.

14. Set the inspection area of the checker

The shapes available are rectangle, ellipse, circle, and polygon (see page 124).

15. Add one or more masks, if necessary

Masks allow you to exclude parts of the checker area from the inspection. You can set up to 16 masks (see page 137).

16. When you have finished setting the checker shape, press <CANCEL> to return to the checker-setting window**17. Use an area-size adjustment, if necessary**

This option is only available if you have already configured an area-size adjustment checker (see page 314).

18. Press <CANCEL>**19. Select "Judgement Limits" and press <ENTER>**

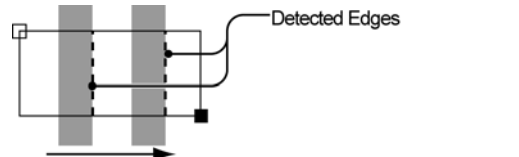

The options on this page are used to enter the limits for judging the detected average gray value.

20. Set the maximum and minimum values**21. Press <TRIG> to execute the checker for testing**





When a live image is displayed, the Imagechecker captures a new image first and then executes the checker. When a memory image is displayed, the Imagechecker runs a test using the current memory image. The checker results are displayed on the left side of the checker-setting window.

7.4 Binary Edge-Detection Checker

Use this checker to detect edges. In a binary image, an edge is a transition or color change from white to black or vice versa. The result of the binary edge checker are the number of edges detected and the edge coordinates X and Y. The column "Detect Color" indicates the color transition: "+" means a black-to-white edge, "-" means a white-to-black edge. If the number of edges detected is within the judgement limits, the checker is judged "OK"; if not, the checker is judged "NG".

Examples for a gray edge-detection checker	Parameter	Setting
	Scan direction	Horizontal
	Target	Black -> White (+)
	Detected position	All
	Scan direction	Vertical
	Target	White -> Black (-)
	Detected position	Front

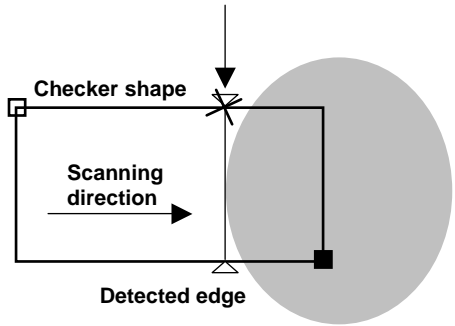
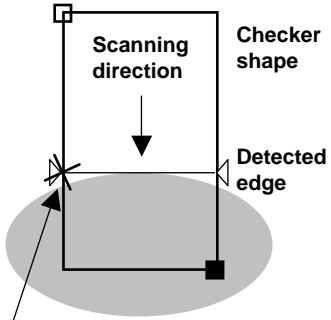
The checker has the following properties:

Checker properties		Additional information
Checker shapes available	Line Rectangle (Plane)	<ul style="list-style-type: none">Line: Fast, but unreliable for noisy camera images or for detecting the edges of circular or pointed objects. Plane (Rectangle): Slower, but also reliable for noisy images and all types of objects. 
Masks available	Not available	
Results	Judgement	If the edge count is within the minimum and maximum limits you have set, the judgement is "OK", if it exceeds the limits, the judgement is "NG".
	No. of Objects	Outputs the number of edges meeting the search conditions.
	X/Y-coordinate	Coordinates of the detected edge (see note below).
	Detect color	Type of edge detected: <ul style="list-style-type: none">"+" means a black-to-white edge"-" means a white-to-black edge



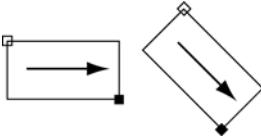
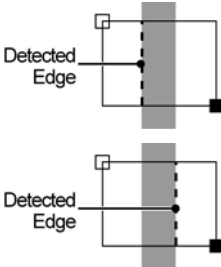
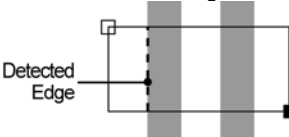
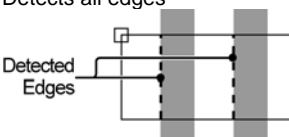
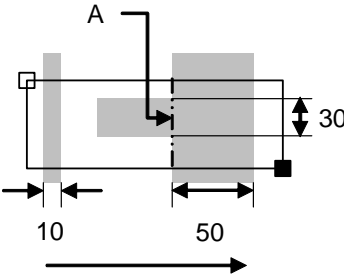
◆ NOTE

The following rules apply for the output of X- and Y-coordinates:

Direction	X-coordinate	Y-coordinate	Example
Horizontal	X-coordinate of the point where the vertical line representing the detected edge meets the checker shape (the point is marked by a cross in the example)	Smallest Y-coordinate of the checker shape	<p>Checker result = coordinates of this point</p> 
Vertical	Smallest X-coordinate of the checker shape	Y-coordinate of the point where the vertical line representing the detected edge meets the checker shape (the point is marked by a cross in the example)	 <p>Checker result = coordinates of this point</p>

7.4.1 Special Checker Parameters

The following parameters are specific to this checker:

Select	Parameter	Description
Inspection condition	Scan direction	<p>Horizontal or vertical search for edges. The search is performed from the start to the end point of the shape.</p> <p>If you have set the shape at an angle, the scan direction will use the angle for the search.</p> <p>Scan direction = Horizontal, Angle = 45°</p> 
	Target	<p>Edge type to be detected:</p>  <ul style="list-style-type: none">• White -> Black:• Black -> White:• Both:
	Detected position	<ul style="list-style-type: none">• Front: Detects the first edge  <p>No. of Objects = 1</p> <ul style="list-style-type: none">• All: Detects all edges  <p>No. of Objects = 2</p>
	Filter	Use a dilation or erosion filter (see page 115).
Search method	Filter	Minimum edge depth in scan direction (see page 172)
	Width	<p>Minimum edge width across the shape (see page 172)</p>  <p>To only detect edge "A", set "Filter" = 20 and "Width" = 40.</p>

7.4.2 Setting Procedure

In order to set up this checker, please proceed as follows:

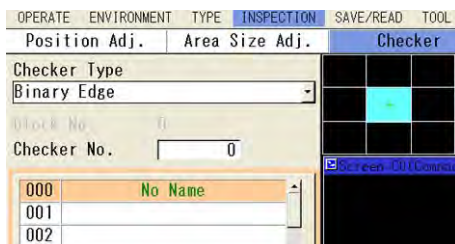


◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**

If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.

2. Select **"Checker"** from the submenu and press **<ENTER>**
3. Select **"Binary Edge"** under **"Checker Type"** and press **<ENTER>**
4. Select a checker number and press **<ENTER>**



The setting window appears. The displayed camera image is binary.

5. Select **"Area Setting"**
6. Set the camera number
The image from the selected camera is displayed as a binary image. Next, set preprocessing tools such as filters and slice levels. You can select to see the gray-value image via the image menu (see page 76).
7. Press **<CANCEL>**
8. Select **"Inspection Condition"** and press **<ENTER>**
9. Select a preprocessing group if you want to preprocess the image
You can define up to 5 preprocessing groups (see page 109).
10. Select a slice level
The slice levels are used to create a binary image. You can define up to 8 slice level groups (A - H) (see page 114).
11. Select **"Scan Direction"** and set the search direction for the checker
The default setting is "Horizontal".
12. Select **"Edge Condition"** and set the color change to be detected
The default setting is "Both" (White -> Black and Black -> White).

13. Set the "Detected Position"

You can search for the first edge ("Front") or all edges ("All").

14. Set a filter under "Filter", if necessary

In addition to the filters available under preprocessing (see page 109) you can add erosion and dilation filters (see page 115). The image display is updated automatically.

15. Press <CANCEL>**16. Select "Search Method" and press <ENTER>****17. Set the edge-detection parameters "Filter" and "Width"**

Try the default settings first. If the default settings fail to detect objects you wish to detect, change the settings (see page 116).

18. Press <CANCEL>**19. Select "Area Setting" and press <ENTER>****20. Under "Position Adj." you can enter the number of a position or rotation adjustment checker**

This option is only available if a position or rotation adjustment checker has been set before (see page 275).

Next, you need to select and set the shape of the checker.

21. Select the button [Set] next to "Area Setting" and press <ENTER>

The default shape is displayed on the screen.

22. Set the inspection area of the checker

The shapes available are line (see page 131) and rectangle (plane) (see page 125).

23. When you have finished setting the checker shape, press <CANCEL> to return to the checker-setting window**24. Use an area-size adjustment, if necessary**

This option is only available if you have already configured an area-size adjustment checker (see page 314).

25. Press <CANCEL>**26. Select "Judgement Limits" and press <ENTER>**

The options on this page are used to enter the limits for judging the detected number of edges.

27. Set the maximum and minimum number of edges**28. Press <TRIG> to execute the checker for testing**

When a live image is displayed, the Imagechecker captures a new image first and

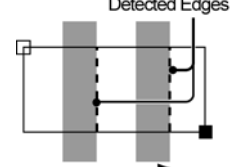
then executes the checker. When a memory image is displayed, the Imagechecker runs a test using the current memory image.

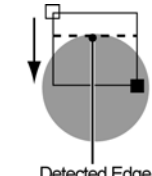
The checker results are displayed on the left side of the checker-setting window. The detected edges are listed in a table. When you select the table and press <ENTER>, you can scroll through the results. When a table row is highlighted, the corresponding edge is displayed in pink in the image. The other detected edges are displayed in cyan.

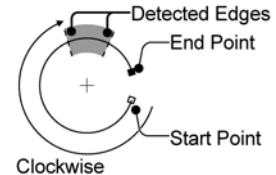
7.5 Gray Edge-Detection Checker

This checker uses gray-scale differences to detect edges. The checker can detect up to 256 edges with subpixel precision. The result of the gray edge checker are the number of edges detected, the X- and Y-coordinates for each detected edge, the differential gray value, and the checker judgement. If the detection count is within the range defined, the checker is judged "OK", otherwise the checker is judged "NG".

Examples for a gray edge-detection checker

	Parameter	Setting
	Scan direction	Horizontal
	Target	Dark -> Light
	Detected position	All

	Parameter	Setting
	Scan direction	Vertical
	Target	Light -> Dark
	Detected position	Front

	Parameter	Setting
	Scan direction	Clockwise
	Target	Both
	Detected position	All

The checker has the following properties:

Checker properties		Additional information
Checker shapes available	Line	For line and rectangle, the search is performed from the start to the end point of the shape. For the elliptic arc, you can set the scan direction to clockwise or counterclockwise.
	Rectangle (plane)	
	Elliptic arc	
Masks available	Not available	
Results	Judgement	If the edge count is within the minimum and maximum limits you have set, the judgement is "OK", if it exceeds the limits, the judgement is "NG".
	No. of objects	Outputs the number of edges meeting the search conditions.
	Differential value	Gray-value difference at the detected edge point.
	X/Y-coordinate	Coordinates of the detected edge. For horizontal edge detection, the Y-coordinate is always the Y-coordinate of the shape's start point. For vertical edge detection, the X-coordinate is always the X-coordinate of the shape's start point.

7.5.1 Special Checker Parameters

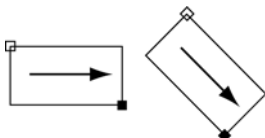
The following parameters are specific to this checker:

Edge detection parameters		Processing condition parameters	
Scan direction	Inspection condition	Scan pitch	Search method
Scan method		Filter	
Edge condition		Width	
Edge threshold		Average range	
Detected position			

7.5.1.1 Scan Direction

Horizontal or vertical search for edges. The search is performed from the start to the end point of the shape. If you have set the shape at an angle, the scan direction will use the angle for the search.

Scan direction = Horizontal, Angle = 45°



◆ NOTE

This parameter is only available if the checker shape is a rectangle. Depending on the selected checker shape, different parameters are available on the "Inspection Condition" tab of the checker-setting window.

7.5.1.2 Scan Method

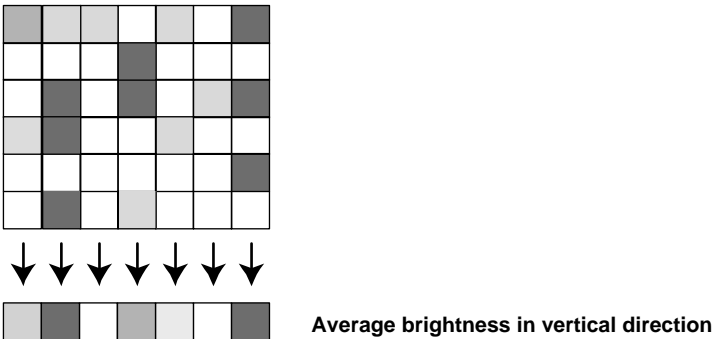
The parameter defines the scan method for detecting edges. Two different scan methods are available: "Single" and "Projection". The default is "Single".



◆ NOTE

This parameter is only available if the checker shape is a rectangle. Depending on the selected checker shape, different parameters are available on the "Inspection Condition" tab of the checker-setting window.

Setting	Use For	Explanation
Single	Edge detection method using the first edge. Recommended when e.g. determining the diameter of an object or when detecting edges on a degraded or uneven object.	A method of edge detection where the inspection area is scanned horizontally for each individual pixel in the scan direction. Scanning is performed according to the four parameters "Scan Pitch", "Filter", "Width", and "Average Area". It is relatively unaffected by noise, enabling reliable edge detection.
Projection	Reliable detection of edges, even if the surface of an object is rough, the gray-scale image is grainy, and individual edges stand out.	Reliable edge detection can be achieved by averaging the brightness in the vertical direction and using the integrated image data produced as the basis for edge detection in the scan direction (see figure below). Check the image created with "Projection" by selecting the option "Projection Image".



7.5.1.3 Edge Condition

Use this parameter to determine the type of edge to be detected. The following settings are available:

Setting	Explanation	Example
Light -> Dark	Detects transitions in the image from light pixels to dark pixels.	
Dark -> Light	Detects transitions in the image from dark pixels to light pixels.	
Both	Detects transitions in the image both from light pixels to dark pixels and vice versa.	

Please also refer to the description of parameters "Edge Threshold" and "Detected Position" below because these parameters influence directly which and how many edges will be detected.

7.5.1.4 Edge Threshold

A gray edge-detection checker detects edges with the help of gray-value differences. Use this parameter to determine the threshold. If two neighboring pixels show a gray-value difference exceeding the threshold, the Imagechecker considers the transition an edge.



◆EXAMPLE

Setting	Det. Count	Example
15	6 (all detected edges are marked with a thick vertical black line for clarification)	<div>Differential value: -20 25 -100 95 -50 55</div> <div>Checker shape</div> <div>Scan direction</div>
70	2 (only the 2 edges of the object in the middle exceed the threshold)	<div>Differential value: -20 25 -100 95 -50 55</div>
150	0 (no edge has a differential value reaching or exceeding the threshold)	<div>Differential value: -20 25 -100 95 -50 55</div>

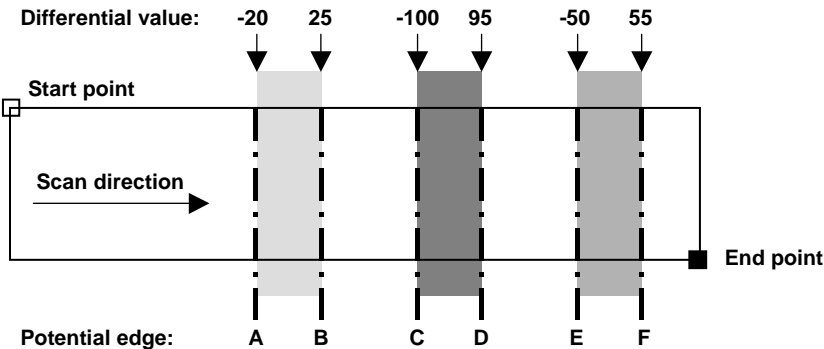


◆NOTE

The current threshold setting of a gray edge-detection checker can be read and/or changed via the serial interface (see page 450).

7.5.1.5 Detected Position

This parameter determines which edge or edges will be detected and output. How many edges will be detected also depends on the setting of parameter "Edge Condition" (see page 169) and "Edge Threshold" (see page 170).



Example with six potential edges ("Edge Condition" = "Both")

Setting	Edge Definition	Edges Detected in Example
Front	Detects the first edge with a differential value equal to or above the setting under "Edge Threshold" after the start point of the checker shape in scan direction.	<p>Diagram showing the scan path with six potential edges (A-F). Only edge A is highlighted with a thick vertical line, indicating it is the first edge detected after the start point.</p>
Peak	Detects the edge with the highest differential value among all edges with a differential value equal to or above the setting under "Edge Threshold".	<p>Diagram showing the scan path with six potential edges (A-F). Only edge C is highlighted with a thick vertical line, indicating it has the highest differential value among all edges above the threshold.</p>
All	Detects all edges with a differential value equal to or above the setting under "Edge Threshold".	<p>Diagram showing the scan path with six potential edges (A-F). All edges (A, B, C, D, E, F) are highlighted with thick vertical lines, indicating they all meet the threshold.</p>
Front/Rear	Detects the edge with a differential value equal to or above the setting under "Edge Threshold" nearest to the start point and the edge nearest to the end point of the checker shape.	<p>Diagram showing the scan path with six potential edges (A-F). Edges A and F are highlighted with thick vertical lines, indicating they are the edges nearest to the start and end points, respectively, that meet the threshold.</p>

7.5.1.6 Scan Pitch

This parameter is only available if you have set parameter "Scan Method" to "Single". "Scan Pitch" sets the interval in terms of pixels in the scan direction at which scanning is performed in the inspection area. The initial value is 1. Setting a wide pitch makes inspection faster, but there is a greater interval between the sections examined. If the pitch is set wider than the scanning area, only a single line is scanned.



◆ EXAMPLE

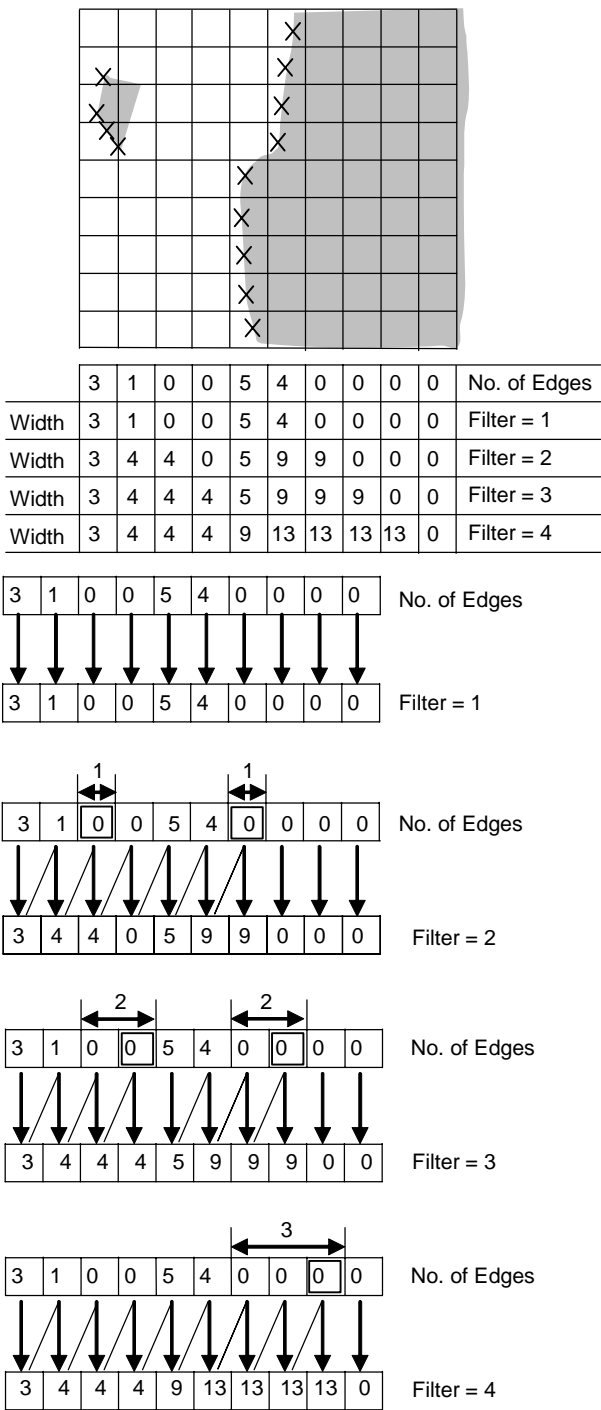
The example shows how the parameter "Scan Pitch" influences which lines are scanned when you use a rectangular checker shape with horizontal scanning.

Scan Pitch = 1	Scan Pitch = 2	Scan Pitch = 3

7.5.1.7 Filter/Width

Use these parameters to ignore noise or unwanted objects near the edge in the inspection image. Try the default settings first. If the Imagechecker still detects noise, increase the "Width" and "Filter" values

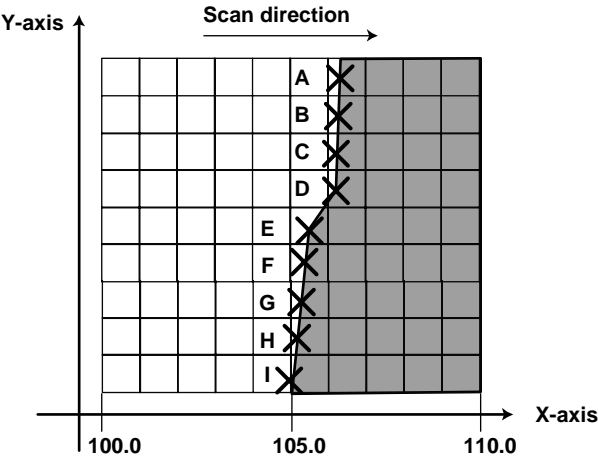
Parameter	Functionality	Restriction
Filter	Combines detected edge pixels into one edge if the interval between them is less than the filter value.	Available for "Scan Method" = "Single" and "Projection"
Width	Counts the detected number of edges in the vertical direction relative to the scan direction, calculates the sum of the continuous edge counts, and if it is as large as or larger than the width value, records it as an edge.	Available for "Scan Method" = "Single" only



7.5.1.8 Average Range

This parameter is only available if you have set parameter "Scan Method" to "Single". This parameter decides how many pixels of the edge are used to calculate the edge by averaging

from the first detection position. The higher the value, the more pixels are used for averaging and the "deeper" inside the object edges are detected.



Detected edge points are marked with crosses

Setting	Detection Position	Edge Points in Figure
Average range = 0	The Imagechecker detects the first edge of the object, that is the foremost edge point at X-coordinate 105.0. There is no averaging.	Edge point "I" in the bottom line at X-coordinate 105.0
Average range = 1	The Imagechecker detects the first edge of the object and calculates the average of this first edge point and the edge points with the same X-coordinate, i.e. X-coordinates between 105.0 and 105.9.	All edge points between X-coordinate 105.0 and 105.9 are averaged = edge points "E" to "I"
Average range = 2	The Imagechecker detects the first edge of the object and calculates the average of this first edge point and the edge points with the same X-coordinate plus 2, i.e. X-coordinates between 105.0 and 106.9.	All edge points between X-coordinate 105.0 and 106.9 are averaged = edge points "A" to "I"



◆ **NOTE**

- When you set "Average range" to a value higher than 1, the Imagechecker also averages the Y-coordinates in horizontal scans and the X-coordinates in vertical scans.
- All edge coordinates are calculated with subpixel accuracy.

7.5.2 Setting Procedure

In order to set up this checker, please proceed as follows:

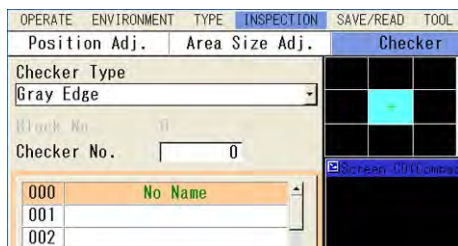


◆ **Procedure**

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**

If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

2. **Select "Checker" from the submenu and press <ENTER>**
3. **Select "Gray Edge" under "Checker Type" and press <ENTER>**
4. **Select a checker number and press <ENTER>**



The setting window appears. The displayed camera image is binary.

5. **Select "Area Setting"**
6. **Set the camera number**
The image from the selected camera is displayed as a binary image. Next, set preprocessing tools such as filters and slice levels. You can select to see the gray-value image via the image menu (see page 76).
7. **Press <CANCEL>**
8. **Select "Inspection Condition" and press <ENTER>**
9. **Select a preprocessing group if you want to preprocess the image**
You can define up to 5 preprocessing groups (see page 109).
10. **Select "Direction" and set the search direction for the checker**
The default setting is "Horizontal".
11. **Select "Scan Method"**

You can choose between "Single" and "Projection" (see page 168). When you select "Projection", the option "Projection Image" becomes available at the bottom of the checker-setting window. Use this option when you wish to see the image used for the projection scan.

12. **Set the "Edge Condition"**

Select the type of edge you want to detect (see page 169).

13. **Set the "Edge Threshold"**

Enter a value to determine the threshold. If a pixel shows a gray-value difference exceeding the threshold, it is considered an edge (see page 170).

14. **Set the "Detected Position"**

Select which edge or edges should be detected and output (see page 171).

15. Press <CANCEL>**16. Select "Search Method" and press <ENTER>****17. Set the edge-detection parameters "Filter" and "Width"**

Try the default settings first. If the default settings fail to detect objects you wish to detect, change the settings (see page 116).

18. Press <CANCEL>**19. Select "Area Setting" and press <ENTER>****20. Under "Position Adj." you can enter the number of a position or rotation adjustment checker**

This option is only available if a position or rotation adjustment checker has been set before (see page 275).

Next, you need to select and set the shape of the checker.

21. Select the button [Set] next to "Area" and press <ENTER>

The default shape is displayed on the screen.

22. Set the inspection area of the checker

The shapes available are line (see page 131) and rectangle (plane) (see page 125).

23. When you have finished setting the checker shape, press <CANCEL> to return to the checker-setting window**24. Use an area-size adjustment, if necessary**

This option is only available if you have already configured an area-size adjustment checker (see page 314).

25. Press <CANCEL>**26. Select "Search Method" and press <ENTER>**

Depending on the setting of parameter "Scan Method" under "Area Setting", one or four parameters are available here. Try the default settings first. If the default settings fail to detect objects you wish to detect, change the settings.

27. Select "Judgement Limits" and press <ENTER>

The options on this page are used to enter the limits for judging the detected number of edges.

28. Set the maximum and minimum number of edges**29. Press <TRIG> to execute the checker for testing**

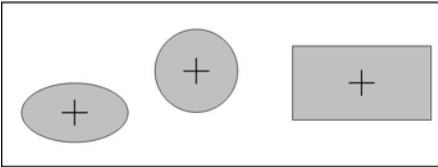
When a live image is displayed, the Imagechecker captures a new image first and then executes the checker. When a memory image is displayed, the Imagechecker runs a test using the current memory image.

The checker results are displayed on the left side of the checker-setting window.

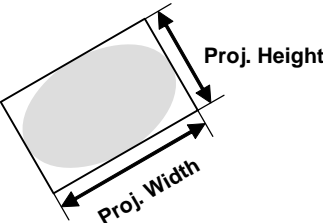
The detected edges are listed in a table. When you select the table and press <ENTER>, you can scroll through the results. When a table row is highlighted, the corresponding edge is displayed in pink in the image. The other detected edges are displayed in cyan.

7.6 Feature Extraction Checker

Use this checker to count black or white objects in a binary image. If the number of counted objects is within the range defined, the checker is judged "OK", otherwise the checker is judged "NG".




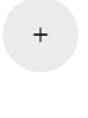
Checker properties		Additional information
Checker shapes available	Rectangle Ellipse Circle Polygon	
Masks available	Rectangle Ellipse Circle Polygon	You can set up to 16 masks.
Results	Judgement	If the number of detected objects is within the minimum and maximum limits you have set, the judgement is "OK", if it exceeds the limits, the judgement is "NG".
	No. of Objects	
	Area size	
	Center of gravity X-coordinate	
	Center of gravity Y-coordinate	
	Principal axis angle	-89.9° to 90.0° or 180° if the principal axis could not be detected, see note.
	Perimeter	
	Width on X-axis	The width and height of the rectangle circumscribing the

Checker properties		Additional information
	Width on Y-axis	object. 



◆ NOTE

The principal axis of inertia will be calculated, if possible. For example, there is no detectable principal axis of inertia for objects like an equilateral triangle, a square, or a perfect circle.

Object	Checker Result
	Judgement: OK Detected X: 100.5 Detected Y: 181.2 Detected Theta: 40.2
	Judgement: OK Detected X: 100.5 Detected Y: 181.2 Detected Theta: 180

7.6.1 Special Checker Parameters

The feature extraction checker uses the following special parameters, which will be explained in detail:

Feature Extraction Parameters		Processing Condition Parameters	
Max. No. of Objects	Inspection condition	Labeling	Search method
Sorting/Sorting order		Boundary	
Min./Max object area	Extraction condition	Perimeter/Projection	
Min./Max projection width		Principal Axis Angle	
Min./Max projection height		Fill Holes	



◆ NOTE

Activate only the search method parameters that you need in order to keep inspection time short.

7.6.1.1 Output: Objects 1 - x

Use this option to set the maximum number of objects to detect and display in the results table. The limit will be applied after sorting if you have set a sorting order (see page 180). If sorting is not activated, the results will be listed in order of appearance.

7.6.1.2 Sorting and Sorting Order

Sorts the extracted objects in ascending or descending order according to area size, X- or Y-coordinate. This is important if you want to reference feature extraction results from a specific object in numerical calculation or judgement formulas.



◆EXAMPLE

Setting	Object Order on "Result" Page
Sorting: Area Sorting Order: Descending	<div><div>213</div><div></div></div>
Sorting: X-coordinate Sorting Order: Ascending	<div><div>123</div><div></div></div>

Refer to the result list on the left of the checker-setting window to see the effect of the sorting.

7.6.1.3 Labeling

Defines the handling of detected objects. With "Labeling" = "Yes", all objects are inspected separately. With "Labeling" = "No", all detected objects are combined into one object and then this object is inspected. Detected objects are marked with a cross symbol in the camera image.



◆ **EXAMPLE**

Labeling	Detection Count	Camera Image
Yes	3	
No	1	

7.6.1.4 Boundary

Defines whether or not an object to be processed will be allowed to touch the checker shape.



◆ **EXAMPLE**

Boundary	Detection Count	Camera Image
On	4	
Off	1	



◆ **NOTE**

- This parameter is not available when you set parameter "Labeling" to "No".
- For objects touching the checker shape, the Imagechecker calculates only the area of the object parts inside the shape.

7.6.1.5 Perimeter

This parameter calculates the perimeter length of an object. For a circular object, the perimeter is the circumference.

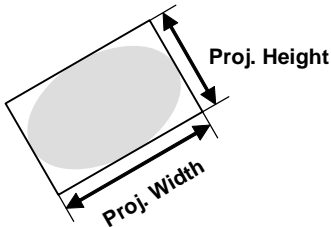


◆ NOTE

This parameter is not available when you set parameter "Labeling" to "No".

7.6.1.6 Projection Width, Height

This parameter calculates the size of the detected object projected in X- and Y-axis.



◆ NOTE

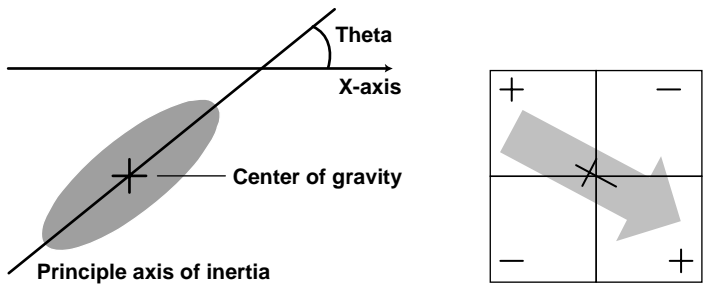
This parameter is not available when you set parameter "Labeling" to "No".

7.6.1.7 Principal Axis Angle

The parameter calculates the angle of the principal axis of inertia (= theta). The angle of the principal axis of inertia is the angle between the object's axis in the longitudinal direction and the X-axis. The range is between -89.9° and $+90^\circ$. Whether an angle result is positive or negative, depends on the orientation of the principal axis in the coordinate system.



◆ **EXAMPLE**



◆ **NOTE**

- It is not possible to detect the principal axis of inertia for objects like an equilateral triangle or a perfect circle. In this case, the Imagechecker output 180° degrees.
- If you set "Principal Axis Angle" to "No", the option "Proj. Width, Height" is set to "No" as well.

7.6.1.8 Fill Holes

When the object contains parts of a different color than the target color, this has an influence on the calculation of features such as the principal axis and the coordinates of the center of gravity. Use this parameter to fill "holes" in the object with the target color.



◆ **EXAMPLE**

Fill holes	Effect on processing
Yes	
No	



◆ **NOTE**

This parameter is not available when you set parameter "Labeling" to "No".

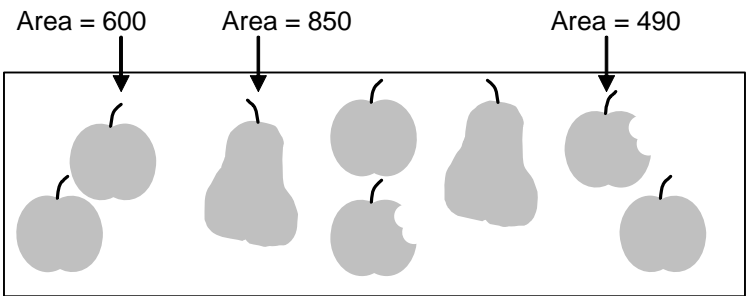
7.6.1.9 Maximum/Minimum Object Area

These options are used to exclude unwanted objects from the image inspection. "Max. Area Limit" and "Min. Area Limit" will be applied to all objects of the color you have selected for detection. Objects which do not fall within the specified size range will not be judged or output.



◆ EXAMPLE

The task is to count the number of whole apples. Bitten apples are smaller in area size, pears are bigger.



Parameter Setting	Detection Count
Max. Area Limit: 1920000 (default) Min. Area Limit: 10 (default)	8 objects
Max. Area Limit: 700 Min. Area Limit: 550	4 objects (only the whole apples)



◆ NOTE

The default value of minimum area limit is "1". For a noisy binary image, it is advisable to set the minimum area limit to a higher value to prevent the Imagechecker from detecting noise as an object.

7.6.1.10 Maximum/Minimum Projection Width/Height

These options are used to exclude unwanted objects from the image inspection. The limits you set here will be applied to all objects of the color you have selected for detection. Objects which do not fall within the specified size range will not be judged or output.

7.6.2 Setting Procedure

In order to set up this checker, please proceed as follows:



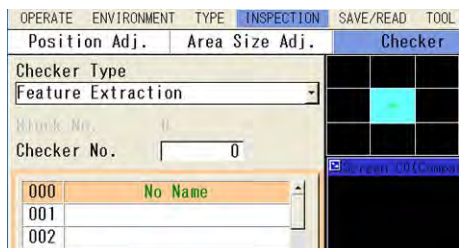
◆ Procedure

1. In the SETUP menu, select "INSPECTION" from the menu bar and press

<ENTER>

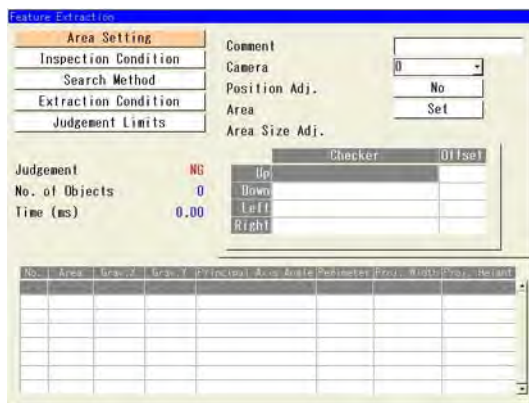
If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

2. Select "Checker" from the submenu and press <ENTER>
3. Select "Feature Extraction" under "Checker Type" and press <ENTER>
4. Select a checker number and press <ENTER>



The setting window appears. The displayed camera image is binary.

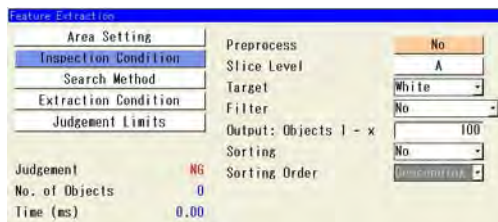
5. Select "Area Setting"



6. Set the camera number

The image from the selected camera is displayed as a binary image. Next, set preprocessing tools such as filters and slice levels. You can select to see the gray-value image via the image menu (see page 76).

7. Press <CANCEL>
8. Select "Inspection Condition"



9. Select a preprocessing group if you want to preprocess the image

You can define up to 5 preprocessing groups (see page 109).

10. Select a slice level

The slice levels are used to create a binary image. You can define up to 8 slice level groups (A - H) (see page 114).

11. Set the color to be detected under "Target"

The default setting is "White".

12. Set a filter under "Filter", if necessary

In addition to the filters available under preprocessing (see page 109) you can add erosion and dilation filters (see page 115). The image display is updated automatically.

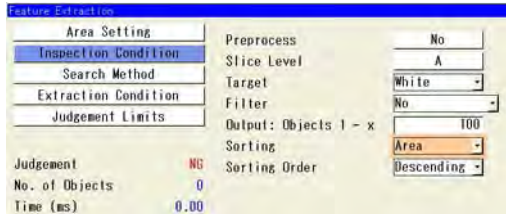
13. Set the number of objects to be detected in "Output: Objects 1 - x"

To limit the number of objects to be detected, enter a number here. The limit will be applied after sorting if you have set a sorting order (see page 180). If sorting is not activated, the results will be listed in order of appearance.

14. Set "Sorting" to sort the extracted objects

You can sort extracted objects in ascending or descending order according to area size, X-, or Y-coordinate (see page 180).

15. If you have activated "Sorting", set the "Sorting Order"



16. Press <CANCEL>

17. Select "Area Setting" and press <ENTER>

18. Under "Position Adj." you can enter the number of a position or rotation adjustment checker

This option is only available if a position or rotation adjustment checker has been set before (see page 275).

Next, you need to select and set the shape of the checker.

19. Select the button [Set] next to "Area Setting" and press <ENTER>

The default shape is displayed on the screen.

20. Set the inspection area of the checker

The shapes available are rectangle, ellipse, circle, and polygon (see page 124).

21. When you have finished setting the checker shape, press <CANCEL> to

return to the checker-setting window

22. Add one or more masks, if necessary

Masks allow you to exclude parts of the checker area from the inspection. You can set up to 16 mask (see page 137).

23. Use an area-size adjustment, if necessary

This option is only available if you have already configured an area-size adjustment checker (see page 314).

24. Select "Filter" and press <ENTER>

25. Set a filter under "Filter", if necessary

In addition to the filters available under preprocessing (see page 109) you can add erosion and dilation filters (see page 115). The image display is updated automatically.

26. Press <CANCEL>

27. Select "Search Method"

Feature Extraction		
Area Setting	Labeling	Yes
Inspection Condition	Boundary	Yes
Search Method	Perimeter	Yes
Extraction Condition	Proj. Width, Height	Yes
Judgement Limits	Principal Axis Angle	Yes
	Plugging	No
Judgement	NG	
No. of Objects	0	
Time (ms)	0.00	

28. Set the parameters "Labeling" and "Boundary" as necessary

29. Select whether "Perimeter" "Proj. Width, Height", "Principal Axis Angle" should be calculated or not

To keep inspection time to a minimum, only calculate the features you need to inspect. For details, refer to the appropriate paragraphs (see page 179).

30. Press <CANCEL>

31. Select "Extraction Condition" and press <ENTER>

Feature Extraction		
Area Setting	Max. Object Area	9999999.999
Inspection Condition	Min. Object Area	0.000
Search Method	Max. Proj. Width	9999999.999
Extraction Condition	Min. Proj. Width	0.000
Judgement Limits	Max. Proj. Height	9999999.999
	Min. Proj. Height	0.000
Judgement	NG	
No. of Objects	0	
Time (ms)	0.00	

32. Set maximum/minimum limits for area size, height and width

Use the options to filter out dust, noise, and unwanted objects (see page 184, see page 184).

33. Press <CANCEL>

34. Select "Judgement Limits" and press <ENTER>

The options on this page are used to enter the limits for judging the detected number of objects.

35. Set the maximum and minimum number of objects**36. Press <TRIG> to execute the checker for testing**

When a live image is displayed, the Imagechecker captures a new image first and then executes the checker. When a memory image is displayed, the Imagechecker runs a test using the current memory image. The checker results are displayed on the left side of the checker-setting window.

The detected objects are listed in a table. When you select the table and press <ENTER>, you can scroll through the results. When a table row is highlighted, the cross marking the center of gravity of the corresponding object is displayed in pink in the image. The other object's crosses are displayed in cyan.

**◆ NOTE**

When more than 40000 objects are detected, the ERROR0 signal is output (see page 144). In this case, adjust the lens aperture and/or slice level to make the image less noisy.

7.7 Smart Matching Checker

Use this checker to seek a pre-registered template image within the search region. The checker works in one step or three steps:

Step	Action	Example
1	The checker searches areas matching the (compressed) template in the (compressed) camera image. By default, the checker tries to find one matching object with as high a correlation factor as possible. You can change the compression sequence to detect more matching objects or to work with less accuracy. The processing speed is inversely related to the compression rate: The higher the compression rate, the faster the processing speed.	<p>The diagram shows a 'Template' image of the letter 'A' being compared against a 'Compressed template image' (also 'A'). An arrow labeled 'Search in compressed camera image' points to a search region containing various characters like 'A', 'F', 'V', 'I', 'H', and 'H'. A dashed box highlights a matching 'A'. An arrow points from this box to a final 'A' with a dot. To the right, the 'Final result' is listed: Detection count = 1, Correlation value = 0.81, X-coordinate = 273.0, Y-coordinate = 166.0, and Angle (if activated) = 1.0.</p>
2	If the subtraction function has been activated, the checker performs subtraction on the matching area(s) it has detected in step 1. This function inspects small differences in detail	<p>The diagram shows a 'Template' 'A' minus a 'Matching object' 'A' (which has two dots) equals a 'Subtraction image' containing only those two dots.</p>
3	When subtraction has been performed, the checker evaluates the subtraction results with a slice level and filter options and outputs the results.	<p>The diagram shows the 'Subtraction image' from step 2 being evaluated. A 'Difference = 128' is noted for one dot and 'Difference = 64' for another. A 'Difference = 0' is noted for the background. An arrow labeled 'Binarization with threshold = 96' points to the 'Final result', which shows only the dot with a difference of 128.</p>

Checker properties		Additional information
Checker shapes available	Template area: <ul style="list-style-type: none"> • Rectangle • Ellipse • Circle • Polygon Rectangle for the search area	
Masks available	Rectangle Ellipse Circle Polygon	You can set up to 16 masks.
Results	No. of Objects	0 to 256
	Template No.	0 to 63
	Correlation value	0 to 1.000 (see note)
	X-coordinate of output point	
	Y-coordinate of output point	
	Angle	0 to 30.0°
	Maximal subtraction	
	Subtraction count	0 to 128



◆ NOTE

- The templates are stored in a dedicated area of the memory. Select TOOL → Information to find out how much memory has been used so far.
- By default, the smart matching checker searches for one object matching the template. If more than one matching object is detected, the one with the highest correlation value is displayed.
- If "Detect Mode" is set to "Low Contrast", the correlation values displayed under "Sequence" and the correction values that are output as inspection results in the table may differ. This is because the Imagechecker corrects the decreased correlation values that were affected by distorted, chipped or overlapped parts of the object and outputs the corrected correlation values as inspection results. The correlation values under "Sequence", on the other hand, are not being corrected and that is why they are lower than the correlation values in the results tables (which are output to the external devices).



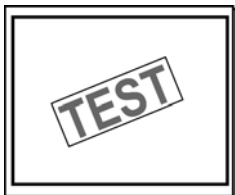
7.7.1 Special Checker Parameters

The checker-setting window of the smart matching checker has two additional tabs with parameters, "Sequence" and "Subtraction".

- The sequence parameters define the compression procedure for the search. By default, the Imagechecker tries to find one matching object with a Minimum Correlation of 60 per cent.

- The subtraction parameters define the subtract procedure. Subtraction is performed on the areas which were detected as matching the template in the compression procedure. The subtraction results are the gray-value differences of the pixels where the image and template images do not match. The Imagechecker calculates the difference in brightness between the inspection image $f(x,y)$ and the template $g(x,y)$. If the absolute value of the difference is larger than the threshold level, the result will be 1; if it is smaller, the result will be 0. It will search for the number of pixels where the result is 1 to find the area size of the differential, and will output that number as the result. It can perform the same filter processing as other binary checkers on pixels where the result is 1.

The following parameters are available and will be explained in detail:

Select	Parameter	Description
Inspection condition	Detect mode	Use this parameter when the contrast between the object to be detected and the background is low of when the object detection fails with the default setting "Normal" (see page 200).
	Filter adjustment	Only available if "Detect Mode" is set to "Low Contrast". Allows you to binarize the object image and background using several adjustment paramaters (see page 201).
	Detect B/W reversed template	Detects objects with inverted gray levels compared with registered template.
	Detect B/W reversed template	<div>Template</div>  <div>Detectable objects</div> 
	Rotation range (+/-)	Rotates the template from 0 (no rotation) to +/-180° (full 360° rotation).  Note: The larger the value you enter here, the longer the inspection time.
	Angle - step	When the object to be detected may be rotated, you need to rotate the template as well. Use this parameter to set the pitch for the rotation angle. The template can be rotated in steps of 8, 4, 2, 1 degrees. Note: When you use the [Recommendation Value] button under "Sequence", this parameters will be set automatically to the optimum value.
	Angle - accuracy	Sets the accuracy of the angle rotation. Select either "1 Degree" or "0.001 Degree". This setting also determines the unit for the of final detect angle is the unit set here. Setting "0.001 Degree" takes longer process time than "1 Degree."
	Sorting	Sorts the extracted objects in ascending or descending order according to correlation value, X- or Y-coordinate.
	Sorting order	Select ascending or descending as the sorting order.
	Template rotated by 180d	Helps to detect objects rotated by 180° more quickly.

Select	Parameter	Description
	Ignore dark image	This function ignores areas darker than the template image when a captured image is so dark that undesired parts are detected.
	Threshold to ignore dark image	Sets the threshold for ignoring dark image areas.
Sequence	Square correlation	This function is helpful when you have set "Detect Mode" to "Low Contrast". It enhances the difference between the correlation values of objects matching the template and objects not matching the template.
Subtraction	Subtraction	Activates the subtraction function.
	Min. subtracted size	Sets a minimum size for parts to be evaluated during subtraction (see page 205).
	Subtraction threshold	Sets a threshold for gray-value differences to be evaluated during subtraction (see page 206).
	Filter	Use a dilation or erosion filter or a combination of both (see page 115). <ul style="list-style-type: none"> 3x3 (5x5) Erosion: Deletes fine noises. 3x3 (5x5) Erosion -> Dilation: After deleting noises, restores the left parts to the original size. 3x3 (5x5) Dilation -> Erosion: Fills holes within the detected area.
	Max. OK No. of subtracted objects	Sets a maximum number of differences to be evaluated during subtraction. Note: When the subtraction result exceeds 128, it becomes "255" automatically and the checker is judged as NG.



◆ NOTE

If the smart matching checker fails to detect the objects you want to find, change the following parameters:

- Set "Detect Mode" to "Low Contrast" and use a filter adjustment (see page 201)
- Activate "Template Rotated by 180d"
- Activate "Ignore Dark Image"

7.7.2 Template Handling

There are two ways of registering (saving) templates:

- Per checker (individual templates for every checker)
- Common (groups of templates that can be used by every checker)

When you register more than one template, the smart matching checker searches for objects matching any of the registered templates. After inspection, the checker outputs the object with the largest correlation value and the number of the template it resembles most.



◆ NOTE

- The template registration method is valid for all types.
- The maximum template size depends on the camera type you are using: For the quad-speed and ultra-compact camera, it is 640 x 480 pixels (full screen). For the 2-mega-pixel camera, it is 1024 x 1024 pixels.
- If the area you have selected as a template has no or little features or there is little change in the gray levels, the image cannot be registered. A warning message will appear.

7.7.2.1 Individual Templates (Per Checker)

The default setting for template registration is "Per Checker". This means every smart matching checker uses its own templates. If you want to register the same template for several smart matching checkers, you need to register it several times. To register a template, please follow the setting procedure (see page 197).

7.7.2.2 Common Templates

When you have activated the common template registration, you can create up to 2000 template groups per type. Common templates are available for all checkers using templates: smart matching checkers and position/rotation adjustment checkers as well as area-size adjustment checkers. To activate the use of common template, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"ENVIRONMENT"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"System Settings"** from the submenu bar and press **<ENTER>**

3. Select "Operation" and press <ENTER>



4. Select "Template Registration" and press <ENTER>

5. Select "Common" and press <ENTER>

If you have already created templates at this time, the templates will be registered as common templates automatically.

6. Press <CANCEL> to return to the "System Settings" window

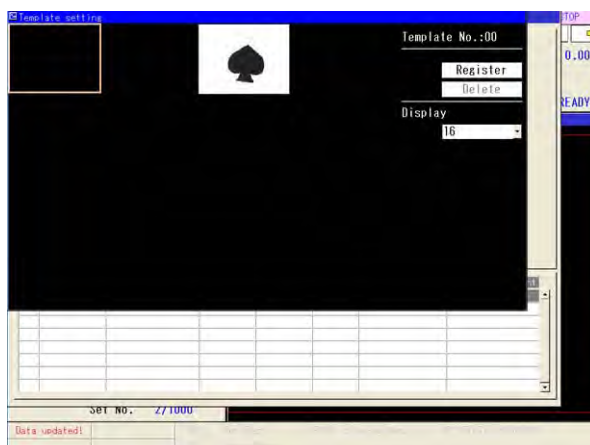
The registration of common templates works similarly. Follow the checker-setting procedure (see page 197) until you register the template image.



◆ Procedure

1. Select the button [Set] next to "Template" and press <ENTER>

The template setting window is displayed. If no templates have been registered so far, the screen appears black apart from an orange rectangle marking the first template number 00 (the number is displayed on the right,



2. Select an empty template and press <ENTER>

The cursor moves to the [Register] button underneath the selected template number.

3. Press <ENTER>

The template dictionary window is displayed. If you have already registered one or more templates, they will be displayed. At the top right, you see the selected template group number belonging to the currently selected template (orange rectangle). Below, you see the number of the template you have selected in the last step for reference.



You can either select an existing template and use it, or select an existing template and overwrite it with a new template image, or create a new group template. Use the appropriate procedure below.

Select an existing group template



◆ Procedure

1. Select a template from the dictionary

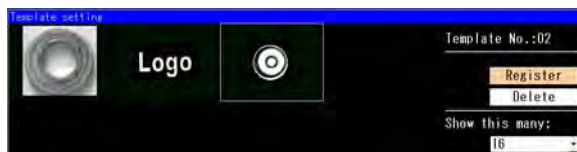


Tilt the cursor to move the orange selection rectangle to the template you want to use.

2. Press <ENTER>

3. Select the [Register] button underneath the template number and press <ENTER>

This will select the group template image for the currently selected checker template.



4. Press <CANCEL> twice to return to the checker-setting window

Proceed with setting the search area and making the inspection, sequence, and

subtraction settings of the smart matching checker (see page 205).

Update an existing group template (re-register)



◆ Procedure

1. Select a template from the dictionary



Tilt the cursor to move the orange selection rectangle to the template you want to use.

2. Press <ENTER>
3. Select the [Register] button underneath "Common Template Setting" and press <ENTER>
4. Follow the procedure to register a template until you return to the "Common Template" window with the dictionary
5. Press <CANCEL> twice to return to the checker-setting window

Proceed with setting the search area and making the inspection, sequence, and subtraction settings of the smart matching checker (see page 203).



◆ NOTE

To overwrite an existing template (be it individual or common) is also called -re-registering a template. You can re-register a template by inputting a signal from an external device (see page 444).

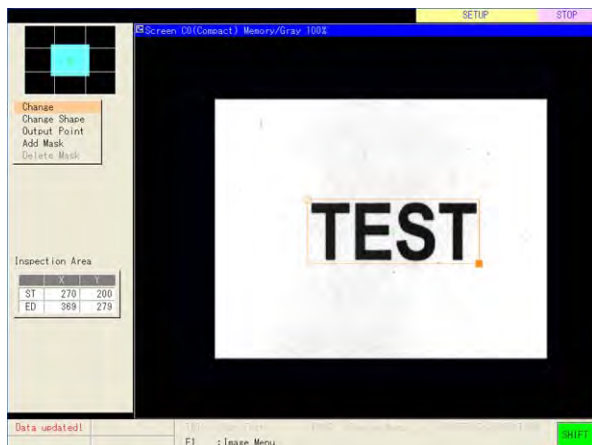
Register a new group template



◆ Procedure

1. Select an empty template and press <ENTER>
2. Select the [Register] button underneath "Common Template Setting" and press <ENTER>

The template area setting screen is displayed with a memory image. Select the template area shape and set the template area as you do for a normal checker (see page 124). If necessary, add a mask (see page 137).



3. Select "Output Point" and press <ENTER>

The output points provides the coordinates for the checker result. You can place it anywhere. To position the output point right in the center of the template shape, open the pop-up menu with the <FUNC> key and select "Middle Point".

4. Press <CANCEL> to return to the template dictionary window

The registered template is displayed.

5. Select the [Register] button underneath the template number and press <ENTER>

This will select the group template image for the currently selected checker template.

6. Press <CANCEL> twice to return to the checker-setting window

Proceed with setting the search area and making the inspection, sequence, and subtraction settings of the smart matching checker (see page 205).

7.7.3 Setting Procedure

In order to set up this checker, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press <ENTER>
If the **RUN** menu is active, press <OPE/SET> to activate the **SETUP** menu.
2. Select **"Checker"** from the submenu and press <ENTER>

3. Select "Smart Matching" under "Checker Type" and press <ENTER>
4. Select a checker number and press <ENTER>
The setting window appears.
5. Press <ENTER> on "Area Setting"
6. Set the camera number



7. Select the button [Set] next to "Template" and press <ENTER>

The template setting window is displayed. If no templates have been registered so far, the screen appears black apart from an orange rectangle marking the first template number 00 (the number is displayed on the right,

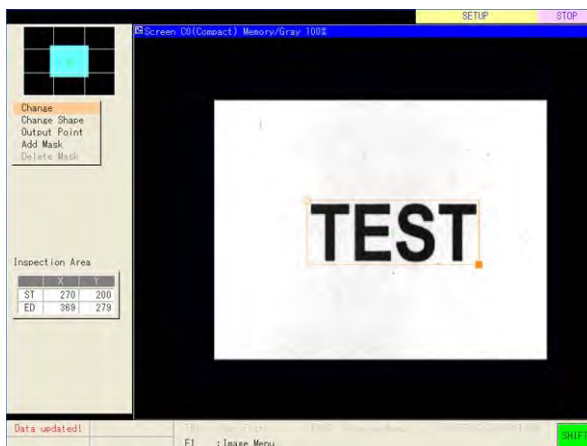


8. Select an empty template and press <ENTER>

The cursor moves to the [Register] button underneath the selected template number.

9. Press <ENTER>

The template area setting screen is displayed with a memory image. Select the template area shape and set the template area as you do for a normal checker. hape setting (see page 124). If necessary, add a mask (see page 137).

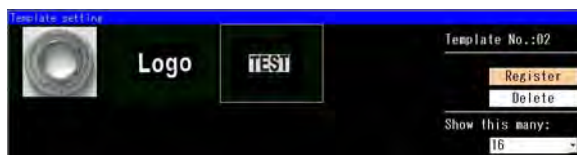


10. Select "Output Point" and press <ENTER>

The output points provides the coordinates for the checker result. You can place it anywhere. To position the output point right in the center of the template shape, open the pop-up menu with the <FUNC> key and select "Middle Point".

11. Press <CANCEL> to return to the template setting window

The registered template is displayed.



12. Press <CANCEL> to return to the checker-setting window

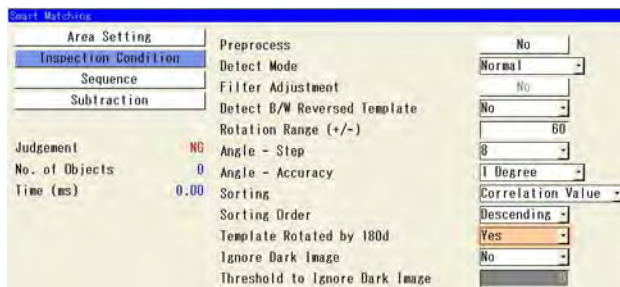
The template has now been successfully created and registered.

13. Change "Search Area" only, if necessary

By default, the search area comprises the complete image. If you need to detect objects only in a part of the image, decrease the search area. This will increase the inspection speed.

14. Press <CANCEL>

15. Select "Inspection Condition" and press <ENTER>



16. Select a preprocessing group if you want to preprocess the image

You can define up to 5 preprocessing groups (see page 109).

17. Set "Detect Mode" and "Filter Adjustment", if necessary

Use this if the object(s) cannot be detected reliably (see page 190).

18. Set "Detect B/W Reversed Image" as needed

Use this if the objects may appear inverted compared to the template image (see page 190).

19. Set the angle and rotation parameters as needed

The template can be fully rotated (see page 190).

20. Set "Sorting" to sort the matching objects

You can sort extracted objects in ascending or descending order according to correlation value, X-, or Y-coordinate (see page 180).

21. Set "Template Rotated by 180d", if necessary

Use this if objects may appear rotated by 180° degrees (see page 190).

22. Set "Ignore Dark Image", if necessary

Use this if areas darker than the template should be ignored (see page 190).

23. Press <CANCEL>**24. Select "Sequence " and press <ENTER>**

Follow the sequence setting procedure (see page 204)

25. Press <CANCEL>**26. If you want to use subtraction, select "Subtraction" and press <ENTER>**

Follow the subtraction setting procedure (see page 206).

27. Press <TRIG> to execute the checker for testing

When a live image is displayed, the Imagechecker captures a new image first and then executes the checker. When a memory image is displayed, the Imagechecker runs a test using the current memory image.

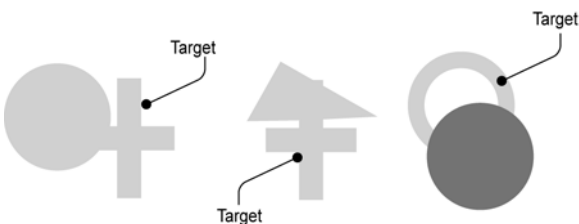
The checker results are displayed on the left side of the checker-setting window. The detected objects are listed in a table. When you select the table and press <ENTER>, you can scroll through the results. When a table row is highlighted, the corresponding object is displayed in pink in the image. The other detected objects are displayed in cyan. The subtraction result columns are "0" if you have not activated subtraction. If "Subtraction Count" is "255", it means that the subtraction function has detected are more than 128 parts where the object and the template differ.

7.7.4 Inspection Condition Parameters

The following inspection condition parameters are specific to this checker.

7.7.4.1 Detect Mode

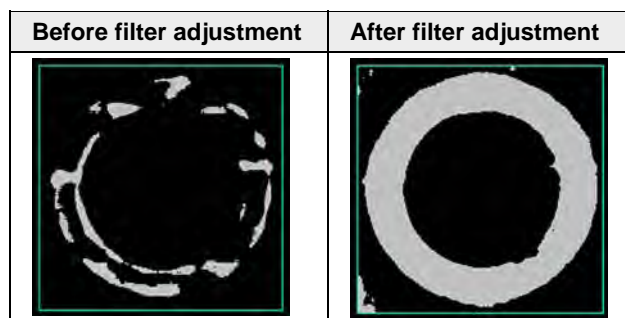
If there is only a small difference in brightness between the object and the background or if some parts of the object are chipped or overlapping other objects, the checker may not detect the object(s) correctly. In such cases, set "Detect Mode" to "Low Contrast" and then specify the intensity under "Filter Adjustment" (see page 201).



7.7.4.2 Filter Adjustment

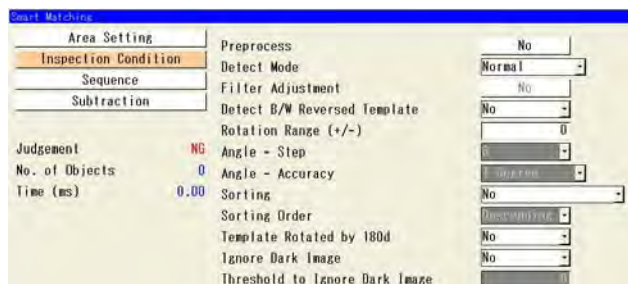
Try [Recommendation Value] first. If the desired result cannot be obtained, adjust the parameter values beginning from the top downwards.

- Target (White / Black): If the object to be detected is brighter than the background, select "White". If the object to be detected is darker than the background, select "Black".
- Denoising (1 - 80): Removes unnecessary noises around the object image. The higher the value, the more noises are removed.
- Distortion (1 - 95): Extracts the image parts containing contrast. If some parts of the extracted object are chipped away, increase the value. If the object is expanded, decrease the 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.



◆ Procedure

1. In the checker-setting window, select "Inspection Condition" and press <ENTER>



2. Select "Detect Mode" and press <ENTER>
3. Select "Low Contrast" and press <ENTER>
The parameter "Filter Adjustment" directly below is now available.
4. Select "No" next to "Filter Adjustment" and press <ENTER>
The template selection window appears.

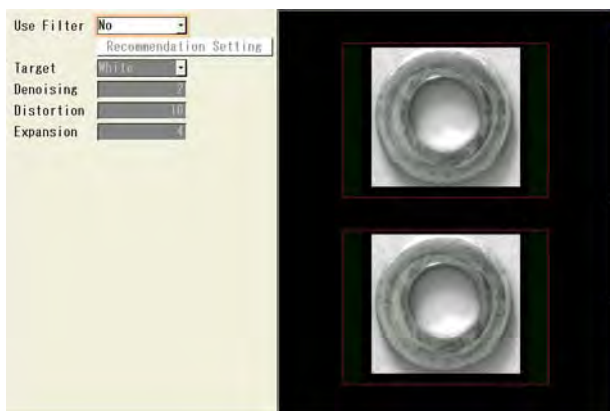
5. **Select the template of the object you want to detect and press <ENTER>**

The cursor moves automatically to the [Set Filter] button.



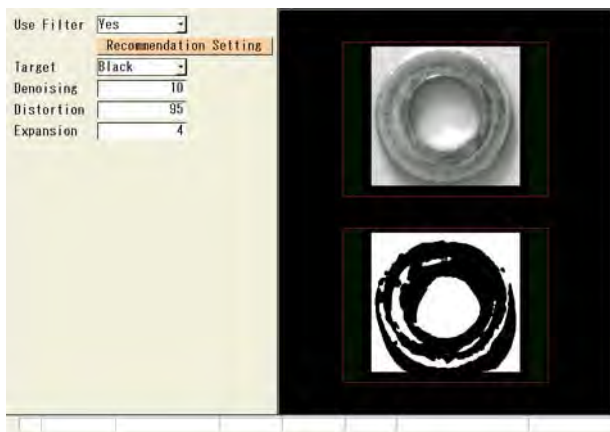
6. **Press <ENTER>**

The filter window appears.



7. **Press <ENTER>**
8. **Select "Yes" and press <ENTER>**
9. **Select [Recommendation Value] and press <ENTER>**

The Imagechecker calculates and enters the optimum values for binarizing the image so that target area and background are clearly distinguished. The result of the filter operation is shown on the bottom right.



10. **If the recommended values do not have the desired effect, change each parameter manually starting from the top**

11. When you have finished, press <CANCEL> to return to the checker-setting window

7.7.5 Sequence Parameters

The sequence parameters define the compression procedure for the search. By default, the Imagechecker tries to find one matching object with a minimum correlation of 60 per cent. If you want to find more objects, you need to change the sequence settings.

7.7.5.1 Accuracy

The Imagechecker compresses the image to increase speed when searching for an object matching the template. The matching takes place step by step, starting with an image compressed by factor 8 (default setting). If the Imagechecker finds a matching object, it remembers the position and uses half the compression, e.g. it uses factor 4 at this position. This way the search process is performed step by step on the matching areas until the search does not use a compressed image any longer, but searches with subpixel accuracy.

Use the parameter "Accuracy" to set the compression factor for each individual search step. There are six compression factors: 32, 16, 8, 4, 2, 1, and S. The compression sequence ends with the setting "S" for "subpixel accuracy". If you do not want to compress the image down to subpixel level, use the setting "0". It makes the current compression step the last step and sets all following steps to "0".



◆ NOTE

- From the second step onwards, you can set "Accuracy" to "0". Then the Imagechecker will not continue compressing the image, but stop with the matching and proceed to subtraction (if this function has been activated) or result output.
- The compression procedure cannot be shortened by setting the first compression step to "S" for subpixel accuracy. In fact, the search will take extremely long.

7.7.5.2 Maximum Count

Defines the upper limit of the number of detected objects (maximum: 256 objects). The checker will detect a number of objects similar to the template within the number set here. At the beginning, we recommend to set a higher value because it is possible that the Imagechecker also detects unwanted objects, when the search accuracy is low. Please note that the number of detected objects cannot be set to exceed the number set for the previous step. The number entered for the last step with an accuracy not equal to 0 is the number used for judging the checker - if the number under "Max. Count" matches the one for "No. of Objects", the checker is OK, otherwise it is NG.

7.7.5.3 Minimum Correlation

The correlation value reflects the degree of similarity between the template and the search object. If it is large, only objects with a high degree of similarity will be detected. The checker will search for objects with a degree of similarity above the correlation value set here. The setting range for the correlation value is 0.01 to 1.00. The default value is 0.60. If there is no object reaching the minimum correlation, the inspection stops and the checker is NG.

7.7.5.4 Sequence Setting Example

In order to change the default sequence where the Imagechecker tries to find one object with a minimum correlation of 60 per cent to a customized sequence searching for more matching objects, please proceed as follows:



◆ Procedure

1. **Open the setting window of the smart matching checker**
2. **Select "Sequence" and press <ENTER>**
3. **Press <ENTER> on [Recommendation Value]**

The Imagechecker finds the most suitable settings and sets them in the table. The parameter "Angle Search" under "Inspection Condition" is updated with the recommended value.

4. **Select the table and press <ENTER>**

The cursor moves to the first step and highlights the compression factor in the "Acc." column. Select a lower factor if you want to use less compression steps. Note that if you have selected a low factor in step 1, you cannot select a higher factor in any of the following steps. However, the Imagechecker copies the settings of the preceding step when you start editing the next step. The smaller the factor, the longer the search. Once you have selected "S" for subpixel accuracy, you cannot set up any subsequent steps.

5. **Move the cursor to the " Max. Count" column and press <ENTER>**

Here you set the number of objects you want to detect. We recommend to set a higher number for the initial steps to make sure all matching candidates are detected. Refer to the explanation below for a quick way of setting the value for several steps in one go.

6. **Move the cursor lever up to select a number and press <ENTER>**
7. **Move the cursor to the "Min. Corr." column and press <ENTER>**

The default value is 0.60. If the Imagechecker does not detect not enough matching objects, lower the value.

8. **Move the cursor lever up to scroll through the possible settings and press <ENTER>**

Select a value in the range of 0.01 to 1.00. The lower the value, the higher the

number of objects detected. If the default setting does not work for your application, try a low setting for the first compression steps and a higher setting for the later compression steps.

9. Test the setting by pressing <TRIG>

The Imagechecker will display the number of detected matching objects in the column "Count" and their correlation factor in "Corr.".

Acc	Max	Count	Min	Corr	Count	Corr
1st	16	4	0.600	4	0.811	
2nd	8	4	0.600	4	0.739	
3rd	4	4	0.600	4	0.725	
4th	2	4	0.600	4	0.702	
5th	5	4	0.600	4	0.686	
6th	0	0	0.000	0	0.000	

Square Correlation: No

10. Set "Square Correlation" to "Yes", if necessary

"Square Correlation" enhances the difference between the correlation values of objects matching the template and objects not matching the template.



◆ EXPLANATION

If you want to set more than one value in the column "Max. Count", select the last compression step you want to use and enter the maximum number of objects there. Then all preceding steps will automatically use the same setting for "Max. Count". This only works if the value you enter for the last step is higher than the values in the preceding steps.

7.7.6 Subtraction Parameters

The subtraction parameters define the subtract procedure. To use the parameters, set "Subtraction" to "Yes". Subtraction is performed on the areas which were detected as matching the template in the compression procedure. The subtraction results are the gray-value differences of the pixels where the image and template images do not match. Up to 128 subtraction parts can be detected and used for judging the smart matching checker.

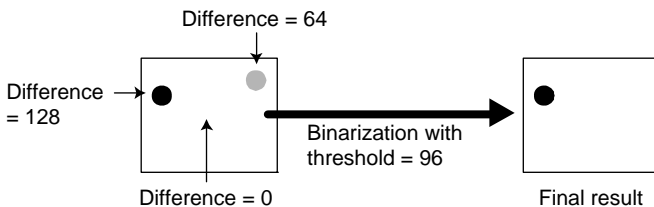
7.7.6.1 Minimum Subtracted Size

To speed up the subtraction process, you can ignore small differences between the template and the matching object by setting a minimum area size. Only areas bigger than the minimum

will be considered in the subtraction process. For example, if you want to exclude parts with 10 pixels or less from the checker judgement, set "Min. subtracted size" to "11".

7.7.6.2 Subtraction Threshold

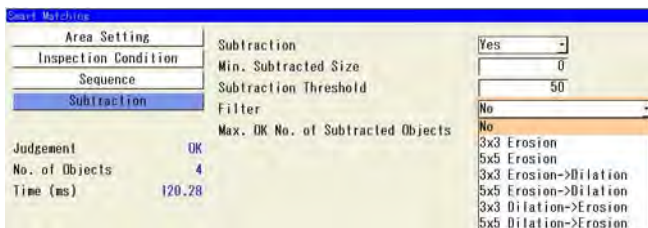
This parameter sets a binarization threshold. All gray-value differences in the subtraction image below the threshold are ignored, all differences above the threshold are output as a difference between template and object in the camera image. The lower the threshold, the fewer differences will be tolerated.



Subtraction threshold example

7.7.6.3 Filter

There are 6 filter options available to remove fine noise from the subtraction result. You can use erosion filters of different size or select a combination of erosion and dilation filters.



7.7.6.4 Max. OK No. of Subtracted Objects

Here you define a maximum number for the subtraction process (0 - 128). If the number of detected gray-value differences exceeds this number, the result becomes "255" and the checker is judged as NG.

7.7.6.5 Subtraction Setting Example

In order to use subtraction, please proceed as follows:



◆ Procedure

1. Open the setting window of the smart matching checker
2. Select "Subtraction" and press <ENTER>

3. Select "Yes" and press <ENTER>

Smart Matching	
Area Setting	Subtraction
Inspection Condition	Subtraction Area Min.
Sequence	Subtraction Threshold
Subtraction	Filter
	Subtraction Number
Judgment	

4. Set "Min. subtracted size" and press <ENTER>

By setting a minimum area size, you can remove small differences between the template and the matching object (see page 205).

5. Set "Subtraction Threshold" and press <ENTER>

By setting a threshold for the gray-value difference, you can remove small differences between the template and the matching object (see page 206). The lower the threshold, the fewer differences will be tolerated

6. Select "Filter"

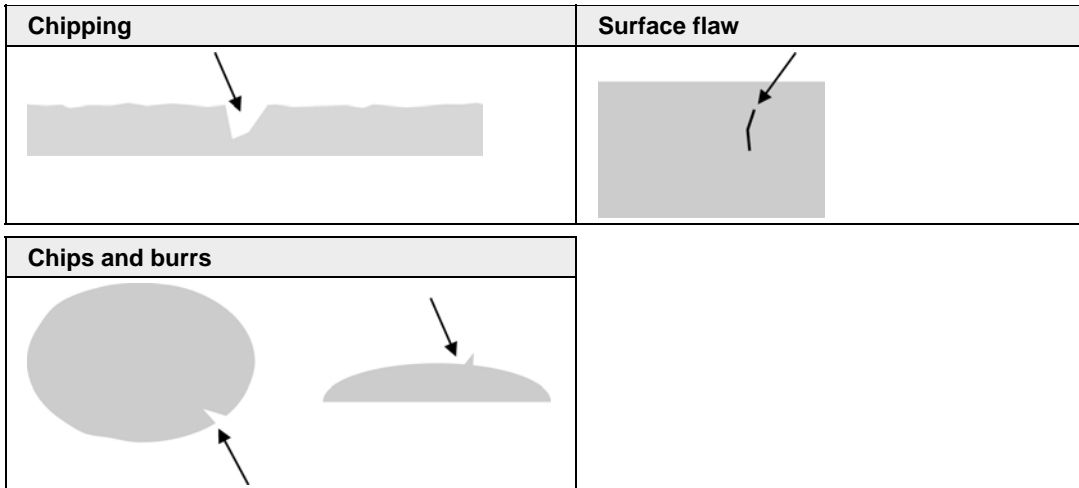
Set a filter if you need to remove noises or fill gaps (see page 206).

7. Set "Max. OK No. of subtracted objects"

Set the maximum number of differences between the template and the object (see page 206).

7.8 Flaw Detection Checker

Use this checker to find flaws, burrs, missing edges, and dirt on objects. The flaw detection checker calculates the average gray value within a segmented area called a cell. The cells are situated at regular intervals along a line, rectangle, or elliptic shape. When the detected gray-value difference in a cell exceeds a certain limit, the Imagechecker considers this a flaw.



The checker has the following properties:

Checker Properties		Additional Information
Checker shapes available	Line Rectangle (Plane) Ellipse	
Masks available	Only in the shape of the cell	The flaw detection checker uses cells for inspection. One or more of the cells can be excluded from inspection by covering them with a mask.
Results	Judgement	If the number of flaws within the minimum and maximum limits you have set, the judgement is "OK", if it exceeds the limits, the judgement is "NG".
	No. of Objects	Outputs the number of flaws (0 - 512).
	No.	Outputs the cell number (0 - 65535)
	Flaw size	Outputs the number of cells making up the flaw (0 - 256)
	X/Y-coordinate	Coordinates of the center point of the first cell containing a flaw.

7.8.1 Special Checker Parameters

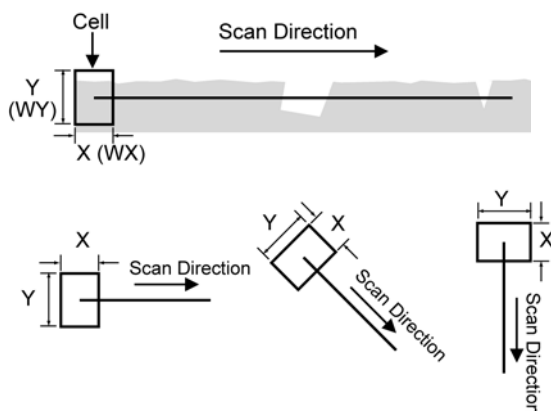
The following parameters are specific to this checker:

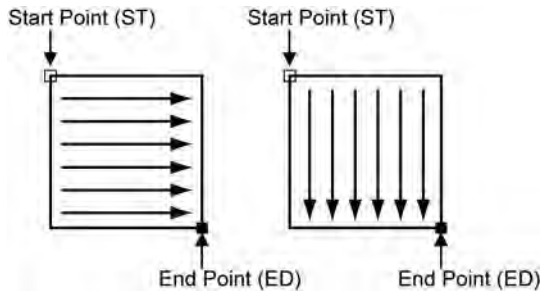
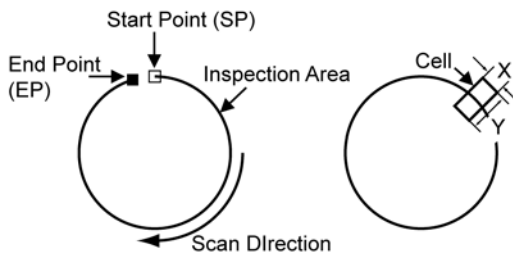
Select	Parameter	Description
Inspection condition	Scan direction	When you have selected the checker shape "Plane" (rectangle), you can select the scan direction: <ul style="list-style-type: none"> • Horizontal • Vertical • Hor./Ver.
Search method	Detect mode	You can choose between "Differential" and "Gray Range" (see page 210).
	No. of cells for calculation range	Used for detect mode "Gray Range" (see page 210).
	No. of cells per shift	Used for detect mode "Gray Range" (see page 210).
	Threshold	Threshold value for judging a flaw based on the gray-value difference detected (see page 210).
	Min. flaw size in cells	Minimum size for a candidate flaw to be judged as a real flaw (see page 210).
Threshold adjustment	Threshold	Tool for finding the optimum setting value for the parameter "Threshold" under "Search Method" (see page 213).

7.8.1.1 Scan Direction

When you have selected the checker shape "Plane" (rectangle), you can select the scan direction:

- Horizontal
- Vertical
- Hor./Ver. (both horizontal and vertical)



Scan direction of the line shape*Horizontal and vertical scan direction of the plane (rectangle) shape**Scan direction of the elliptic shape***7.8.1.2 Detect Mode**

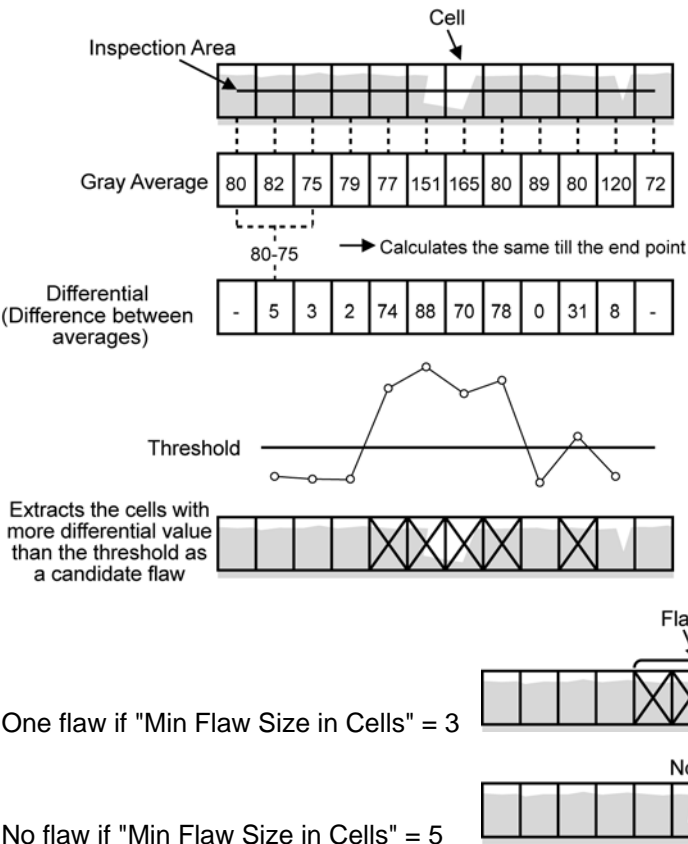
There are two modes, "Differential" (default setting) and "Gray Range". "Differential" is the default setting. When "Differential" mode fails to detect flaws, try "Gray Range". "Gray Range" mode is useful for inspecting objects with an uneven surface, but takes longer to process.

Differential mode

If the calculated average brightness of the cells is more than the "Threshold" value set under "Search Method", the Imagechecker detects the cell as a possible candidate for a flaw (see the figure shown on the right).

The higher the threshold value, the fewer flaw candidates will be detected. With a low threshold value, areas with even slight differences in brightness will be detected as a candidate flaw.

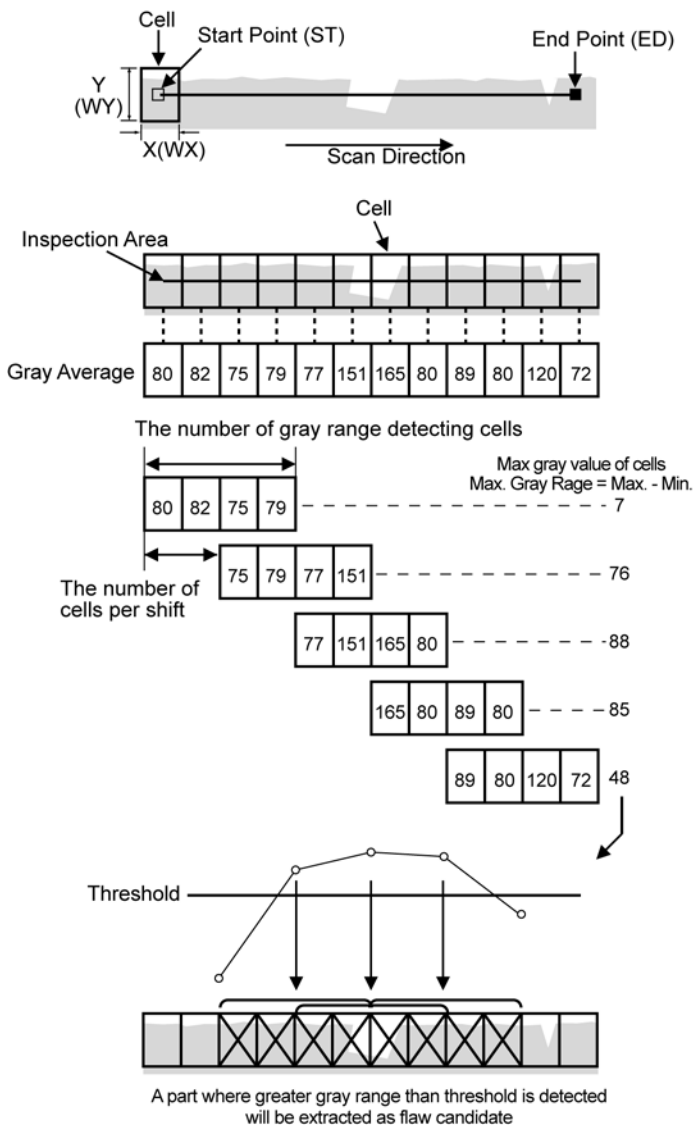
The Imagechecker then counts the number of cells with flaw candidates and if there are more candidate cells than the number set under "Min Flaw Size in Cells", the cell is judged as a flaw.



Gray range

The Imagechecker groups the cells according to the value set in "Num. Of Cells for Calc. Range" under "Search Method" and calculates the maximum difference in the gray values of the grouped cell. Then the Imagechecker shifts to the next group of cells by the amount set in "Num. of Cells per shift" and calculates the maximum difference in the gray values of the second group and so on until all cells have been grouped. If the maximum difference of a group is higher than the value set in "Threshold", the Imagechecker regards the group as a candidate flaw. The higher the threshold value, the fewer flaw candidates will be detected. With a low threshold value, areas with even slight differences in brightness will be detected as a candidate flaw.

The Imagechecker judges the candidate flaws based on the value set in "Min Flaw Size in Cells". If there are more cells in the candidate flaw than set in "Min Flaw Size in Cells", the candidate flaw is judged as a real flaw.



One flaw if "Min Flaw Size in Cells" = 3

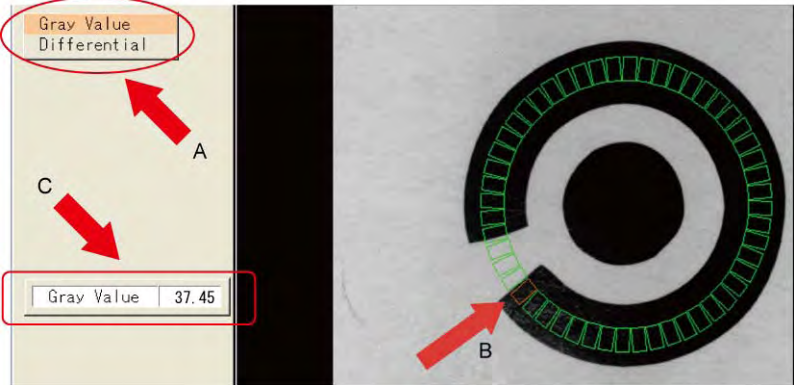
No flaw if "Min Flaw Size in Cells" = 10



◆ NOTE

To check the differential values or gray values detected in the cells, use the <FUNC> key in the checker-setting window. From the pop-up menu, select

"Data Display", then select either "Gray Value" or "Differential". Tilt the cursor lever to move through the cells and see the values for the currently selected cells.



7.8.1.3 Threshold Adjustment


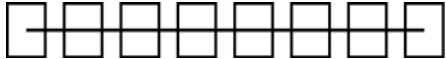
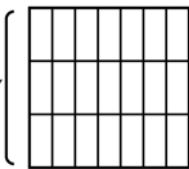
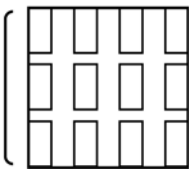
Use this function to find the optimum setting value for the parameter "Threshold" under "Search Method". When you select it, the Imagechecker displays a table with the number of possible flaws per threshold level in descending order. The position of the flaws is marked by a cyan cross in the image. The currently selected threshold setting is displayed above the table.



When you select the best threshold for detecting flaws from the list, a message appears. When you confirm with "Yes", the selected threshold value will be copied to the option "Threshold" under "Search Method".

7.8.2 Area Setting Procedures

The flaw detection checker differs from the other checker insofar as the checker uses small areas called cells for the inspection. The detection cells are evenly spread out along the selected shape (line, plane, or ellipse). It is important to set the cell number, size, and width so that the whole inspection area is covered and there are no gaps.

Correct shape setting	Incorrect shape setting
	
<p>Cell Number: NX</p> <p>Cell Number: NY</p> 	<p>Cell Number: NX</p> <p>Cell Number: NY</p> 

The cursor lever on the keypad works as follows when you set a flaw detection checker:

- Line shape:

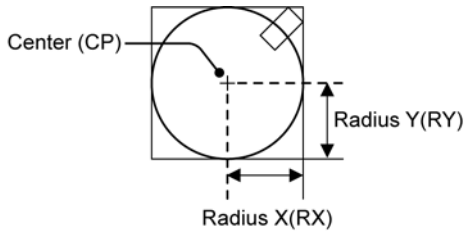
	X (set with left/right movement of the cursor lever)	Y (set with up/down movement of the cursor lever)
ST	X-coordinate of the start point	Y-coordinate of the start point
ED	X-coordinate of the end point	Y-coordinate of the end point
W	Width of cells	Height of cells
N	Number of cells in X-direction	

- Plane shape:

	X (set with left/right movement of the cursor lever)	Y (set with up/down movement of the cursor lever)
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 of cells	Height of cells
N	Number of cells in X-direction	Number of cells in Y-direction

- Elliptic shape:

	X (set with left/right movement of the cursor lever)	Y (set with up/down movement of the cursor lever)
CP	X-coordinate of the center of the ellipse	Y-coordinate of the center of the ellipse
R	Radius of the ellipse in X-direction	Radius of the ellipse in Y-direction
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 of cells	Height of cells
N	Number of cells in X-direction	



◆ NOTE

- When you are using an area size adjustment, please note that changing the checker's area size does not change the number of cells or the cell size. Specify a sufficiently high number of cells to execute an inspection thoroughly even if the area size adjustment enlarges the checker.
- If you set the area of the flaw detection checker in such a way that the cells are fully or partly covered by other cells, the inspection time becomes longer because the Imagechecker always scans the complete cell area independent of whether the area has been inspected before.
- Make sure that the whole area to be inspected is covered by cells. Avoid gaps between cells otherwise the Imagechecker may miss flaws during inspection.

7.8.2.1 How to Create or Edit a Line

This is how you create and edit a flaw detection checker with a line shape.

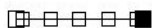


◆ Procedure

1. Create a flaw detection checker
2. In the checker-setting window, select "Area Setting"
3. Select the button [Set] next to "Area Setting" and press <ENTER>

The screen displays the default shape (five small green square cells). At the same time, the "Area" menu appears on the left side of the screen.

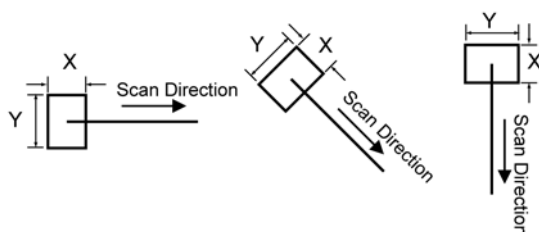
4. Press <ENTER> on "Change



The five small green squares turn orange and the underlying default line shape is displayed as well. A table appears below the "Area Setting" menu with the coordinates for the line's start (ST) and end point (ED). The "W" refers to the cell dimensions (11 pixels wide and 11 pixels high by default), the "N" = 5 refers to the default number of cells.

Inspection Area		
	X	Y
ST	270	240
ED	369	240
W	11	11
N	5	

The cell width (X) and height (Y) are defined as shown below.



As long as you see both the start and the end point displayed, you move the complete checker by moving the cursor lever. Use the <SHIFT> key together with the cursor lever to move the shape by 10 pixels at once.

5. Press <ENTER> to move only the start point
6. Tilt the cursor lever to move the start point from its current position

The checker shape can be horizontal, vertical, or diagonal. When you move the start point, the cells will be moved as well to maintain regular spacing.

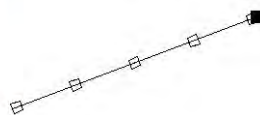
Inspection Area		
	X	Y
ST	135	303
ED	369	240
W	11	11
N	5	



7. Press <ENTER> when the start point is in the desired position

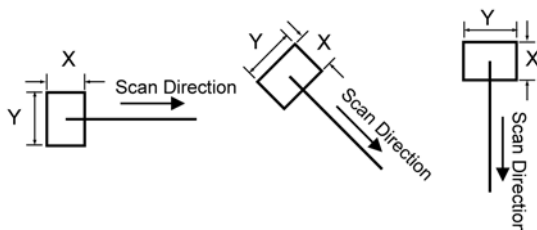
Now only the end point of the checker shape is displayed.

Inspection Area		
	X	Y
ST	135	303
ED	389	208
W	11	11
N	5	



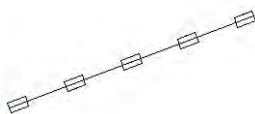
8. Tilt the cursor lever to move the end point from its current position
9. Press <ENTER> when the end point is in the desired position

The cursor jumps to the line "W". This is where you set the width and height of the cells. The "X" column defines the cell width, the "Y" column the cell height.



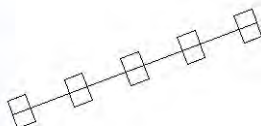
10. Tilt the cursor lever left/right to reduce/increase the cell width

Inspection Area		
	X	Y
ST	135	303
ED	389	208
W	21	11
N	5	



11. Tilt the cursor lever down/up to reduce/increase the cell height

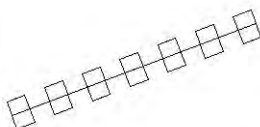
Inspection Area		
	X	Y
ST	135	303
ED	389	208
W	21	31
N	5	



12. Press <ENTER>

13. Tilt the cursor lever left/right to reduce/increase the number of cells

Inspection Area		
	X	Y
ST	135	303
ED	389	208
W	21	31
N	7	



14. Press <ENTER>

The checker shape turns green again and the table with coordinates disappears.

15. Press <CANCEL> to return to the checker-setting window

7.8.2.2 How to Create or Edit a Rectangle/Plane



◆ Procedure

1. Create a flaw detection checker
2. In the checker-setting window, select "Area Setting"
3. Select the button [Set] next to "Area Setting" and press <ENTER>

The screen displays the default shape (five small green square cells). At the same

time, the "Area" menu appears on the left side of the screen.

4. Select "Change Shape" and press <ENTER>

5. Select "Plane" and press <ENTER>

The default shape appears - a green matrix consisting of 5 rows and 5 columns of squares.



6. Select "Change" and press <ENTER>

The shape turns orange and a surrounding rectangle is displayed with start and end point.



A table appears below the "Area Setting" menu with the coordinates for the shape's start (ST) and end point (ED). The "W" refers to the cell dimensions (11 pixels wide and 11 pixels high by default), the "N" = 5 refers to the default number of cells in the rows (X) and columns (Y).

Inspection Area		
	X	Y
ST	270	200
ED	369	279
W	11	11
N	5	5

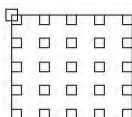
As long as you see both the start and the end point displayed, you move the complete checker by moving the cursor lever. Use the <SHIFT> key together with the cursor lever to move the shape by 10 pixels at once.

7. Press <ENTER> to move only the start point

8. Tilt the cursor lever to move the start point from its current position

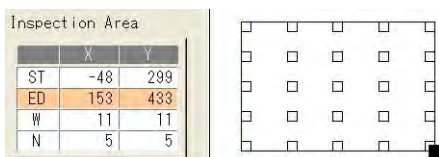
When you move the start point, the cells will be moved as well to maintain regular spacing.

Inspection Area		
	X	Y
ST	-48	299
ED	77	407
W	11	11
N	5	5



9. Press <ENTER> when the start point is in the desired position

Now only the end point of the checker shape is displayed.



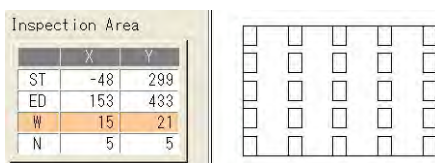
10. Tilt the cursor lever to move the end point from its current position

11. Press <ENTER> when the end point is in the desired position

The cursor jumps to the line "W". This is where you set the width and height of the cells. The "X" column defines the cell width, the "Y" column the cell height.

12. Tilt the cursor lever left/right to reduce/increase the cell width

13. Tilt the cursor lever down/up to reduce/increase the cell height

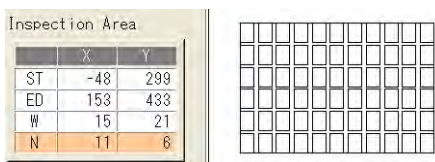


14. Press <ENTER>

The cursor jumps to the line "N". This is where you set the number of rows and columns. The "X" column defines the number of rows, the "Y" column the number of columns.

15. Tilt the cursor lever left/right to reduce/increase the number of rows

16. Tilt the cursor lever down/up to reduce/increase the number of columns



17. Press <ENTER>

The checker shape turns green again and the table with coordinates disappears.

18. Press <CANCEL> to return to the checker-setting window

7.8.2.3 How to Create or Edit a Circle or Ellipse



◆ Procedure

1. Create a flaw detection checker
2. In the checker-setting window, select "Area Setting"

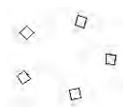
3. Select the button [Set] next to "Area Setting" and press <ENTER>

The screen displays the default shape (five small green square cells). At the same time, the "Area" menu appears on the left side of the screen.

4. Select "Change Shape" and press <ENTER>

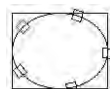
5. Select "Ellipse" and press <ENTER>

The default shape appears - a green ellipse made up of 5 squares (cells).

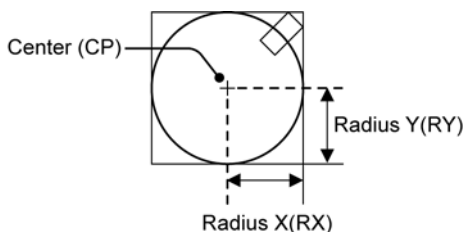


6. Select "Change" and press <ENTER>

The shape turns orange and a surrounding rectangle is displayed with start and end point.



A table appears below the "Area Setting" menu with the coordinates for the shape's properties.



Abbreviation	Explanation
CP	Center point (invisible)
R	Radius of the ellipse
SP	Start point
EP	End point
W	Cell width and height
N	Number of cells

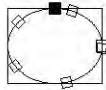
Inspection Area		
	X	Y
CP	320	240
R	49	39
SP	369	240
EP	369	240
W	11	11
N	5	

As long as you see both the start and the end point displayed and the row "CP" is highlighted in the table, you move the complete checker by moving the cursor lever. Use the <SHIFT> key together with the cursor lever to move the shape by 10 pixels at once.

7. Press <ENTER>

Inspection Area

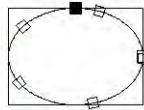
	X	Y
CP	5	403
R	49	39
SP	54	403
EP	54	403
W	11	11
N	5	



8. Tilt the cursor lever to change the radius

Inspection Area

	X	Y
CP	5	403
R	70	50
SP	75	403
EP	75	403
W	11	11
N	5	

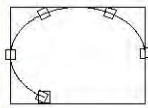


9. Press <ENTER> to move only the start point

10. Tilt the cursor lever to move the start point from its current position

Inspection Area

	X	Y
CP	5	403
R	70	50
SP	-30	446
EP	75	403
W	11	11
N	5	



11. Press <ENTER> when the start point is in the desired position

Now only the end point of the checker shape is displayed.

12. Tilt the cursor lever to move the end point from its current position

13. Press <ENTER> when the end point is in the desired position

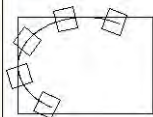
The cursor jumps to the line "W". This is where you set the width and height of the cells. The "X" column defines the cell width, the "Y" column the cell height.

14. Tilt the cursor lever left/right to reduce/increase the cell width

15. Tilt the cursor lever down/up to reduce/increase the cell height

Inspection Area

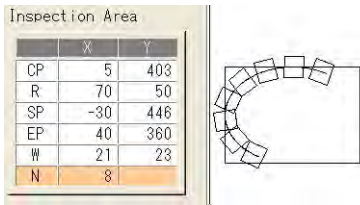
	X	Y
CP	5	403
R	70	50
SP	-30	446
EP	40	360
W	21	23
N	5	



16. Press <ENTER>

The cursor jumps to the line "N". This is where you set the number of cells.

17. Tilt the cursor lever left/right to reduce/increase the number of cells



18. Press <ENTER>

The checker shape turns green again and the table with coordinates disappears.

19. Press <CANCEL> to return to the checker-setting window

7.8.2.4 Working with Masks

A mask is an area within an inspection area where inspection is not performed. In the case of flaw detection checkers, you can exclude cells from the inspection by masking them.

How to create a mask

Masks are displayed in blue. Unselected cells have a green frame, while selected cells have an orange frame. The colors are represented as shown below:

Representation	Cell color
	Cell with green frame (unselected, unmasked)
	Cell with orange frame (selected)
	Cell with blue frame (masked cell)

The example shows how to mask cell number 3 to cell number 7 out of 9 cells. Please proceed as follows:

Procedure

- 1. Open the area setting window**

All cells are displayed with a green frame.
- 2. Select "Add Mask" and press <ENTER>**

The frame of cell 1 turns orange.
- 3. Move the cursor lever to the right until cell 3 is orange and press <ENTER>**

This marks the third cell as the beginning of the masked zone.

4. **Move the cursor lever further to the right until you reach the cell 7 and press <ENTER>**

All cells starting from where you pressed <ENTER> are selected and have an orange frame.



5. **Press <ENTER> to finish the masked zone**

Cell number 3 to 6 are framed in blue, cell number 7 still has an orange frame because the cursor is still positioned on it.



6. **Press <CANCEL> to finish the mask setting**

As soon as you move the cursor lever or press <CANCEL>, you see that cells 3 to 7 have been masked successfully.



◆ NOTE

If you wish to mask one cell only, select the cell with the cursor and press <ENTER> twice - once to select the beginning, once to select the end of the masked zone.

How to delete a mask

The example shows how to delete the mask from cell number 4 to cell number 6. Please proceed as follows:



◆ Procedure

1. **Open the area setting window**

Cells that are inspected are displayed with a green frame, masked cells have a blue frame.



2. **Select "Delete Mask" and press <ENTER>**

The frame of the first cell turns orange.



3. **Move the cursor lever to the right until cell 4 is orange and press <ENTER>**

This marks the fourth cell as the beginning of the zone where the masks should be deleted.



4. **Move the cursor lever further to the right until you reach cell 6 and press <ENTER>**

All cells starting from where you pressed <ENTER> are selected and have an orange frame.



5. **Press <ENTER> to finish deleting masks**

Cell number 4 and 5 are framed in green again, cell number 6 still has an orange frame because the cursor is still positioned on it.



6. **Press <CANCEL> to finish the mask setting**

As soon as you move the cursor lever or press <CANCEL>, you see that now only cells 3 and 7 are masked.



◆ NOTE

If you wish to delete one mask only, select the masked cell with the cursor and press <ENTER> twice - once to select the beginning, once to select the end of the deletion zone.

7.8.3 Setting Procedure

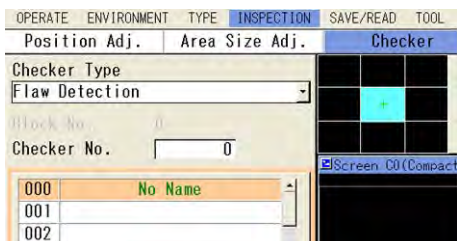
In order to set up this checker, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press <ENTER>
If the **RUN** menu is active, press <OPE/SET> to activate the **SETUP** menu.
2. Select **"Checker"** from the submenu and press <ENTER>

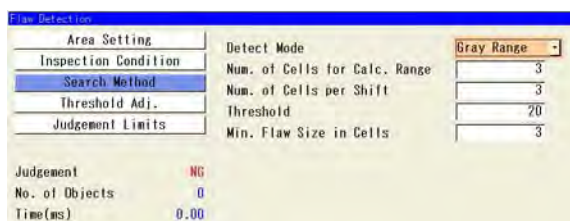
3. Select "Flaw Detection" under "Checker Type" and press <ENTER>



4. Select a checker number and press <ENTER>

The setting window appears.

5. Select "Search Method" and press <ENTER>



6. Set "Detect Mode"

Depending on your application, leave the default setting "Differential" or use "Gray Range" (see page 210).

7. Press <CANCEL>

8. Select "Area Setting" and press <ENTER>

9. Set the area for inspection

Determine the most suitable checker shape and follow the appropriate procedure (see page 213).

10. Press <CANCEL> to return to the checker-setting window

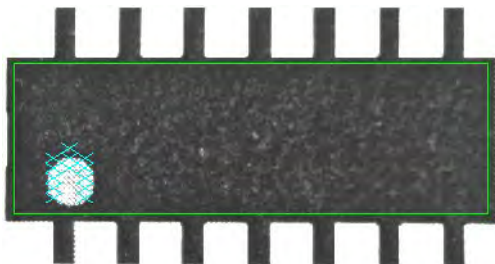
If you use a rectangular checker shape, you also need to set the parameter "Scan Direction" under "Inspection Condition" (see page 209). For a line or elliptic shape, you can immediately test the checker. If you use a flawed object for testing, you can immediately see whether the flaw is detected or not.

11. Select "Threshold Adj." and press <ENTER>

This function helps you to determine the best setting for the flaw threshold (see page 213).

12. Press <TRIG> to execute the checker for testing

Detected flaws are marked with crosses in cyan.



If the flaw is not detected or only partially, adjust the following options:

Option name	Location	Purpose
Preprocess	Inspection Condition	Improve the image by filter operations
Detect Size	Search Method	Set a smaller size to detect more flaws
Min. Flaw Size in Cells		Set a smaller number to detect more flaws
Threshold	Threshold Adj.	

13. Select "Judgement Limits" and press <ENTER>

The options on this page are used to enter the limits for judging the detected number of objects.

14. Press <TRIG> to execute the checker for testing

When a live image is displayed, the Imagechecker captures a new image first and then executes the checker. When a memory image is displayed, the Imagechecker runs a test using the current memory image. The checker results are displayed on the left side of the checker-setting window.

The detected objects are listed in a table. When you select the table and press <ENTER>, you can scroll through the results. When a table row is highlighted, the crosses from the corresponding flaw are displayed in pink in the image. The other crosses are displayed in cyan.



◆ NOTE

When you are using a rectangular flaw detection checker in "Differential" and have set the option "Scan Direction" to "Hor./Ver.", the table lists first the flaws detected in horizontal direction (in ascending order sorted by Y-coordinate) and then the flaws detected in vertical direction (in ascending order sorted by X-coordinate).

7.9 Connector (Binary Window)

This checker is used to check connector pins by counting black or white pixels within cells (one cell is used for each pin). You may set limits for the obtained number of pixels and if the area of each connector pin is within the range, the pin is judged OK, otherwise it is judged NG. Only if all pins are judged OK will the checker be judged OK.

The checker has the following properties:

Checker Properties		Additional Information
Checker shapes available	Line	The only shape available is a line with a default 3 cells.
Masks available	Not available	
Results	Judgement	If the pixel count of each cell is within the minimum and maximum limits you have set, the checker judgement is "OK", if one or more cells exceeds the limits, the checker judgement is "NG".
	Area	Outputs for each cell the number of pixels with the target color.

7.9.1 Special Checker Parameters

The following parameters are specific to this checker:

Select	Parameter	Description
Inspection condition	Target	Determines the target color for the pixel count (white or black).
	Filter	Use a dilation or erosion filter (see page 115).

7.9.2 Setting Procedure

In order to set up this checker, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Checker"** from the submenu and press **<ENTER>**
3. Select **"Connector (Bin. Win.)"** under **"Checker Type"** and press **<ENTER>**
The setting window appears. The displayed camera image is binary.
4. Select a checker number and press **<ENTER>**

5. Select "Area Setting" and press <ENTER>

Connector (Bin. Win.)

Area Setting

Inspection Condition

Judgement Limits

Judgement **NG**

Time(ms) **0.00**

Comment

Camera **0**

Position Adj. **No**

Area **Set**

Area Size Adj.

Checker

Offset

Start Point

End Point

No.	Area	Judgement

6. Set the camera number

The image from the selected camera is displayed as a binary image. Next, set preprocessing tools such as filters and slice levels.

7. Press <CANCEL>

8. Select "Inspection Condition"

Connector (Bin. Win.)

Inspection Condition

Judgement Limits

Judgement **OK**

Time(ms) **0.79**

Preprocess **No**

Slice Level **A**

Target **White**

Filter **3x3 Dilation**

9. Select a preprocessing group if you want to preprocess the image

You can define up to 5 preprocessing groups (see page 109).

10. Select a slice level

The slice levels are used to create a binary image. You can define up to 8 slice level groups (A - H) (see page 114).

11. Set the color to be detected under "Target"

The default setting is "White".

12. Set a filter under "Filter", if necessary

In addition to the filters available under preprocessing (see page 109) you can add erosion and dilation filters (see page 115). The image display is updated automatically.

13. Press <CANCEL>

14. Select "Area Setting" and press <ENTER>

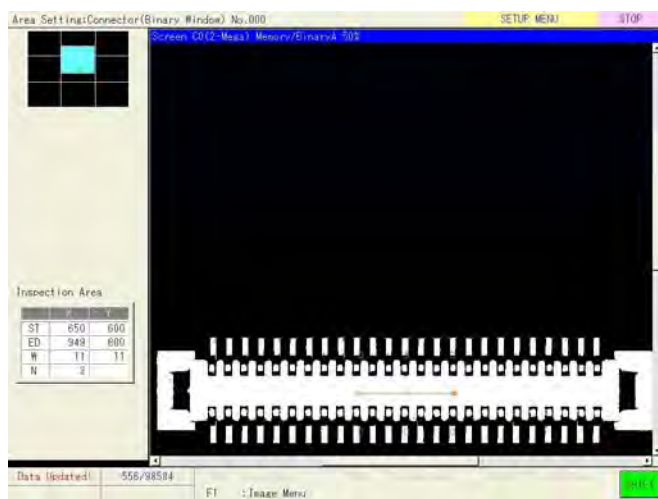
15. Under "Position Adj." you can enter the number of a position or rotation adjustment checker

This option is only available if a position or rotation adjustment checker has been set before (see page 275).

Next, you need to set the shape of the checker.

16. Select the button [Set] next to "Area Setting" and press <ENTER>

The default shape is displayed on the screen. It is a line with three cells. In order to set the checker shape accurately, it is recommended to zoom into the image.



17. Press <F1> to open the image menu

18. Select "Magnification" and press <ENTER>

19. Enter a percentage figure (e.g. 150) and press <ENTER>

Now the object is probably no longer in the viewing area. You need to scroll the screen to see the object.

20. Press <CANCEL>

21. Select "Scroll" and press <ENTER>

Use the navigation tool in the top as a guide. The cyan square indicates the currently displayed part of the image. The green cross marks the location of the checker shape.

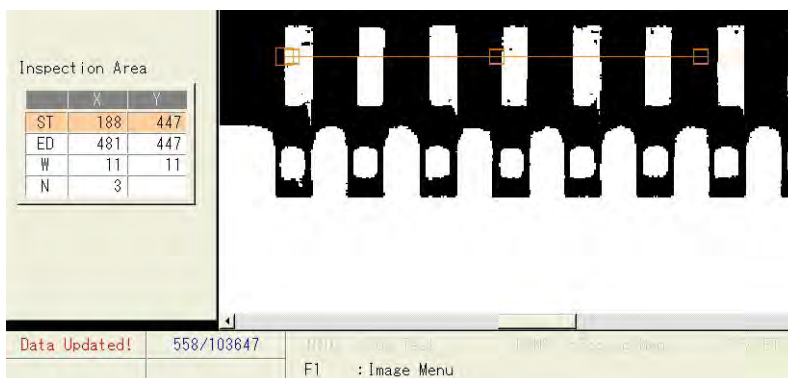


Scroll until the cyan square is in the middle where the green cross is located.

22. Press <CANCEL> to close the image menu

23. Move the default shape to the first pin to be checked

The start point needs to be set exactly on the edge of the first pin.

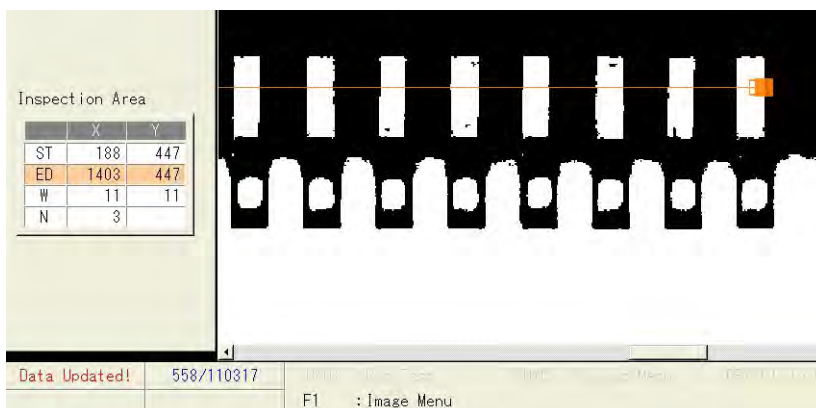


24. Press <ENTER> to move only the start point

25. Tilt the cursor lever to move the start point from its current position

26. Press <ENTER> when the start point is in the desired position

27. Set the end point accordingly



28. Press <ENTER> twice to reach row "N" of the table

Before you can set the cell width and height, you need to set the number of cells.

29. Set the number of cells to the number of pins to be checked

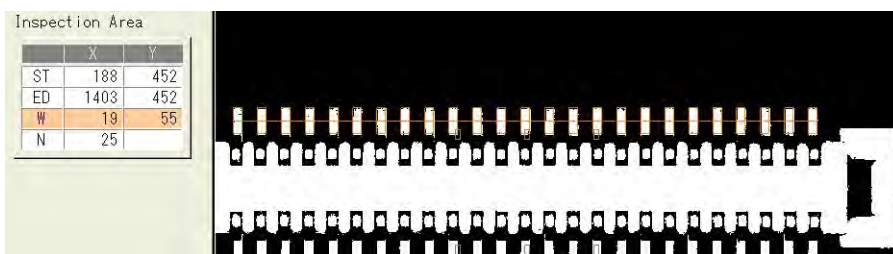
In our example, the connector has 25 pins.

30. Tilt the cursor lever to the right to increase the number of cells

31. Press <CANCEL> to return to the width and height setting of the cells

32. Set the cell width and height so that the pins are completely surrounded

If necessary, press <CANCEL> to return to the start/end point setting and readjust them.



33. Press <ENTER> twice to return to the checker-setting window

34. Press <TRIG> to execute the checker for testing

The result table displays all pin areas. All pins and the checker will be judged OK until you set the judging conditions.

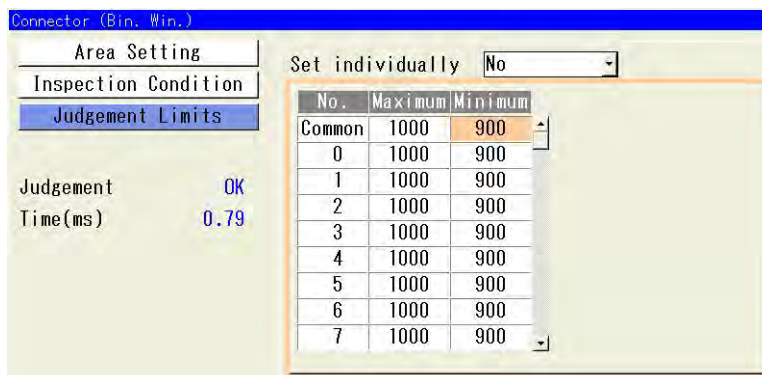
35. Press <CANCEL>

36. Select "Judgement Limits" and press <ENTER>

The options on this page are used to enter the limits for judging the detected pin areas. It is possible to set judgement limits for each individual pin, but it is not recommended.

37. Select the table of maximum/minimum values and press <ENTER>

38. In the "Common" row, set the maximum and minimum value based on your checker results



39. Press <TRIG> to execute the checker for testing

As soon as only one pin is judged NG because its area is outside the judgement limits, the total checker result is NG. The detected pins are listed in a table. When you select the table and press <ENTER>, you can scroll through the results.

When a table row is highlighted, the corresponding pin is displayed in pink in the image. The other detected pins are displayed in green if they are judged OK and red if they are judged NG.

Connector (Bin. Win.)

Area Setting		Set individually	
Inspection Condition		No	
Judgement Limits			

Judgement **NG**

Time(ms) **1.29**

No.	Maximum	Minimum
Common	1100	900
0	1100	900
1	1100	900
2	1100	900
3	1100	900
4	1100	900
5	1100	900
6	1100	900
7	1100	900

No.	Area	Judgement
0	956	OK
1	913	OK
2	967	OK
3	894	NG
4	968	OK
5	920	OK
6	968	OK
7	869	NG

7.10 Connector (Gray Window)

This checker is used to check connector pins by calculating the average gray value within cells (one cell is used for each pin). You may set limits for the average gray value and if the average gray value of each connector pin is within the range, the pin is judged OK, otherwise it is judged NG. Only if all pins are judged OK will the checker be judged OK.

The checker has the following properties:

Checker Properties		Additional Information
Checker shapes available	Line	The only shape available is a line with a default 3 cells.
Masks available	Not available	
Results	Judgement	If the average gray value of each cell is within the minimum and maximum limits you have set, the checker judgement is "OK", if one or more cells exceeds the limits, the checker judgement is "NG".
	Average gray value	Outputs the average gray value for each cell.

7.10.1 Setting Procedure

In order to set up this checker, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Checker"** from the submenu and press **<ENTER>**
3. Select **"Connector (Gra. Win.)"** under **"Checker Type"** and press **<ENTER>**
The setting window appears. The displayed camera image is binary.
4. Select a checker number and press **<ENTER>**

5. Select "Area Setting" and press <ENTER>

Connector (Gra. Win.)

Area Setting

Inspection Condition

Judgement Limits

Judgement **NG**

Time(ms) **0.00**

Comment

Camera **0**

Position Adj. **No**

Area **Set**

Area Size: 100

Checker	Offset
Start Point	
End Point	

No.	Average gray value	Judgement

6. Set the camera number

The image from the selected camera is displayed as a binary image. Next, set preprocessing tools such as filters and slice levels.

7. Press <CANCEL>

8. Select "Inspection Condition"

9. Select a preprocessing group if you want to preprocess the image

You can define up to 5 preprocessing groups (see page 109).

10. Press <CANCEL>

11. Select "Area Setting" and press <ENTER>

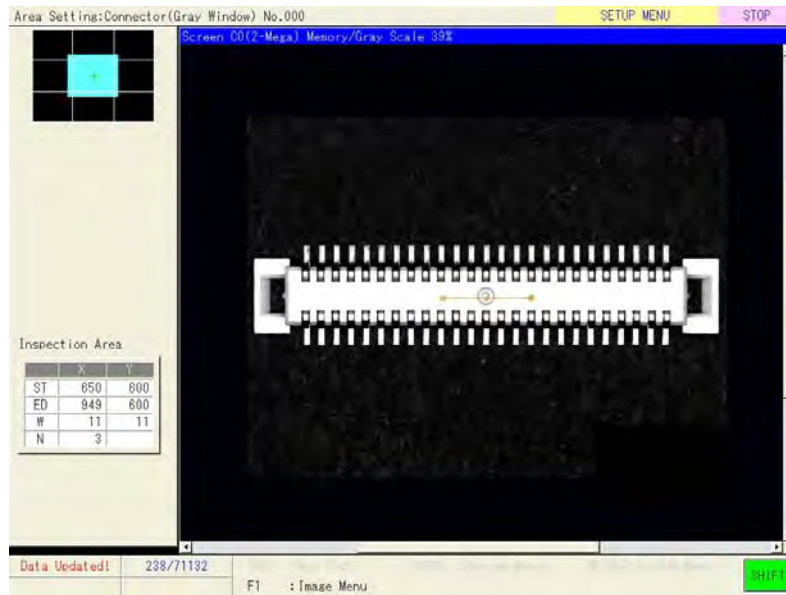
12. Under "Position Adj." you can enter the number of a position or rotation adjustment checker

This option is only available if a position or rotation adjustment checker has been set before (see page 275).

Next, you need to set the shape of the checker.

13. Select the button [Set] next to "Area Setting" and press <ENTER>

The default shape is displayed on the screen. It is a line with three cells. In order to set the checker shape accurately, it is recommended to zoom into the image.



14. Press <F1> to open the image menu

15. Select "Magnification" and press <ENTER>

16. Enter a percentage figure (e.g. 150) and press <ENTER>

Now the object is probably no longer in the viewing area. You need to scroll the screen to see the object.



17. Press <CANCEL>

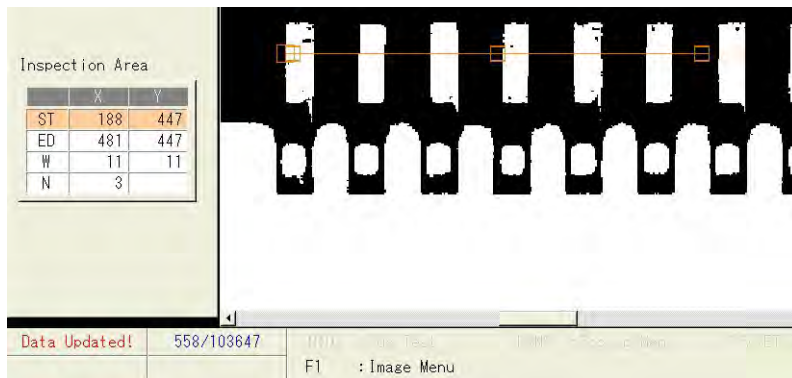
18. Select "Scroll" and press <ENTER>

Use the navigation tool in the top as a guide. The cyan square indicates the currently displayed part of the image. The green cross marks the location of the checker shape. Scroll until the cyan square is in the middle where the green cross is located.

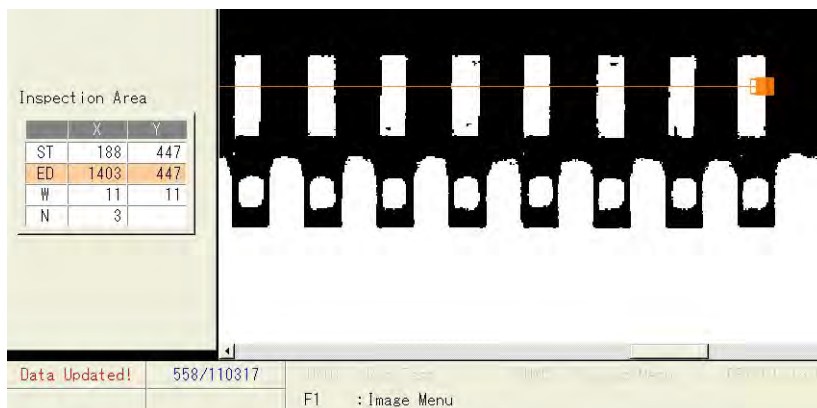
19. Press <CANCEL> to close the image menu

20. Move the default shape to the first pin to be checked

The start point needs to be set exactly on the edge of the first pin.

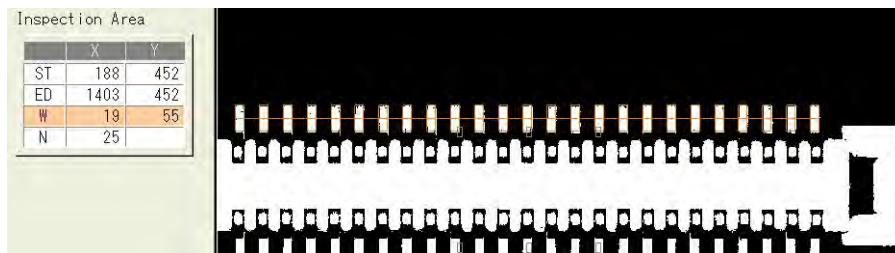


21. Press <ENTER> to move only the start point
22. Tilt the cursor lever to move the start point from its current position
23. Press <ENTER> when the start point is in the desired position
24. Set the end point accordingly



25. Press <ENTER> twice to reach row "N" of the table
Before you can set the cell width and height, you need to set the number of cells.
26. Set the number of cells to the number of pins to be checked
In our example, the connector has 25 pins.
27. Tilt the cursor lever to the right to increase the number of cells
28. Press <CANCEL> to return to the width and height setting of the cells
29. Set the cell width and height so that the pins are completely surrounded

If necessary, press <CANCEL> to return to the start/end point setting and readjust them.



30. Press <ENTER> twice to return to the checker-setting window

31. Press <TRIG> to execute the checker for testing

The result table displays all pin areas. All pins and the checker will be judged OK until you set the judging conditions.

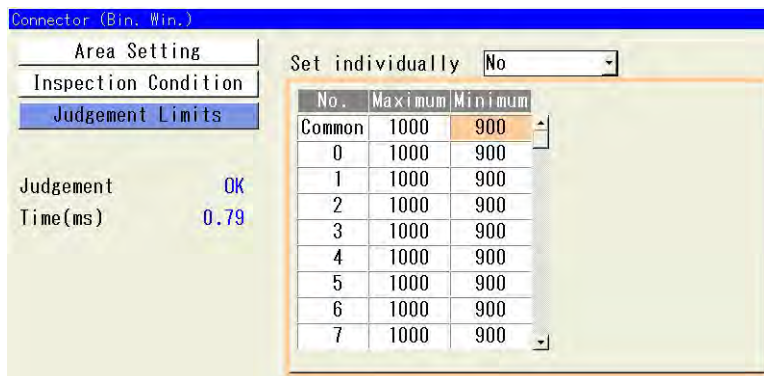
32. Press <CANCEL>

33. Select "Judgement Limits" and press <ENTER>

The options on this page are used to enter the limits for judging the detected pin areas. It is possible to set judgement limits for each individual pin, but it is not recommended.

34. Select the table of maximum/minimum values and press <ENTER>

35. In the "Common" row, set the maximum and minimum value based on your checker results



36. Press <TRIG> to execute the checker for testing

As soon as only one pin is judged NG because its average gray value is outside the judgement limits, the total checker result is NG. The detected pins are listed in a table. When you select the table and press <ENTER>, you can scroll through the results. When a table row is highlighted, the corresponding pin is displayed in pink in the image. The other detected pins are displayed in green if they are judged OK and red if they are judged NG.

Connector (Gra. Win.)

Area Setting

Inspection Condition

Judgement Limits

Set individually

No

No.	Maximum	Minimum
Common	245	220
0	245	220
1	245	220
2	245	220
3	245	220
4	245	220
5	245	220
6	245	220
7	245	220

Judgement

NG

Time(ms)

0.68

No.	Average gray value	Judgement
17	235	OK
18	249	NG
19	239	OK
20	239	OK
21	243	OK
22	231	OK
23	231	OK
24	247	NG

7.11 Connector (Gray Edge)

This checker measures the gaps of IC pins, pitch and float of leads, and the size of parts (outside/inside diameters) by setting multiple gray edge-detection checkers on a horizontal or vertical line in the checker area.



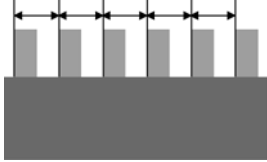

The checker has the following properties:

Checker Properties		Additional Information
Checker shapes available	Line	The line can have two directions, horizontal or vertical. There can be up to 100 cells for gray-edge detection in four different execution modes.
Masks available	Not available	
Results	Judgement	If "Pitch Total Judgement" and "Distance Diff. Total Judg." (if calculated) are OK, then the checker is OK
	Max. pitch	Maximum result (gap, pitch, float, width measurement)
	Min. pitch	Minimum result (gap, pitch, float, width measurement)
	Average pitch	Average result (gap, pitch, float, width measurement)
	Pitch total judgement	If all results in the "Pitch" column are within the judgement limits, "Pitch Total Judgement" is OK.
	Distance difference total judgement	Only available for execution mode "Float" If all results in the "Dist. Diff." column are within the judgement limits, "Distance Diff. Total Judg." is OK.

The results in the result table depend on the execution mode selected under "Inspection Condition" (see page 240).

7.11.1 Overview of the Execution Modes

There are four execution modes available:

Execution mode	Description	Example
Gap (see page 247)	<p>Detects the distance (gap) between pin pairs on opposite sides of the connector. When all gaps are within the judgement limits, the object is judged as OK.</p> <p>2 checker areas need to be set: area 0 and area 1 for the two rows of pins on the connector.</p>	
Float (see page 253)	<p>Measures the height of pins by measuring the distance from the tip of each pin to the connector body.</p> <p>If the float judgement and dispersion total judgement are both OK, total judgement will be OK.</p> <p>2 checker areas need to be set: area 0 for the pins and area 1 for connector body.</p>	
Pitch (see page 261)	<p>Detects the distance (pitch) between pin pairs on one side of the connector. When all pitches within the judgement limits, the object is judged as OK.</p> <p>1 checker area needs to be set: area 0 for the pins.</p>	
Width Measurement (see page 267)	<p>Detects an edge in each of two areas and calculates the distance (width) between them. Multiple widths on the inspection line can be measured at the same time. When all width measurements are within the judgement limits, the object is OK.</p> <p>1 checker area needs to be set: area 0 for the pins.</p>	



◆ NOTE

The following two parameters must be set **BEFORE** you set the checker area. Every time you change one of these parameters, the checker area is reset to the default setting:

- Execution mode
- Checker direction (horizontal or vertical)

7.11.2 Checker Results by Execution Mode

Apart from the results common to all execution modes, the following checker results are calculated and displayed in a table:

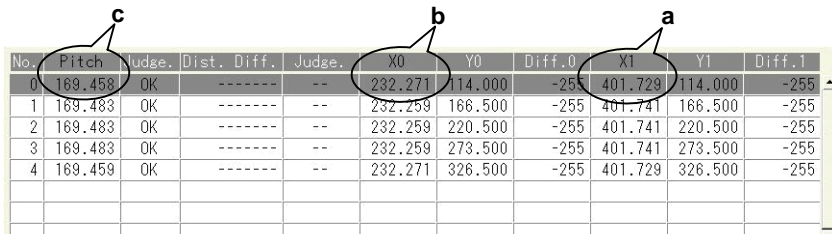


◆ NOTE

- The results of the connector (gray edge) checker are often labeled simply as "pitch", independent of the execution mode.

- The result of the gray-value differential is positive if the edge condition is "Dark -> Light" and negative if it is "Light -> Dark".

Mode	Results and calculation formula																																																																																																			
Gap	<ul style="list-style-type: none">Gap (displayed in column "Pitch")Judgement of each gap in column "Judge"X0, Y0, Diff.0: X-, Y-coordinate and gray-value difference of the pin in the first checker area (area0)X1, Y1, Diff.1: X-, Y-coordinate and gray-value difference of the pin in the second checker area (area1) <p>Calculation formula: $a - b = c$ resp. $Y1 (row_n) - Y0 (row_n) = Pitch (row_n)$</p> <table><tr><th>No.</th><th>Pitch</th><th>Judge.</th><th>Dist. Diff.</th><th>Judge.</th><th>X0</th><th>Y0</th><th>Diff.0</th><th>X1</th><th>Y1</th><th>Diff.1</th></tr><tr><td>0</td><td>95.514</td><td>OK</td><td>-----</td><td>--</td><td>194.508</td><td>544.594</td><td>-138</td><td>194.000</td><td>640.108</td><td>-140</td></tr><tr><td>1</td><td>94.695</td><td>OK</td><td>-----</td><td>--</td><td>244.000</td><td>544.634</td><td>-143</td><td>243.500</td><td>639.328</td><td>-125</td></tr><tr><td>2</td><td>95.149</td><td>OK</td><td>-----</td><td>--</td><td>294.500</td><td>544.443</td><td>-138</td><td>294.000</td><td>639.592</td><td>-133</td></tr><tr><td>3</td><td>94.611</td><td>OK</td><td>-----</td><td>--</td><td>344.500</td><td>544.803</td><td>-154</td><td>344.000</td><td>639.413</td><td>-135</td></tr><tr><td>4</td><td>94.880</td><td>OK</td><td>-----</td><td>--</td><td>395.000</td><td>544.495</td><td>-131</td><td>394.500</td><td>639.375</td><td>-154</td></tr><tr><td>5</td><td>94.491</td><td>OK</td><td>-----</td><td>--</td><td>445.000</td><td>544.529</td><td>-142</td><td>444.000</td><td>639.021</td><td>-146</td></tr><tr><td>6</td><td>94.692</td><td>OK</td><td>-----</td><td>--</td><td>495.000</td><td>544.620</td><td>-139</td><td>494.000</td><td>639.312</td><td>-133</td></tr><tr><td>7</td><td>94.212</td><td>OK</td><td>-----</td><td>--</td><td>545.000</td><td>544.807</td><td>-131</td><td>543.857</td><td>639.019</td><td>-119</td></tr></table>	No.	Pitch	Judge.	Dist. Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1	0	95.514	OK	-----	--	194.508	544.594	-138	194.000	640.108	-140	1	94.695	OK	-----	--	244.000	544.634	-143	243.500	639.328	-125	2	95.149	OK	-----	--	294.500	544.443	-138	294.000	639.592	-133	3	94.611	OK	-----	--	344.500	544.803	-154	344.000	639.413	-135	4	94.880	OK	-----	--	395.000	544.495	-131	394.500	639.375	-154	5	94.491	OK	-----	--	445.000	544.529	-142	444.000	639.021	-146	6	94.692	OK	-----	--	495.000	544.620	-139	494.000	639.312	-133	7	94.212	OK	-----	--	545.000	544.807	-131	543.857	639.019	-119
No.	Pitch	Judge.	Dist. Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1																																																																																										
0	95.514	OK	-----	--	194.508	544.594	-138	194.000	640.108	-140																																																																																										
1	94.695	OK	-----	--	244.000	544.634	-143	243.500	639.328	-125																																																																																										
2	95.149	OK	-----	--	294.500	544.443	-138	294.000	639.592	-133																																																																																										
3	94.611	OK	-----	--	344.500	544.803	-154	344.000	639.413	-135																																																																																										
4	94.880	OK	-----	--	395.000	544.495	-131	394.500	639.375	-154																																																																																										
5	94.491	OK	-----	--	445.000	544.529	-142	444.000	639.021	-146																																																																																										
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7	94.212	OK	-----	--	545.000	544.807	-131	543.857	639.019	-119																																																																																										
Pitch	<ul style="list-style-type: none">PitchJudgement of each pitch in column "Judge"X0, Y0, Diff.0: X-, Y-coordinate and gray-value difference of the pin's edge pin <p>Calculation formula: $a - b = c$ resp. $X0 (row_{n+1}) - X0 (row_n) = Pitch (row_n)$</p> <table><tr><th>No.</th><th>Pitch</th><th>Judge.</th><th>Dist. Diff.</th><th>Judge.</th><th>X0</th><th>Y0</th><th>Diff.0</th><th>X1</th><th>Y1</th><th>Diff.1</th></tr><tr><td>0</td><td>51.021</td><td>OK</td><td>-----</td><td>--</td><td>188.102</td><td>446.000</td><td>164</td><td>-----</td><td>-</td><td>-</td></tr><tr><td>1</td><td>49.724</td><td>OK</td><td>-----</td><td>--</td><td>239.123</td><td>446.000</td><td>182</td><td>-----</td><td>-</td><td>-</td></tr><tr><td>2</td><td>50.192</td><td>OK</td><td>-----</td><td>--</td><td>288.847</td><td>446.000</td><td>182</td><td>-----</td><td>-</td><td>-</td></tr><tr><td>3</td><td>48.926</td><td>OK</td><td>-----</td><td>--</td><td>339.039</td><td>446.000</td><td>186</td><td>-----</td><td>-</td><td>-</td></tr><tr><td>4</td><td>49.997</td><td>OK</td><td>-----</td><td>--</td><td>387.965</td><td>446.000</td><td>192</td><td>-----</td><td>-</td><td>-</td></tr><tr><td>5</td><td>50.255</td><td>OK</td><td>-----</td><td>--</td><td>437.962</td><td>446.000</td><td>167</td><td>-----</td><td>-</td><td>-</td></tr><tr><td>6</td><td>49.249</td><td>OK</td><td>-----</td><td>--</td><td>488.218</td><td>446.000</td><td>181</td><td>-----</td><td>-</td><td>-</td></tr><tr><td>7</td><td>50.556</td><td>OK</td><td>-----</td><td>--</td><td>537.467</td><td>446.000</td><td>184</td><td>-----</td><td>-</td><td>-</td></tr></table>	No.	Pitch	Judge.	Dist. Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1	0	51.021	OK	-----	--	188.102	446.000	164	-----	-	-	1	49.724	OK	-----	--	239.123	446.000	182	-----	-	-	2	50.192	OK	-----	--	288.847	446.000	182	-----	-	-	3	48.926	OK	-----	--	339.039	446.000	186	-----	-	-	4	49.997	OK	-----	--	387.965	446.000	192	-----	-	-	5	50.255	OK	-----	--	437.962	446.000	167	-----	-	-	6	49.249	OK	-----	--	488.218	446.000	181	-----	-	-	7	50.556	OK	-----	--	537.467	446.000	184	-----	-	-
No.	Pitch	Judge.	Dist. Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1																																																																																										
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Float	<ul style="list-style-type: none">Float (displayed in column "Pitch")Judgement of each float in the first column "Judge"Dist. Diff.: Difference between floats of adjacent pinsX0, Y0, Diff.0: X-, Y-coordinate and gray-value difference of each pin edge in the first checker area (area0, pins)X1, Y1, Diff.1: X-, Y-coordinate and gray-value difference of the edge detected in the second checker area (area1, connector body) <p>Calculation formula for "Pitch": $a - b = c$ resp. $Y1 (row_0) - Y0 (row_n) = Pitch (row_n)$</p> <p>Calculation formula for "Dist. Diff": $c - d = e$ resp. $Pitch (row_n) - Pitch (row_{n-1})$</p> <table><tr><th>No.</th><th>Pitch</th><th>Judge.</th><th>Dist. Diff.</th><th>Judge.</th><th>X0</th><th>Y0</th><th>Diff.0</th><th>X1</th><th>Y1</th><th>Diff.1</th></tr><tr><td>0</td><td>68.084</td><td>OK</td><td>1.131</td><td>OK</td><td>198.000</td><td>425.535</td><td>107</td><td>161.000</td><td>493.619</td><td>86</td></tr><tr><td>1</td><td>66.953</td><td>OK</td><td>0.134</td><td>OK</td><td>248.000</td><td>426.666</td><td>130</td><td>-----</td><td>-----</td><td>-----</td></tr><tr><td>2</td><td>67.087</td><td>OK</td><td>0.224</td><td>OK</td><td>298.808</td><td>426.532</td><td>129</td><td>-----</td><td>-----</td><td>-----</td></tr><tr><td>3</td><td>66.862</td><td>OK</td><td>0.664</td><td>OK</td><td>347.696</td><td>426.757</td><td>112</td><td>-----</td><td>-----</td><td>-----</td></tr><tr><td>4</td><td>66.198</td><td>OK</td><td>0.670</td><td>OK</td><td>396.645</td><td>427.421</td><td>120</td><td>-----</td><td>-----</td><td>-----</td></tr><tr><td>5</td><td>66.868</td><td>OK</td><td>0.881</td><td>OK</td><td>448.000</td><td>426.751</td><td>133</td><td>-----</td><td>-----</td><td>-----</td></tr><tr><td>6</td><td>65.988</td><td>OK</td><td>1.121</td><td>OK</td><td>496.375</td><td>427.632</td><td>111</td><td>-----</td><td>-----</td><td>-----</td></tr><tr><td>7</td><td>67.109</td><td>OK</td><td>0.722</td><td>OK</td><td>545.800</td><td>426.511</td><td>146</td><td>-----</td><td>-----</td><td>-----</td></tr></table>	No.	Pitch	Judge.	Dist. Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1	0	68.084	OK	1.131	OK	198.000	425.535	107	161.000	493.619	86	1	66.953	OK	0.134	OK	248.000	426.666	130	-----	-----	-----	2	67.087	OK	0.224	OK	298.808	426.532	129	-----	-----	-----	3	66.862	OK	0.664	OK	347.696	426.757	112	-----	-----	-----	4	66.198	OK	0.670	OK	396.645	427.421	120	-----	-----	-----	5	66.868	OK	0.881	OK	448.000	426.751	133	-----	-----	-----	6	65.988	OK	1.121	OK	496.375	427.632	111	-----	-----	-----	7	67.109	OK	0.722	OK	545.800	426.511	146	-----	-----	-----
No.	Pitch	Judge.	Dist. Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1																																																																																										
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Mode	Results and calculation formula																																																																																																																								
Width measurement	<ul style="list-style-type: none">Width (displayed in column "Pitch")Judgement of each width in the first column "Judge"X0, Y0, Diff.0: X-, Y-coordinate and gray-value difference of each pin edge in the first checker area (area0, pins)X1, Y1, Diff.1: X-, Y-coordinate and gray-value difference of the edge detected in the second checker area (area1, connector body) <p>Calculation formula for "Pitch": $a - b = c$, resp. $X1 ((row_n) - X0 (row_n) = Pitch ((row_n)$</p>  <table><tr><th>No.</th><th>Pitch</th><th>Judge.</th><th>Dist.</th><th>Diff.</th><th>Judge.</th><th>X0</th><th>Y0</th><th>Diff.0</th><th>X1</th><th>Y1</th><th>Diff.1</th></tr><tr><td>0</td><td>169.458</td><td>OK</td><td>-----</td><td>--</td><td>--</td><td>232.271</td><td>114.000</td><td>-255</td><td>401.729</td><td>114.000</td><td>-255</td></tr><tr><td>1</td><td>169.483</td><td>OK</td><td>-----</td><td>--</td><td>--</td><td>232.259</td><td>166.500</td><td>-255</td><td>401.741</td><td>166.500</td><td>-255</td></tr><tr><td>2</td><td>169.483</td><td>OK</td><td>-----</td><td>--</td><td>--</td><td>232.259</td><td>220.500</td><td>-255</td><td>401.741</td><td>220.500</td><td>-255</td></tr><tr><td>3</td><td>169.483</td><td>OK</td><td>-----</td><td>--</td><td>--</td><td>232.259</td><td>273.500</td><td>-255</td><td>401.741</td><td>273.500</td><td>-255</td></tr><tr><td>4</td><td>169.459</td><td>OK</td><td>-----</td><td>--</td><td>--</td><td>232.271</td><td>326.500</td><td>-255</td><td>401.729</td><td>326.500</td><td>-255</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	No.	Pitch	Judge.	Dist.	Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1	0	169.458	OK	-----	--	--	232.271	114.000	-255	401.729	114.000	-255	1	169.483	OK	-----	--	--	232.259	166.500	-255	401.741	166.500	-255	2	169.483	OK	-----	--	--	232.259	220.500	-255	401.741	220.500	-255	3	169.483	OK	-----	--	--	232.259	273.500	-255	401.741	273.500	-255	4	169.459	OK	-----	--	--	232.271	326.500	-255	401.729	326.500	-255																																																
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7.11.3 Special Checker Parameters

The following parameters are specific to this checker. Their availability depends on the execution mode selected.

Select	Parameter	Description
Inspection condition	Execution mode	Set this parameter first as all other parameters (including area setting) depend on it and may be reset when you change it (see page 239).
	Detect direction	Specify the direction in which to scan the cells for edges (see page 243). Note that this parameter setting depends on the setting of "Checker Direction". This parameter is not available for execution mode "Pitch".
	Checker direction	Specify the direction of the checker. The checker should have the same orientation as the connector.
	Scan method	"Single" or "Projection", see Scan Method (see page 168)
	Edge condition 0	Edge type to be detected, see Edge Condition (see page 169) <ul style="list-style-type: none"> Light -> Dark Dark -> Light Both
	Edge condition 1	See "Edge condition 0". Not available for execution modes "Pitch" and "Width measurement"
	Detected position	<ul style="list-style-type: none"> Front: Detects the first edge with a differential value equal to or above the setting under "Threshold Adj." after the start point of the checker shape in scan direction. Peak: Detects the edge with the highest differential value among all edges with a differential value equal to or above the setting under "Threshold Adj."
Search method	Scan pitch	Parameter for edge detection, see Scan Pitch (see page 172) (not available if "Execution Mode" = "Gap")
	Filter	Parameter for edge detection, see Filter/Width (see page 172)

Select	Parameter	Description
	Width	Parameter for edge detection, see Filter/Width (see page 172) (not available if "Execution Mode" = "Gap")
	Average range	Parameter for edge detection, see Average Range (see page 173) (not available if "Execution Mode" = "Gap")
Threshold adjustment	Set individually	We recommend to leave the default setting "No" and use common settings for all cells.
	Thre.0, thre.1	Set thresholds for the differential values of the detected pin edges (Thre.0) and for the connector body (Thre.1)

7.11.3.1 Detect Direction

The parameter "Detect Direction" refers to the direction in which the Imagechecker searches for an edge within the cell. "Detect Direction" is directly linked to the "Checker Direction", which in turn depends on the connector's orientation. Refer to the table for details.

Checker direction = horizontal		Checker direction = vertical	
Inside->Outside	Outside->Inside	Inside->Outside	Outside->Inside
Top->Bottom	Bottom->Top	Left->Right	Right->Left

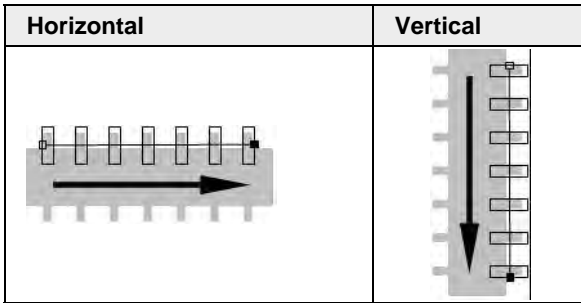


◆ NOTE

- You need to select the checker direction **BEFORE** setting the detect direction. When you change the checker direction, the detect direction will be reset to the default setting.
- Select a direction which makes it possible to start searching edges from the side with less noise or preprocess the image (see page 109).

7.11.3.2 Checker Direction

The checker direction is defined by the start point (unfilled square) and end point (filled square) of the checker shape, which is always a line for the connector checker. The cells are positioned at a right angle to the checker shape.



◆ NOTE

Select a direction which makes it possible to start searching edges from the side with less noise or preprocess the image (see page 109).

7.11.3.3 Scan Method

The option "Scan Method" works the same as for the gray-edge detection checker (see page 168).

7.11.3.4 Edge Condition 0/1

Use this parameter to determine the type of edge to be detected. The number 0 and 1 refer to the checker area where the setting will be applied. For execution mode "Pitch" only one checker area is set, so the parameter "Edge Condition 1" is not available.



◆ NOTE

The type of edge that can be detected also depends on the setting of parameter "Detect Direction". If the checker fails to detect the pin edges, use the setting "Both" to cover all types of edges and/or or preprocess the image (see page 109).

7.11.3.5 Detected Position

This parameter determines which edge will be detected and used for calculating results:

- Front: Detects the first edge with a differential value equal to or above the setting under "Threshold Adj." after the start point of the checker shape in scan direction.
- Peak: Detects the edge with the highest differential value among all edges with a differential value equal to or above the setting under "Threshold Adj."

7.11.3.6 Threshold Adjustment

This parameter helps you to filter out noise and prevent the checker from detecting wrong edges. Only edges with a gray-value difference higher than the threshold will be detected.

Thre.0 and Diff.0 refer to edges detected by area0, Thre.1 and Diff.1 refer to edges detected by area1 and are only displayed when they are used, e.g. for execution mode "Float" and "Gap". You can set one threshold for all cells (common) or individually for each edge, respectively cell.



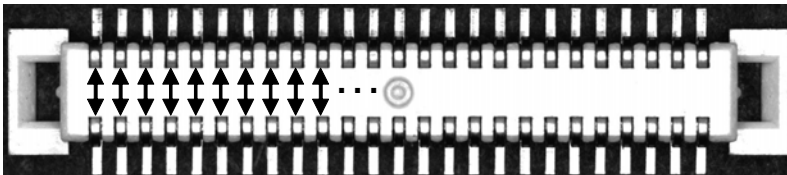
◆ NOTE

We recommend to use the common setting (default). Use independent settings if the pins differ in brightness or some of the pins appear darker than others due to lighting conditions.

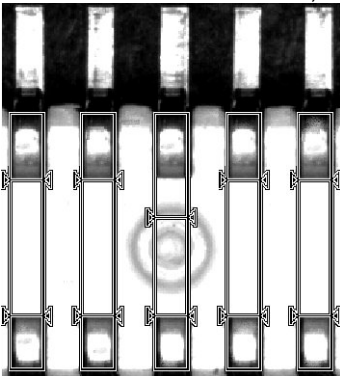


◆ EXAMPLE

Inspection task: Check the inner distance between the pins.



When you use the execution mode "Width measurement" with the detect direction "Inside->Outside" and the edge condition "Light->Dark", the mark at the center of the connector will be detected, although this is not the pin edge.



To ignore the edges of the mark, adjust the gray-value threshold.



◆ Procedure

1. Execute the connector checker
2. Scroll through the result table until you find the wrongly detected edge

The edge will differ in the values in the columns "Diff.0" and/or "Diff.1".

No.	Pitch	Judge.	Dist.	Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1
10	94.285	OK	-----	--		694.500	544.717	-149	694.500	639.002	-136
11	94.907	OK	-----	--		744.500	544.975	-146	744.500	639.881	-165
12	68.007	OK	-----	--		801.167	571.383	-56	794.500	639.390	-130
13	94.407	OK	-----	--		844.500	544.834	-131	844.500	639.240	-146
14	94.872	OK	-----	--		894.500	544.551	-146	894.500	639.423	-139
15	94.171	OK	-----	--		944.500	544.956	-145	944.500	639.128	-133
16	94.077	OK	-----	--		995.500	545.081	-136	995.500	639.158	-119
17	94.847	OK	-----	--		1045.500	544.911	-145	1045.500	639.759	-149

In the example, all other edges have a gray-value difference of more than 130.

3. Select "Threshold Adj." and press <ENTER>

Leave the parameter "Set individually" at "No".

4. Select the table and press <ENTER>

The threshold value next to "Common" is highlighted.

Connector (Gra. Eds.)

Area Setting		Set individually		No
Inspection Condition				
Search Method				
Judgement Limits				
Threshold Adj.				

Judgement OK

Time(ms) 4.72

Max. Pitch 95.342

Min. Pitch 94.211

Average Pitch 94.686

Pitch Total Judgement OK

Distance Diff. Total Judg.

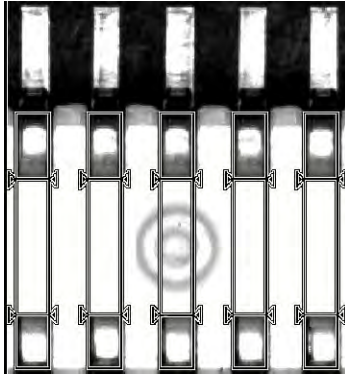
No.	Pitch	Judge.	Dist.	Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1
10	94.426	OK	-----	--		694.500	544.717	-149	694.667	639.143	-151
11	94.900	OK	-----	--		744.136	544.981	-148	744.500	639.881	-165
12	94.980	OK	-----	--		794.762	544.330	-144	795.833	639.310	-139
13	94.413	OK	-----	--		846.143	544.818	-139	844.682	639.231	-148
14	94.829	OK	-----	--		894.500	544.551	-146	892.125	639.380	-146
15	94.228	OK	-----	--		945.000	544.991	-152	945.000	639.219	-149
16	94.313	OK	-----	--		994.733	545.037	-150	993.667	639.350	-139
17	94.980	OK	-----	--		1046.529	544.814	-156	1044.895	639.794	-156

5. Press <ENTER>

6. Change the value and press <ENTER>

7. Press <TRIG> to execute the checker for testing

Now only the pin edges are detected.



7.11.4 Setting Procedure

As the parameters to be set differ for the various execution modes, there will be an example for each execution mode.

7.11.4.1 Setting Procedure for Execution Mode "Gap"

The execution mode "Gap" is the default execution mode for the connector (gray edge) checker.

Overview of Setting Procedure

The following steps need to be taken:

1. Set execution mode and checker direction to follow the orientation of the connector
2. Set one checker area to detect the edges of one row of pins (area0)
3. Set the second checker area to detect the edges of the opposite row of pins (area1, same height, width and number of cells as area0)
4. Check an OK and a NG object to measure the gaps
5. Set judgement limits based on the OK/NG measurements

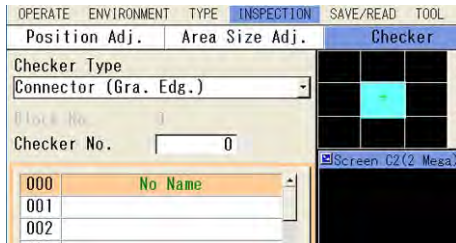
In order to set up the checker, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Checker"** from the submenu and press **<ENTER>**
3. Select **"Connector (Gra. Edg.)"** under **"Checker Type"** and press **<ENTER>**

4. Select a checker number and press <ENTER>



The setting window appears.

5. Select "Inspection Condition" and press <ENTER>

6. Select a preprocessing group if you want to preprocess the image

You can define up to 5 preprocessing groups (see page 109).

7. Set the "Checker Direction"

Select "Horizontal" or "Vertical" depending on the orientation of the connector to be checked. You need to select the checker direction BEFORE setting the detect direction. When you change the checker direction, the detect direction will be reset to the default setting (see page 243).

8. Set the "Detect Direction"

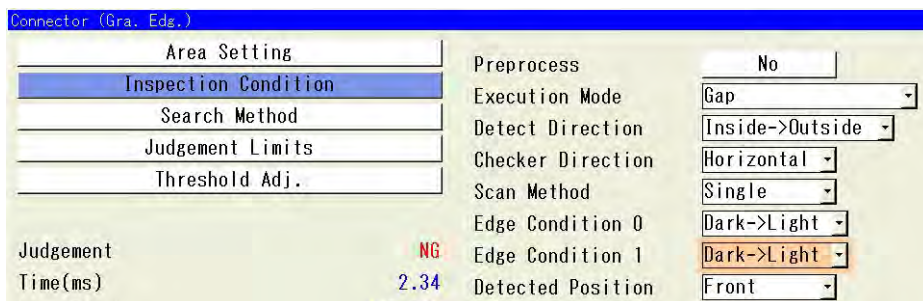
The default setting is "Inside->Outside". This setting is used for the example. You can choose from 4 different settings (see page 243).

9. Set the "Scan Method"

You can choose between "Single" and "Projection" (see page 168).

10. Set the "Edge Condition 0" and "Edge Condition 1"

As the execution mode "Gap" works with two checker areas, you need to set the type of edge to be detected for both checker areas. In the example, we need to find transitions from dark to light.



11. Set the "Detected Position"

Select which edge should be detected and used for calculating the gap. In the example, the first edge should be used ("Front").

12. Press <CANCEL>

13. Select "Area Setting" and press <ENTER>**14. Set the camera number****15. Select the button [Set] next to "Area" and press <ENTER>**

The two default areas for area0 and area1 are displayed on the screen. For demonstration purposes, this procedure leaves out the image of the connector for the first few steps to allow you a clear view of the two areas.

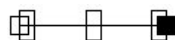
Both areas consist of three rectangular cells next to each other. Whether the cells form a horizontal or vertical line depends on the setting of "Checker Direction" under "Inspection Condition".



Area0 is displayed at the top in orange, area1 below area 0 in green. To toggle between the two areas, move the cursor lever up or down until the colors change.

16. Press <ENTER>

The three small green squares turn orange and the underlying default line shape is displayed as well.

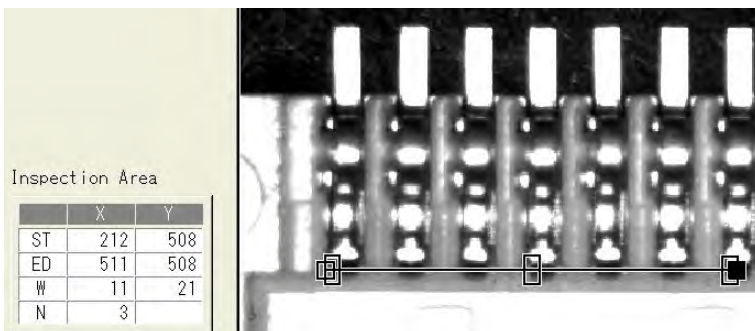


A table appears below the "Area Setting" menu with the coordinates for the line's start (ST) and end point (ED). The "W" refers to the cell dimensions (11 pixels wide and 21 pixels high by default), the "N" = 3 refers to the default number of cells.

Inspection Area		
	X	Y
ST	212	508
ED	511	508
W	11	21
N	3	

17. Tilt the cursor lever to move the complete shape so that the start point is directly to the left of the first pin edge

It may make sense to zoom into the image for better accuracy in positioning the area (see page 76). Note that the second (green) area is moved along with the first area. All settings you make for area0 are automatically applied to area1.



18. Press <ENTER> twice to move only the end point

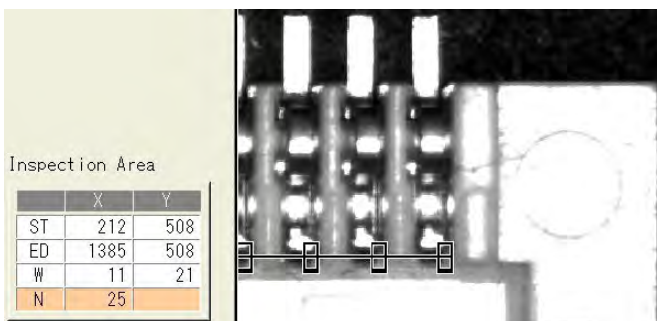
19. Move the end point so that it is close directly to the right of the last pin edge



20. Press <ENTER> twice to reach the table row "N"

21. Tilt the cursor lever up until "N" equals the number of pins

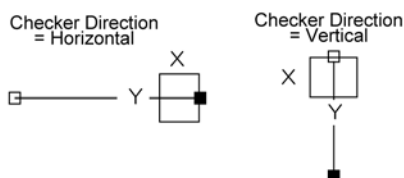
The example checks the gap between 25 pin pairs.



Next, the cell width and height needs to be set.

22. Press <CANCEL>

The cursor returns to the table row "W". This row defines the width and height of the cells. Note that X and Y appear reversed when the checker direction is vertical.

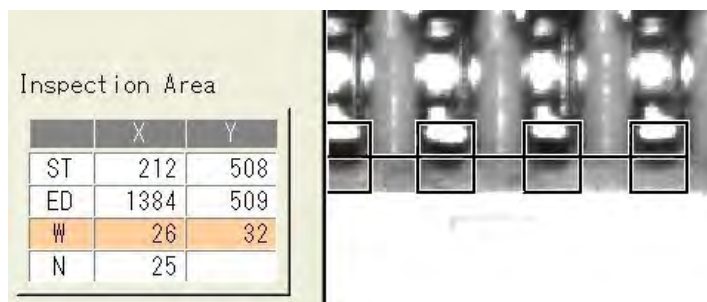


23. Move the cursor lever to the right to increase the cell width

Hold the cursor lever to the right side until the cell is wide enough for the edge.

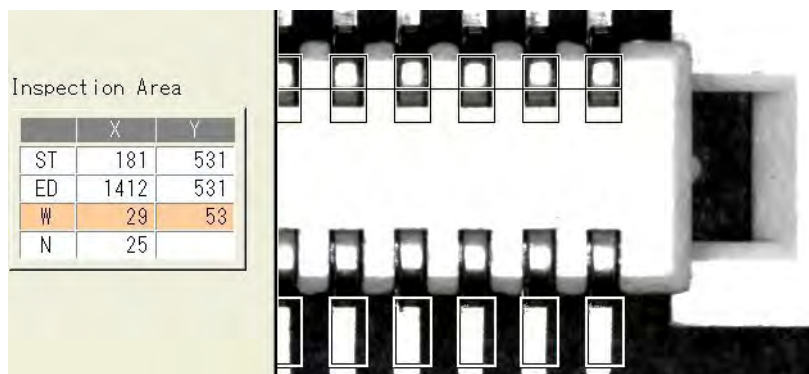
24. Move the cursor lever up to increase the cell height

Hold the cursor lever up until the cell is high enough for detecting the edge.



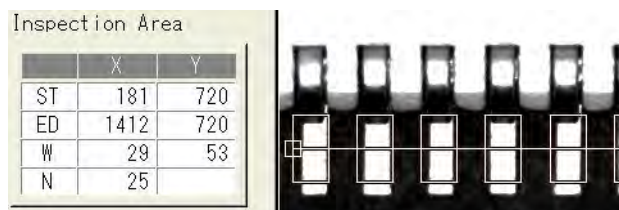
25. Press <ENTER> twice to finish setting area0

Next, area1 (green) has to be positioned correctly

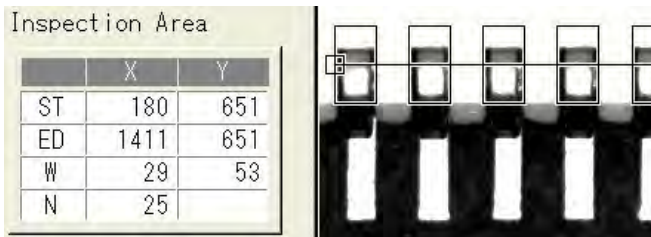


Move the cursor lever down so that the other shape turns orange

26. Press <ENTER>



27. Tilt the cursor lever to move the complete shape so that the start point is directly to the left of the edge



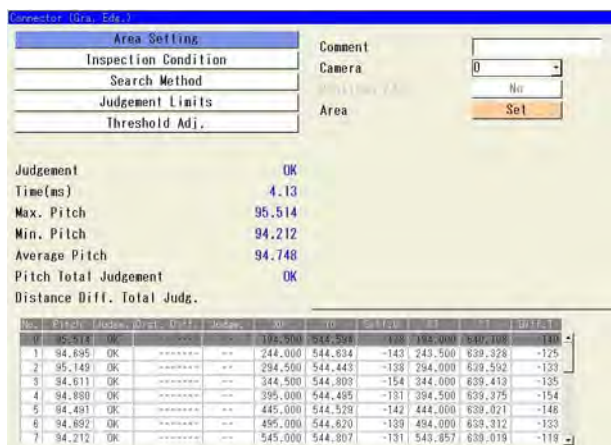
28. Press <ENTER> 4 times to confirm the area settings

When the "Inspection Area" table disappears, you have finished setting area1.

29. Press <CANCEL> to return to the checker setting window

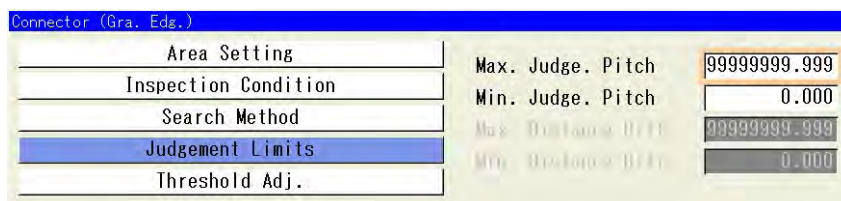
30. Press <TRIG> to execute the checker for testing

The Imagechecker calculates the maximum, minimum, and average gap detected and lists the individual results in the results table. By selecting the table and pressing <ENTER> you can scroll through the results. When you select a row, the corresponding edge pair is highlighted in pink (when you are displaying transparent windows (see page 77)).



Next, set the judgement limits for detecting NG connectors.

31. Select "Judgement Limits" and press <ENTER>



32. Enter values for "Max. Judge. Pitch" and "Min. Judge. Pitch"

Use the results listed next to "Max. Pitch" and "Min. Pitch" as a guideline.

Connector (Gra. Edg.)

Area Setting	Max. Judge. Pitch	95.999
Inspection Condition	Min. Judge. Pitch	94.000
Search Method	Max. Distance Diff.	99999999.999
Judgement Limits	Min. Distance Diff.	0.000
Threshold Adj.		

Judgement

OK

Time(ms)

4.13

Max. Pitch

95.514

Min. Pitch

94.212

33. Test the checker with an NG object

When one or more gaps are outside the judgement limit, the gap is judged NG, the "Pitch Total Judgement" is NG, and this makes the complete connector checker NG.

Judgement

NG

Time(ms)

2.33

Max. Pitch

220.117

Min. Pitch

211.043

Average Pitch

213.504

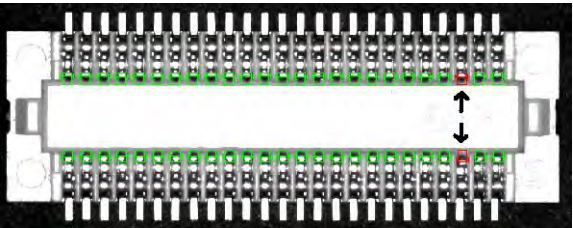
Pitch Total Judgement

NG

Distance Diff. Total Judg.

No.	Pitch	Judge.	Dist.	Diff.	Judge.	X0	Y0	Diff.0	XT	YT	Diff.T
17	212.493	OK	-----	--		1036.000	501.764	169	1038.000	714.257	146
18	212.406	OK	-----	--		1083.500	501.946	166	1085.000	714.352	157
19	215.289	OK	-----	--		1132.500	499.844	169	1131.500	715.133	147
20	212.409	OK	-----	--		1177.500	501.892	159	1180.500	714.302	151
21	213.045	OK	-----	--		1227.500	501.366	153	1227.167	714.411	152
22	220.117	NG	-----	--		1275.000	502.418	168	1275.500	722.535	151
23	215.338	OK	-----	--		1322.000	500.536	162	1322.091	715.873	145
24	214.303	OK	-----	--		1370.500	501.040	155	1370.000	715.343	149

Check the camera image. OK gaps are green, NG gaps are red.



7.11.4.2 Setting Procedure for Execution Mode "Float"

The execution mode "Float" measures the height of pins by measuring the distance from the tip of each pin to the foot of the pin or the connector body.

Overview of Setting Procedure

The following steps need to be taken:

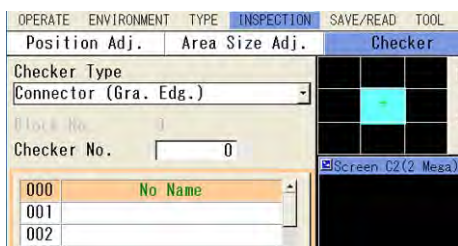
1. Set execution mode and checker direction to follow the orientation of the connector
2. Set one checker area to detect the top edges of the pins (area0)
3. Set one checker area to detect the edge of the connector body (area1)
4. Check an OK and a NG object to measure the float
5. Set judgement limits based on the OK/NG measurements

In order to set up the checker, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Checker"** from the submenu and press **<ENTER>**
3. Select **"Connector (Gra. Edg.)"** under **"Checker Type"** and press **<ENTER>**
4. Select a checker number and press **<ENTER>**



The setting window appears.

5. Select **"Inspection Condition"** and press **<ENTER>**
6. Select a preprocessing group if you want to preprocess the image
You can define up to 5 preprocessing groups (see page 109).

7. Set "Execution Mode" to "Float"

Connector (Gra. Edg.)	
Area Setting	
Inspection Condition	
Search Method	
Judgement Limits	
Threshold Adj.	
Judgement	NG
Time(ms)	0.00
Max. Pitch	0.000
Min. Pitch	0.000
Average Pitch	0.000
Pitch Total Judgement	NG
Distance Diff. Total Judg.	NG
Preprocess	No
Execution Mode	Float
Detect Direction	Inside->Outside
Checker Direction	Horizontal
Scan Method	Single
Edge Condition 0	Both
Edge Condition 1	Both
Detected Position	Front

8. Confirm the message that the area setting will be initialized

9. Set the "Checker Direction"

Select "Horizontal" or "Vertical" depending on the orientation of the connector to be checked. You need to select the checker direction BEFORE setting the detect direction. When you change the checker direction, the detect direction will be reset to the default setting (see page 243).

10. Set the "Detect Direction" to "Top->Bottom"

This is the recommended setting for using execution mode "Float" in horizontal direction. You can choose from 4 different settings (see page 243).

11. Set the "Scan Method"

You can choose between "Single" and "Projection" (see page 168).

12. Set the "Edge Condition 0" and "Edge Condition 1"

As the execution mode "Float" uses two checker areas to search for edges, you need to set the type of edge to be detected for both checker areas. In the example, we need to find transitions from dark to light.

Connector (Gra. Edg.)	
Area Setting	
Inspection Condition	
Search Method	
Judgement Limits	
Threshold Adj.	
Judgement	NG
Time(ms)	0.00
Max. Pitch	0.000
Min. Pitch	0.000
Average Pitch	0.000
Pitch Total Judgement	NG
Distance Diff. Total Judg.	NG
Preprocess	No
Execution Mode	Float
Detect Direction	Top->Bottom
Checker Direction	Horizontal
Scan Method	Single
Edge Condition 0	Dark->Light
Edge Condition 1	Dark->Light
Detected Position	Front

13. Set the "Detected Position"

Select which edge should be detected and used for calculating the gap. In the example, the first edge should be used ("Front").

14. Press <CANCEL>**15. Select "Area Setting" and press <ENTER>****16. Set the camera number****17. Select the button [Set] next to "Area" and press <ENTER>**

The two default areas for area0 and area1 are displayed on the screen. For demonstration purposes, this procedure leaves out the image of the connector for the first few steps to allow you a clear view of the two areas.

The first area consist of three rectangular cells next to each other. Whether the cells form a horizontal or vertical line depends on the setting of "Checker Direction" under "Inspection Condition". This is area0 and it will be set to cover all pins of the connector.

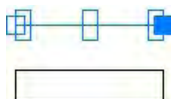
The second area is a rectangle with a width equal to the width of area0 (all cells plus gaps). Basically, area1 is one large cell.



Area0 is displayed in orange, area1 below in green. To toggle between the two areas, move the cursor lever up or down until the colors change.

18. Press <ENTER>

The three small green squares turn orange and the underlying default line shape is displayed as well. Area1 remains unchanged.



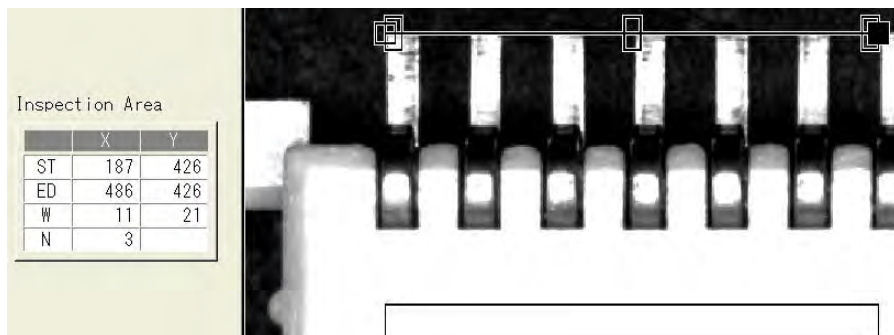
A table appears below the "Area Setting" menu with the coordinates for the line's start (ST) and end point (ED). The "W" refers to the cell dimensions (11 pixels wide and 21 pixels high by default), the "N" = 3 refers to the default number of cells.

Inspection Area		
	X	Y
ST	650	480
ED	949	480
W	11	21
N	3	

19. Tilt the cursor lever to move the complete shape so that the start point is directly on the edge of the first pin

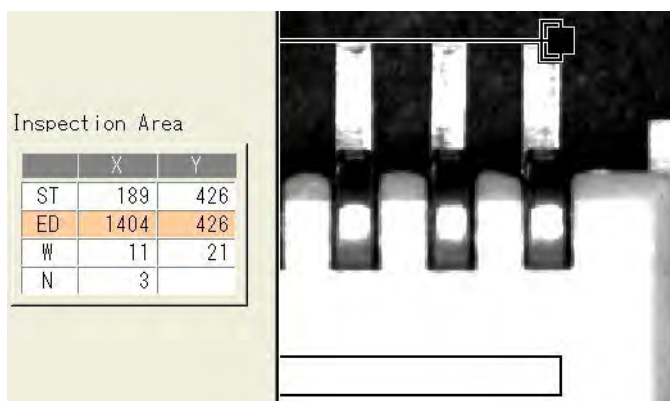
It may make sense to zoom into the image for better accuracy in positioning the

area (see page 76). Note that the second (green) area is moved along with the first area. All settings you make for area0 are automatically applied to area1.



20. Press <ENTER> twice to move only the end point

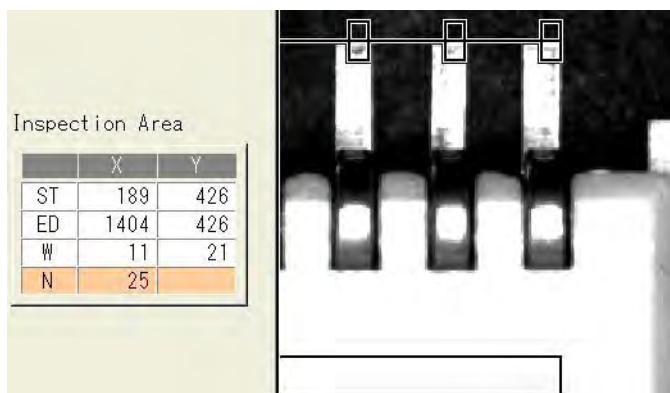
21. Move the end point so that it is directly on the edge of the last pin



22. Press <ENTER> twice to reach the table row "N"

23. Tilt the cursor lever up until "N" equals the number of pins

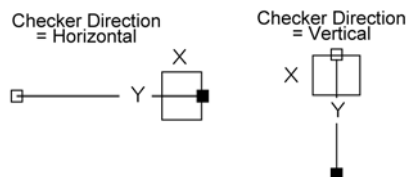
The example checks the gap between 25 pin pairs.



Next, the cell width and height needs to be set.

24. Press <CANCEL>

The cursor returns to the table row "W". This row defines the width and height of the cells. Note that X and Y appear reversed when the checker direction is vertical.

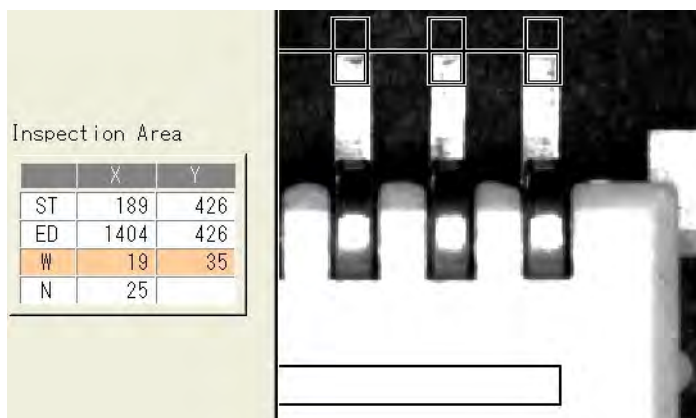


25. Move the cursor lever to the left to increase the cell width

Hold the cursor lever to the right side until the cell is wide enough for the edge.

26. Move the cursor lever up to increase the cell height

Hold the cursor lever up until the cell is high enough for detecting the edge.

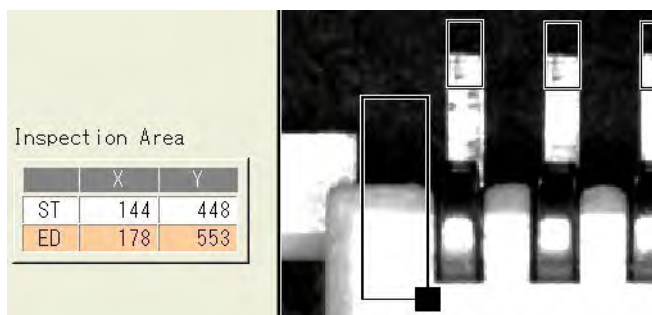


27. Press <ENTER> twice to finish setting area0

Next, area1 (green) has to be positioned correctly.

28. Move the cursor lever down so that the other shape turns orange

29. Reposition and resize the second area so that it detects the edge of the connector body as shown below



When the "Inspection Area" table disappears, you have finished setting area1.

30. Press <CANCEL> to return to the checker setting window

31. Press <TRIG> to execute the checker for testing

The Imagechecker calculates the maximum, minimum, and average float detected and lists the individual results in the results table. By selecting the table and pressing <ENTER> you can scroll through the results. Note that area1 only yields one result - the edge between the background and the connector body (see right side of table). This edge is the basis from which the float values are calculated and displayed in the "Pitch" column. The column "Dist. Diff." contains the difference between the float of one pin to the next pin.

Connector (Gra. Edg.)

Area Setting		Comment
Inspection Condition		Camera
Search Method		Position (mm)
Judgement Limits		Area
Threshold Adj.		

Judgement OK
 Time(ms) 1.29
 Max. Pitch 68.084
 Min. Pitch 65.988
 Average Pitch 67.323
 Pitch Total Judgement OK
 Distance Diff. Total Judg. OK

No.	Pitch	Judge.	Dist. Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1
0	68.084	OK	1.131	OK	198.000	425.535	107	161.000	493.613	36
1	66.953	OK	0.134	OK	248.000	426.666	130	-----	-----	-----
2	67.087	OK	0.224	OK	298.808	426.532	129	-----	-----	-----
3	66.862	OK	0.664	OK	347.896	426.757	112	-----	-----	-----
4	66.198	OK	0.670	OK	396.645	427.421	120	-----	-----	-----
5	66.868	OK	0.881	OK	448.000	426.751	133	-----	-----	-----
6	65.988	OK	1.121	OK	496.375	427.632	111	-----	-----	-----
7	67.109	OK	0.722	OK	545.800	426.511	146	-----	-----	-----

When you select the first row, the edge detected by area1 as well as the first pin corresponding edge are highlighted in pink (when you are displaying transparent windows (see page 77)).

Next, set the judgement limits for detecting NG connectors.

32. Select "Judgement Limits" and press <ENTER>

33. Enter values for "Max. Judge. Pitch" and "Min. Judge. Pitch"

Use the results listed next to "Max. Pitch" and "Min. Pitch" as a guideline.

34. Enter values for "Max. Distance Diff." and "Min. Distance Diff."

Use the results listed in the table as a guideline.

Connector (Gra. Eds.)	
Area Setting	
Inspection Condition	
Search Method	
Judgement Limits	
Threshold Adj.	
Max. Judge. Pitch	68.999
Min. Judge. Pitch	65.000
Max. Distance Diff.	1.300
Min. Distance Diff.	0.000
Judgement	OK
Time(ms)	1.29
Max. Pitch	68.084
Min. Pitch	65.988
Average Pitch	67.323
Pitch Total Judgement	OK
Distance Diff. Total Judg.	OK

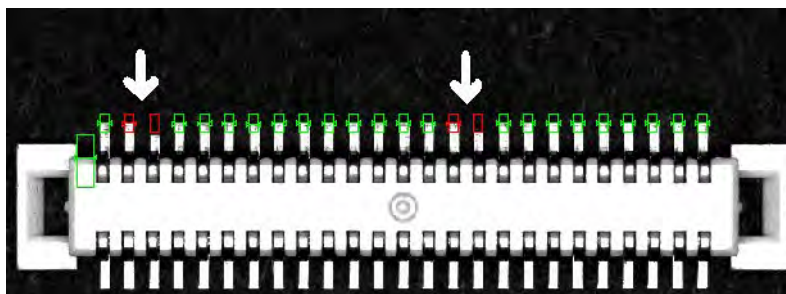
35. Test the checker with an NG object

When one or more floats are outside the judgement limit, the float is judged NG (next to column "Pitch"), and the "Pitch Total Judgement" is NG.

Judgement	NG
Time(ms)	1.98
Max. Pitch	68.158
Min. Pitch	44.229
Average Pitch	65.866
Pitch Total Judgement	NG
Distance Diff. Total Judg.	NG

No.	Pitch	Judge.	Dist. Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1
0	68.158	OK	1.063	OK	197.500	425.603	105	161.500	493.761	85
1	67.095	OK	22.866	NG	248.000	426.666	130	-----	-----	-----
2	44.229	NG	22.776	NG	298.808	449.532	129	-----	-----	-----
3	67.005	OK	0.616	OK	347.696	426.757	112	-----	-----	-----
4	66.388	OK	0.622	OK	396.375	427.373	119	-----	-----	-----
5	67.011	OK	0.881	OK	448.000	426.751	133	-----	-----	-----
6	66.130	OK	1.121	OK	496.375	427.632	111	-----	-----	-----
7	67.251	OK	0.722	OK	545.800	426.511	146	-----	-----	-----

Check the camera image. OK floats are green, NG floats are red. In addition, the pin before the pin with the NG float is also marked in red, even if its float is OK. This is due to the fact that the distance difference value is NG.



7.11.4.3 Setting Procedure for Execution Mode "Pitch"

The execution mode "Pitch" measures the distance between pins.

Overview of Setting Procedure

The following steps need to be taken:

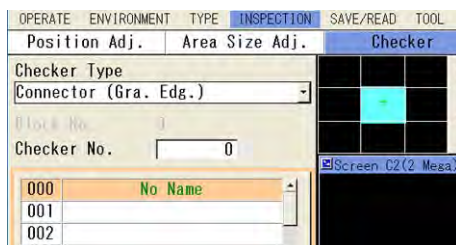
1. Set execution mode and checker direction to follow the orientation of the connector
2. Set checker area to cover the pins (area0)
3. Check an OK and a NG object to measure the pitch
4. Set judgement limits based on the OK/NG measurements

In order to set up the checker, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the RUN menu is active, press **<OPE/SET>** to activate the SETUP menu.
2. Select **"Checker"** from the submenu and press **<ENTER>**
3. Select **"Connector (Gra. Edg.)"** under **"Checker Type"** and press **<ENTER>**
4. Select a checker number and press **<ENTER>**



The setting window appears.

5. Select **"Inspection Condition"** and press **<ENTER>**
6. Select a preprocessing group if you want to preprocess the image

You can define up to 5 preprocessing groups (see page 109).

7. Set "Execution Mode" to "Pitch"

Connector (Gra. Edg.)	
Area Setting	
Inspection Condition	
Search Method	
Judgement Limits	
Threshold Adj.	
Judgement	NG
Time(ms)	1.27
Preprocess	A
Execution Mode	Pitch
Detect Direction	Inside->Outside
Checker Direction	Horizontal
Scan Method	Single
Edge Condition 0	Both
Edge Condition 1	Both
Detected Position	Front

8. Confirm the message that the area setting will be initialized

9. Set the "Checker Direction"

Select "Horizontal" or "Vertical" depending on the orientation of the connector to be checked. You need to select the checker direction BEFORE setting the detect direction. When you change the checker direction, the detect direction will be reset to the default setting (see page 243).

10. Set the "Scan Method"

You can choose between "Single" and "Projection" (see page 168).

11. Set the "Edge Condition 0"

As the execution mode "Pitch" works with one checker area only, you need to set only one type of edge to be detected. In the example, we need to find transitions from dark to light.

Connector (Gra. Edg.)	
Area Setting	
Inspection Condition	
Search Method	
Judgement Limits	
Threshold Adj.	
Judgement	NG
Time(ms)	0.00
Max. Pitch	0.000
Preprocess	No
Execution Mode	Pitch
Detect Direction	Inside->Outside
Checker Direction	Horizontal
Scan Method	Single
Edge Condition 0	Dark->Light
Edge Condition 1	Both
Detected Position	Front

12. Set the "Detected Position"

Select which edge should be detected and used for calculating the gap. In the example, the first edge should be used ("Front").

13. Press <CANCEL>

14. Select "Area Setting" and press <ENTER>

15. Set the camera number

16. Select the button [Set] next to "Area" and press <ENTER>

The screen displays the memory image and the default shape (three small green

square cells). At the same time, the "Area" menu appears on the left side of the screen.

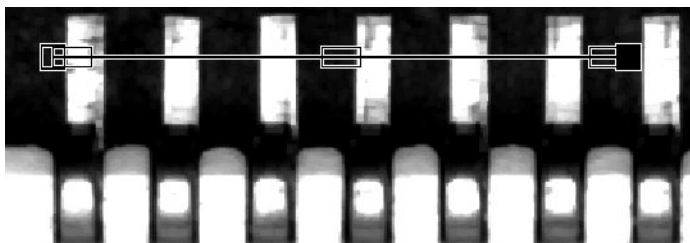


A table appears below the "Area Setting" menu with the coordinates for the line's start (ST) and end point (ED). The "W" refers to the cell dimensions (11 pixels wide and 21 pixels high by default), the "N" = 3 refers to the default number of cells.

Inspection Area		
	X	Y
ST	650	600
ED	949	600
W	21	11
N	3	

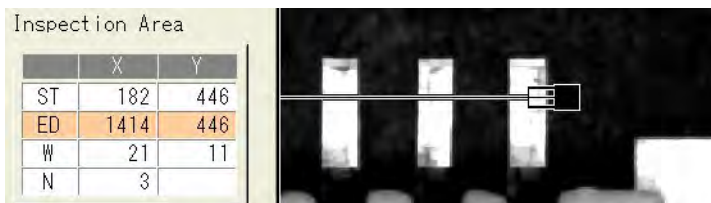
- 17. Tilt the cursor lever to move the complete shape so that the first cell covers the first edge of the first pin**

It may make sense to zoom into the image for better accuracy in positioning the area (see page 76).



- 18. Press <ENTER> twice to move only the end point**

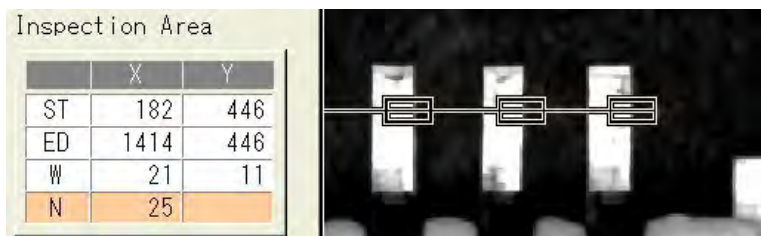
- 19. Move the end point so that the last cell covers the second edge of the last pin**



- 20. Press <ENTER> twice to reach the table row "N"**

- 21. Tilt the cursor lever up until "N" equals the number of pins**

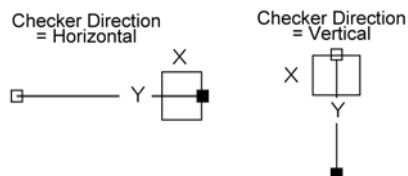
The example checks the pitch of a 25-pin connector.



Next, the cell width and height needs to be set.

22. Press <CANCEL>

The cursor returns to the table row "W". This row defines the width and height of the cells. Note that X and Y appear reversed when the checker direction is vertical.

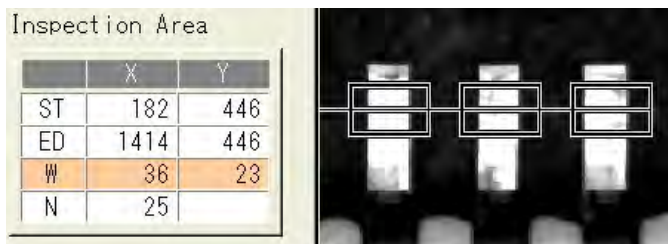


23. Move the cursor lever to the right to increase the cell width

Hold the cursor lever to the right side until the cell is wide enough for the edge.

24. Move the cursor lever up to increase the cell height

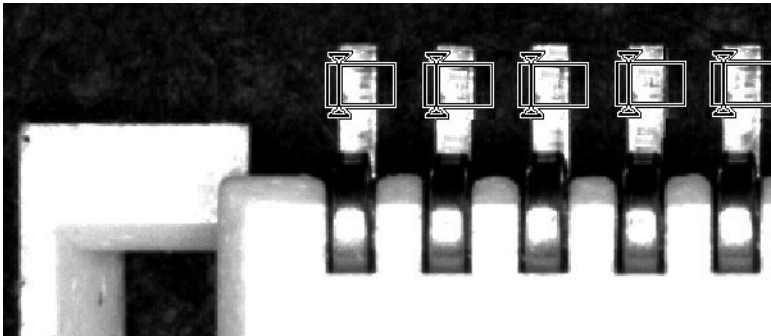
Hold the cursor lever up until the cell is high enough for detecting the edge.



25. Press <ENTER> twice to finish setting area0

When you have finished setting the area, you are automatically returned to the checker setting window.

26. Press <TRIG> to execute the checker for testing



The Imagechecker calculates the maximum, minimum, and average pitch detected and lists the individual results in the results table. By selecting the table and pressing <ENTER> you can scroll through the results. When you select a row, the corresponding cell and edge are highlighted in pink (when you are displaying transparent windows (see page 77)).

Connector (Gra. Edg.)

Area Setting

Inspection Condition

Search Method

Judgement Limits

Threshold Adj.

Comment

Camera

Area

0

No

Set

Judgement

Time(ms)

Max. Pitch

Min. Pitch

Average Pitch

Pitch Total Judgement

Distance Diff. Total Judg.

OK

1.27

51.021

47.231

49.847

OK

No.	Pitch	Judge.	Dist.	Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1
0	51.021	OK	-----	--		188.102	446.000	164	-----	-----	-----
1	49.724	OK	-----	--		239.123	446.000	182	-----	-----	-----
2	50.192	OK	-----	--		288.847	446.000	182	-----	-----	-----
3	48.926	OK	-----	--		339.039	446.000	186	-----	-----	-----
4	49.997	OK	-----	--		387.965	446.000	192	-----	-----	-----
5	50.255	OK	-----	--		437.962	446.000	167	-----	-----	-----
6	49.249	OK	-----	--		488.218	446.000	181	-----	-----	-----
7	50.556	OK	-----	--		537.467	446.000	184	-----	-----	-----

Next, set the judgement limits for detecting NG connectors.

27. Select "Judgement Limits" and press <ENTER>

Connector (Gra. Edg.)

Area Setting	Max. Judge. Pitch	51.999
Inspection Condition	Min. Judge. Pitch	47.000
Search Method	Max. Distance Diff.	99999999.999
Judgement Limits	Min. Distance Diff.	0.000
Threshold Adj.		

Judgement	OK
Time(ms)	1.28
Max. Pitch	51.021
Min. Pitch	47.231
Average Pitch	49.847
Pitch Total Judgement	OK

28. Enter values for "Max. Judge. Pitch" and "Min. Judge. Pitch"

Use the results listed next to "Max. Pitch" and "Min. Pitch" as a guideline.

Connector (Gra. Edg.)

Area Setting	Max. Judge. Pitch	95.999
Inspection Condition	Min. Judge. Pitch	94.000
Search Method	Max. Distance Diff.	99999999.999
Judgement Limits	Min. Distance Diff.	0.000
Threshold Adj.		

Judgement	OK
Time(ms)	4.13
Max. Pitch	95.514
Min. Pitch	94.212

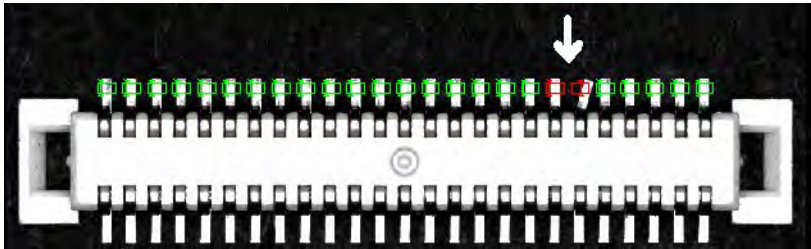
29. Test the checker with an NG object

When one or more gaps are outside the judgement limit, the pitch is judged NG, the "Pitch Total Judgement" is NG and this makes the complete connector checker NG.

Judgement	NG
Time(ms)	1.27
Max. Pitch	62.664
Min. Pitch	37.256
Average Pitch	49.847
Pitch Total Judgement	NG
Distance Diff. Total Judg.	

No.	Pitch	Judge.	Dist.	Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1
15	49.600	OK	-----	--	--	936.818	446.000	176	-----	-----	-----
16	49.026	OK	-----	--	--	986.418	446.000	187	-----	-----	-----
17	50.918	OK	-----	--	--	1035.444	446.000	170	-----	-----	-----
18	62.664	NG	-----	--	--	1086.362	446.000	198	-----	-----	-----
19	37.256	NG	-----	--	--	1149.026	449.000	151	-----	-----	-----
20	49.875	OK	-----	--	--	1186.282	446.000	186	-----	-----	-----
21	50.999	OK	-----	--	--	1236.157	446.000	192	-----	-----	-----
22	50.037	OK	-----	--	--	1287.156	446.000	183	-----	-----	-----

Check the camera image. OK pitches are green, NG pitches are red.





7.11.4.4 Setting Procedure for Execution Mode "Width Measurement"

The execution mode "Width Measurement" measures the width of an object.



◆ EXAMPLE

OK	NG
	

Overview of Setting Procedure

The following steps need to be taken:

1. Set execution mode and checker direction
2. Set checker area to cover the object (the cells need to be laid "across" the object)
3. Check an OK object to measure the width
4. Set judgement limits based on the OK measurements

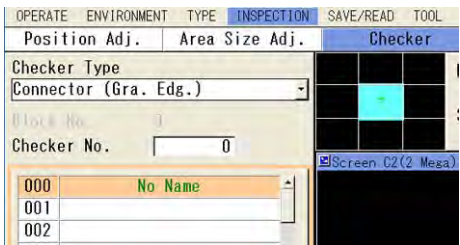
In order to set up the checker, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Checker"** from the submenu and press **<ENTER>**
3. Select **"Connector (Gra. Edg.)"** under **"Checker Type"** and press **<ENTER>**

4. Select a checker number and press <ENTER>



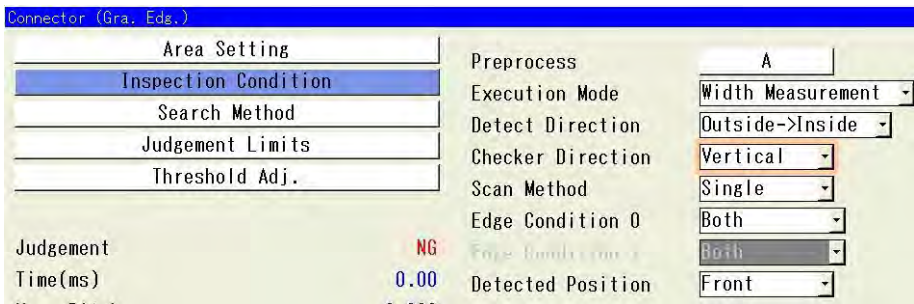
The setting window appears.

5. Select "Inspection Condition" and press <ENTER>

6. Select a preprocessing group if you want to preprocess the image

You can define up to 5 preprocessing groups (see page 109).

7. Set "Execution Mode" to "Width Measurement"



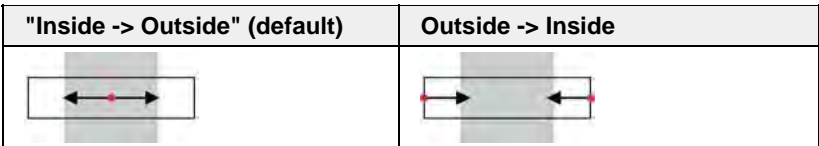
8. Confirm the message that the area setting will be initialized

9. Set the "Checker Direction"

Select "Vertical" as the object's main axis is vertical. You need to select the checker direction BEFORE setting the detect direction. When you change the checker direction, the detect direction will be reset to the default setting (see page 243).

10. Set the "Detect Direction" to "Outside->Inside"

There are two settings to choose from.



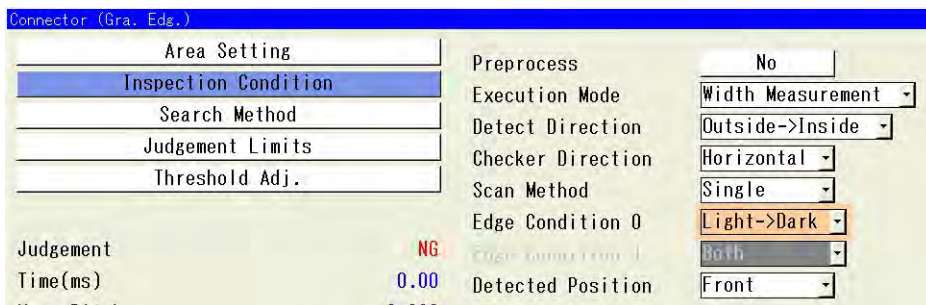
11. Set the "Scan Method"

You can choose between "Single" and "Projection" (see page 168).

12. Set the "Edge Condition 0"

As the execution mode "Pitch" works with one checker area only, you need to set only one type of edge to be detected. In the example, we need to find transitions

from light to dark.



13. Set the "Detected Position"

Select which edge should be detected and used for calculating the gap. In the example, the first edge should be used ("Front").

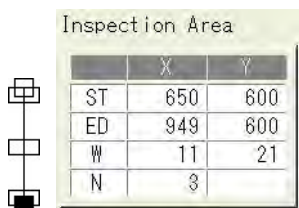
14. Press <CANCEL>

15. Select "Area Setting" and press <ENTER>

16. Set the camera number

17. Select the button [Set] next to "Area" and press <ENTER>

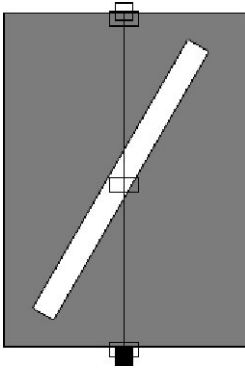
The screen displays the memory image and the default shape (three small green square cells). At the same time, the "Area" menu appears on the left side of the screen.



A table appears below the "Area Setting" menu with the coordinates for the line's start (ST) and end point (ED). The "W" refers to the cell dimensions (11 pixels wide and 21 pixels high by default), the "N" = 3 refers to the default number of cells.

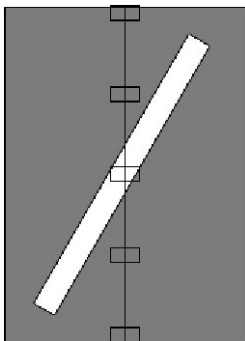
18. Tilt the cursor lever to move the complete shape into the vertical middle of the object

It may make sense to zoom into the image for better accuracy in positioning the area (see page 76).



19. Press <ENTER> twice to move only the end point
20. Move the end point so that the last cell ends with the bottom line of the object
21. Press <ENTER> twice to reach the table row "N"
22. Tilt the cursor lever up until "N" equals 5

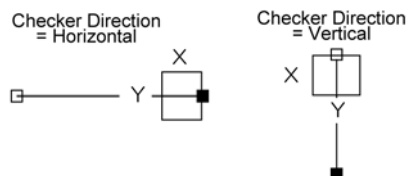
Use a value that fits your object properties.



Next, the cell width and height needs to be set.

23. Press <CANCEL>

The cursor returns to the table row "W". This row defines the width and height of the cells. Note that X and Y appear reversed when the checker direction is vertical.

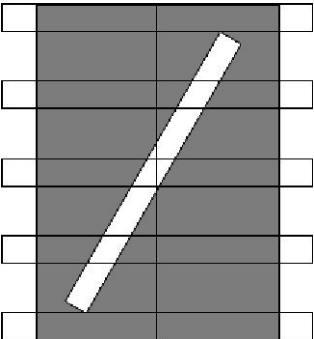


24. Move the cursor lever up to increase the cell width

Hold the cursor lever up until the cell is wide enough to overlap the object edges.

25. Move the cursor lever to the right to increase the cell height

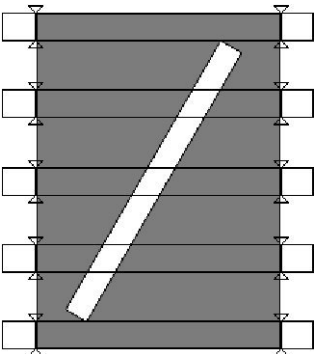
Hold the cursor lever to the right side until the cell is high enough.



26. Press <ENTER> twice to finish setting area0

When you have finished setting the area, you are automatically returned to the checker setting window.

27. Press <TRIG> to execute the checker for testing



The Imagechecker calculates the maximum, minimum, and average pitch detected and lists the individual results in the results table. By selecting the table and pressing <ENTER> you can scroll through the results. When you select a row, the corresponding cell and edge are highlighted in pink (when you are displaying transparent windows (see page 77).

Judgement	OK
Time(ms)	1.00
Max. Pitch	169.483
Min. Pitch	169.458
Average Pitch	169.473
Pitch Total Judgement	OK
Distance Diff. Total Judg.	

No.	Pitch	Judge.	Dist.	Diff.	Judge.	X0	Y0	Drift,0	X1	Y1	Drift,1
0	169.458	OK	-----	--		232.271	114.000	-255	401.729	114.000	-255
1	169.483	OK	-----	--		232.259	166.500	-255	401.741	166.500	-255
2	169.483	OK	-----	--		232.259	220.500	-255	401.741	220.500	-255
3	169.483	OK	-----	--		232.259	273.500	-255	401.741	273.500	-255
4	169.458	OK	-----	--		232.271	326.500	-255	401.729	326.500	-255

Next, set the judgement limits for detecting NG connectors.

28. Select "Judgement Limits" and press <ENTER>

29. Enter values for "Max. Judge. Pitch" and "Min. Judge. Pitch"

Use the results listed next to "Max. Pitch" and "Min. Pitch" as a guideline.

Connector (Gra. Eds.)		
Area Setting	Max. Judge. Pitch	169.999
Inspection Condition	Min. Judge. Pitch	169.000
Search Method	Max. Distance Diff.	9999999.999
Judgement Limits	Min. Distance Diff.	0.000
Threshold Adj.		

Judgement	OK
Time(ms)	1.00
Max. Pitch	169.483
Min. Pitch	169.458
Average Pitch	169.473
Pitch Total Judgement	OK

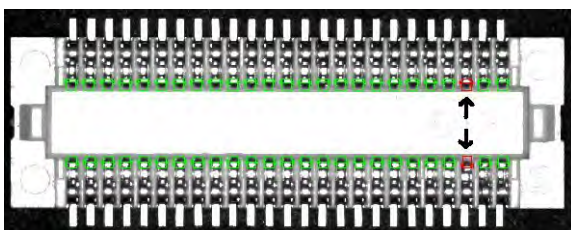
30. Test the checker with an NG object

When one or more gaps are outside the judgement limit, the pitch is judged NG, the "Pitch Total Judgement" is NG and this makes the complete connector checker NG.

Judgement	NG
Time(ms)	1.01
Max. Pitch	169.459
Min. Pitch	132.098
Average Pitch	156.644
Pitch Total Judgement	NG
Distance Diff. Total Judg.	

No.	Pitch	Judge.	Dist. Diff.	Judge.	X0	Y0	Diff.0	X1	Y1	Diff.1
0	169.458	OK	-----	--	232.271	114.000	-255	401.729	114.000	-255
1	160.382	NG	-----	--	237.284	181.500	-223	397.667	180.500	-227
2	132.098	NG	-----	--	250.978	220.500	-201	383.077	220.500	-207
3	151.822	NG	-----	--	240.985	277.000	-217	392.808	277.500	-222
4	169.459	OK	-----	--	232.271	326.500	-255	401.729	326.500	-255

Check the camera image. The top and bottom measurements are OK (green), the middle 3 measurements are NG (red).



Chapter 8

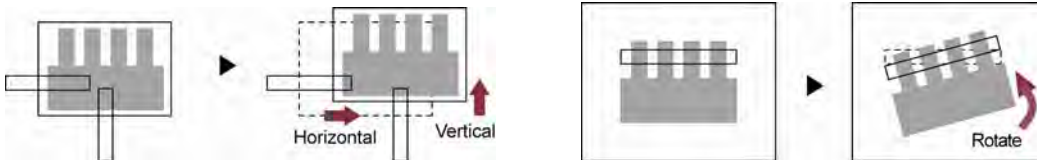
Position and Rotation Adjustment

8.1 Overview of Adjustment Functions

Position adjustment checkers are used if the position of inspection checkers has to be adjusted horizontally or vertically to the current position of the object to be checked.


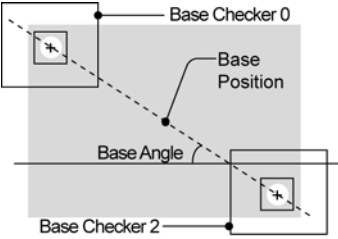
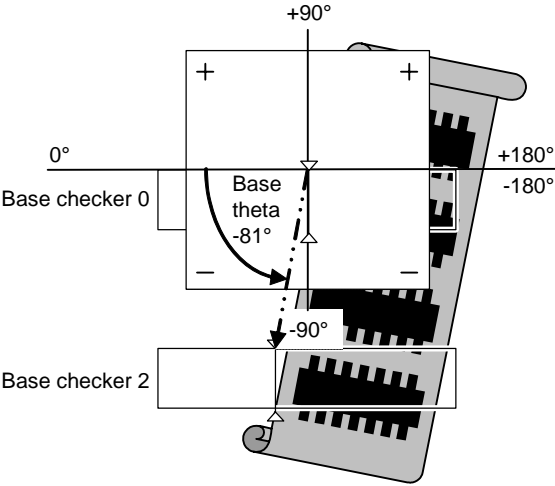
Position/rotation adjustment checkers are used if inspection checkers need not only be moved in X- or Y-direction, but also need to be rotated to fit the object orientation.

You can set up to 1000 position adjustment checkers per type (when 10 blocks are used).



Position and rotation adjustment

Adjustment type	Checkers available	Example
Position Adjustment	Binary Edge	
Position Adjustment	Gray Edge	
Position Adjustment	Feature Extraction	
Position Adjustment	Matching	
Position/Rotation Adjustment	Feature Extraction (Principal Axis Angle)	

Adjustment type	Checkers available	Example
Position/Rotation Adjustment	Matching (360 Degrees)	
Position/Rotation Adjustment	Feature Extraction (2 Checkers)	
Position/Rotation Adjustment	Matching (2 Checkers)	
Rotation Adjustment	Binary Edge Hor.	
	Gray Edge Hor.	
	Binary Edge Ver.	
	Gray Edge Ver.	

8.1.1 Setting Procedure

The following steps need to be taken regardless the type of adjustment:

- 1. Set and execute the adjustment checker area(s)
- 2. Register the base position
- 3. Assign the adjustment checker to an inspection checker

8.1.2 Calculation of the Base Position and Angle

When you register the base position, the checker window displays information on the base checker or checkers (if there is two) and on the base position. The values are calculated as follows:

Checker	Base position: X	Base position: Y	Base position: Theta
PA Binary Edge	X_{checker0}	Y_{checker2}	---
PA Gray Edge	X_{checker0}	Y_{checker2}	---
PA Feature Extraction	X-coordinate of center of gravity	Y-coordinate of center of gravity	---
PA Matching	X-coordinate of output point	Y-coordinate of output point	---
PRA Feature Extraction (Principal Axis Angle)	X-coordinate of the detected object's center of gravity	Y-coordinate of the detected object's center of gravity	Angle of the principle axis of the detected object
PRA Matching (360 Degrees)	X-coordinate of output point	Y-coordinate of output point	Angle of the detected object matching the template
PRA Feature Extraction (2 Checkers)	$(X_{\text{checker2}} + X_{\text{checker0}}) / 2$	$(Y_{\text{checker2}} + Y_{\text{checker0}}) / 2$	Angle between the centers of gravity of checker 0 and checker 2
PRA Matching (2 Checkers)	$(X_{\text{outputpoint2}} + X_{\text{outputpoint0}}) / 2$	$(Y_{\text{outputpoint2}} + Y_{\text{outputpoint0}}) / 2$	Angle between the output points of checker 0 and checker 2
RA Binary Edge Hor.	$(X_{\text{detectededge2}} + X_{\text{detectededge0}}) / 2$	$(Y_{\text{startpoint2}} + Y_{\text{startpoint0}}) / 2$	How the angle of the base position is determined (see page 306)
RA Gray Edge Hor.	$(X_{\text{detectededge2}} + X_{\text{detectededge0}}) / 2$	$(Y_{\text{startpoint2}} + Y_{\text{startpoint0}}) / 2$	
RA Binary Edge Ver.	$(X_{\text{startpoint2}} + X_{\text{startpoint0}}) / 2$	$(Y_{\text{detectededge2}} + Y_{\text{detectededge0}}) / 2$	
RA Gray Edge Ver.	$(X_{\text{startpoint2}} + X_{\text{startpoint0}}) / 2$	$(Y_{\text{detectededge2}} + Y_{\text{detectededge0}}) / 2$	



◆ NOTE

PA = Position adjustment, PRA = position/rotation adjustment, RA = rotation adjustment

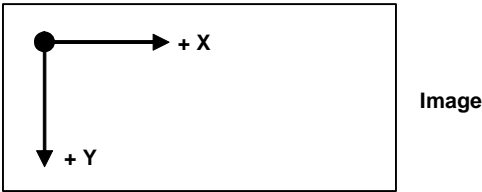
8.1.3 Calculation of the Adjustment Position and Angle

When you execute the checker or project, the Imagechecker tries to detect the object used for registering the base position. When a suitable object is detected, its coordinate values and angle are displayed in the row labeled "Detection Position". The adjustment amount is calculated as the difference between the base position and the detection position, respectively base angle and detection angle, and displayed in the top row "Adjustment Amount".

Row header	Contents of column "X"	Contents of column "Y"	Contents of column "Theta"
Adjustment amount	Adjustment calculated from the difference between base and detection position in X-direction	Adjustment calculated from the difference between base and detection position in Y-direction	Adjustment angle (theta) calculated from the difference between detection and base angle
Detection position	X-coordinate of the point equivalent to the base position	Y-coordinate of the point equivalent to the base position	Angle at the currently detected position
Base position	X-coordinate of the base position	Y-coordinate of the base position	Angle at the registered base position

8.2 Introduction to Position Adjustment

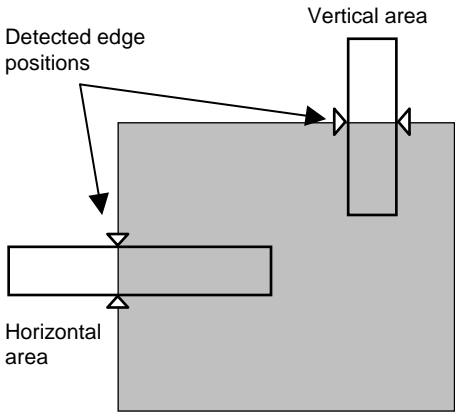
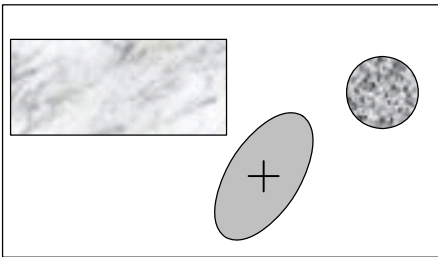
With position adjustment, the first step is to identify the base position of the object. Then the deviation compared to the "normal" position where the inspection checker was set is detected. Finally, the inspection checker is adjusted by the amount of deviation so that it is in the correct position. The adjustment is output in pixels and uses the coordinate system as follows.

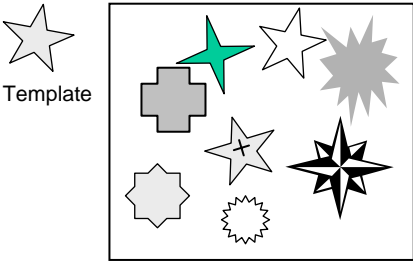


Coordinate system used for position adjustment

The object position for position adjustment can be established in four ways:

- Binary edge detection (see page 161)
- Gray edge detection (see page 167)
- Feature extraction (see page 178)
- Matching (see page 189)

Position Adjustment Type	Method	Example
Binary edge detection Gray edge detection	Set two checker areas, one horizontal and one vertical. They detect the object edges in the selected color or color transition.	
Feature extraction	Set one checker area. It detects the object in the selected color and calculates the object's center of gravity.	

Position Adjustment Type	Method	Example
Matching	Register a template to find a matching object.	



◆ **NOTE**

- To adjust inspection checkers by position or rotation adjustment, set the parameter "Position Adj." to the appropriate checker number in the checker setting window.
- To adjust position and rotation adjustment checkers by position or rotation adjustment, you must pay attention to the checker numbers. Position and rotation adjustment checkers will only work for checkers set after them. For example, a position adjustment checker set at number 015 can be used to adjust checkers set at numbers 016 to 099, but not for checkers set at number 000 to 014.

8.2.1 Position Adjustment with Edge Detection

There are two checkers available for position adjustment with edge detection:


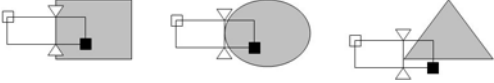
- Binary edge detection (see page 161)
- Gray edge detection (see page 167)

The following sections deal with the common properties of binary and gray edge position adjustment checkers. For the differences, see the sections on the individual checkers.

8.2.1.1 Available Shapes

Position adjustment via edge detection offers two shapes for the reliable detection of edges:

- Line: Fast, but unreliable for noisy camera images or for detecting the edges of circular or pointed objects.
- Plane (Rectangle): Slower, but also reliable for noisy images and all types of objects.

Line	Plane (Rectangle)
Searches for an edge using one line. 	Searches for an edge using multiple lines (the number of lines is defined by the size of rectangular shape). 



◆ **NOTE**

It is possible to combine shapes, for example by setting "Horizontal" to a line shape and "Vertical" to a plane shape.

8.2.1.2 Using "Priority"

Use this parameter to give one of the two edge-detection checkers priority over the other. The checker with priority is executed first. This is useful if the object to be inspected is likely to be displaced more in one direction than in the other.

	Vertical priority	Horizontal priority
Setting the position adjustment		
Without priority setting position adjustment may fail		
Specifying a priority ensures that both edge-detection checkers work.		

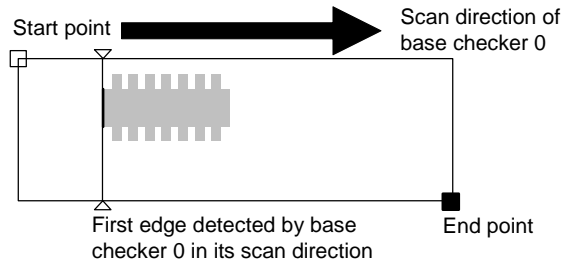
8.2.1.3 Using "Detect Center of Base"

Use this parameter if you need to detect the center point of an object for position adjustment. With this parameter activated, the Imagechecker works with two checkers in each direction. The base checker numbers 0 and 1 refer to the pair of horizontal checkers, the number 2 and 3 to the pair of vertical checkers.

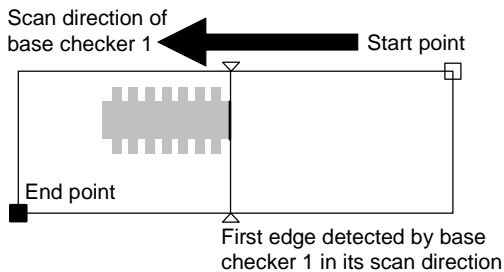


◆ EXAMPLE

The horizontal base checker 0 searches for the first edge in scanning direction. The edge condition is "Both", so all edges can be detected.



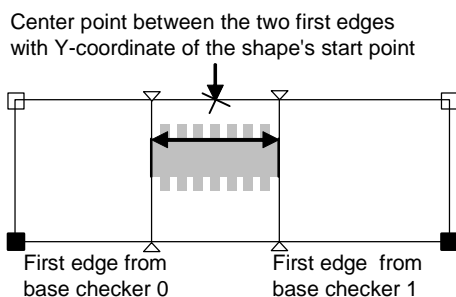
When you set "Detect Center of Base 0, 1" it to "Yes", a mirror copy of the horizontal base checker 0 is created and listed in the table as "Hor. Base Checker 1". The mirror copy is positioned right on top the original base checker 0 and searches the image from the other end. The image only shows the mirror copy, base checker 1, not the original base checker 0.



When each of the two base checkers detects the first edge in its scanning direction, the center point is calculated from the edge points. The X-coordinate of the center point (X_{CP}) is determined by the formula

$$X_{CP} = X_{E1} - \frac{(X_{E1} - X_{E0})}{2}$$

with E0 = first edge detected by base checker 0 in its scanning direction, E1 = first edge detected by base checker 1 in its scanning direction. The Y-coordinate is the Y-coordinate of the start point of base checker 0. If you have not changed the area setting for base checker 1, its start point has the same Y-coordinate.



To detect the center point of an object, please follow the setting procedure (see page 280).

8.2.1.4 Deleting the Horizontal or Vertical Checker

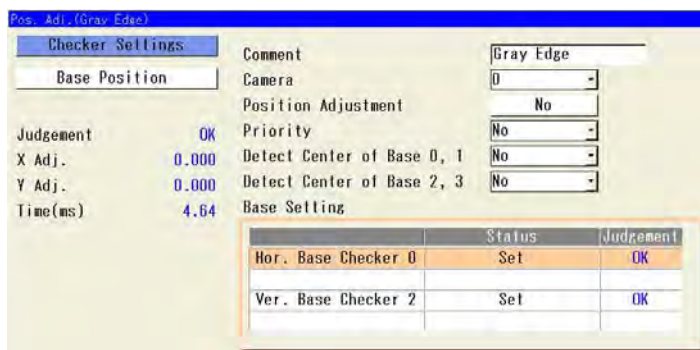
Normally, you need two checkers to perform accurate position adjustment. However, there may be applications where the misplacement only occurs in horizontal or vertical direction. When you have set up both the horizontal and the vertical checker and wish to use only one checker, you can delete the other checker.



◆ Procedure

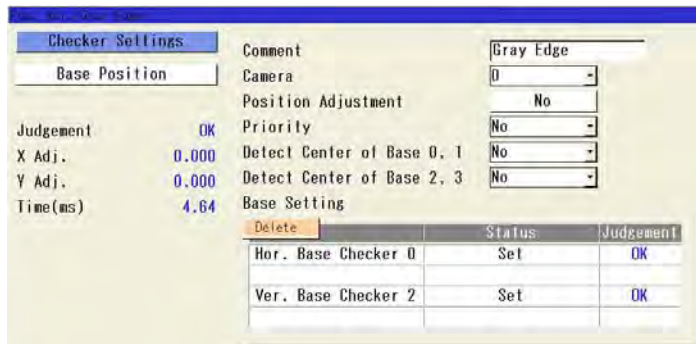
1. In the checker setting window, select the table and press <ENTER>
2. Select the checker you wish to delete

In this example, the horizontal checker will be deleted.



3. Press <FUNC>

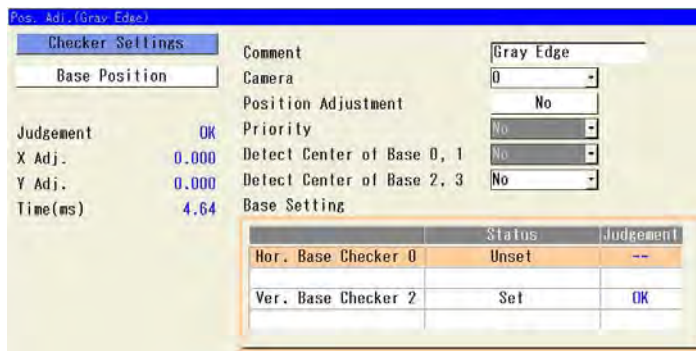
4. From the submenu select "Delete"



A message asking for confirmation is displayed.

5. Select "Yes" and press <ENTER>

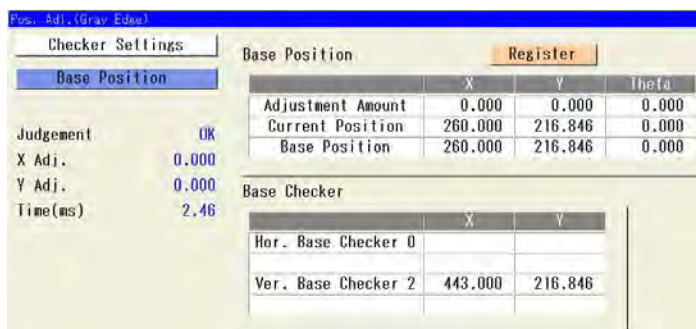
The Imagechecker deletes the checker. Next, you need to reset the base position.



6. Press <CANCEL> twice

7. Select "Base Position" and press <ENTER>

8. Press <ENTER> again



A message appears asking whether you wish to register a current point as the base position.

9. Select "Yes" and press <ENTER>

When the Imagechecker detects an edge, the new base position is displayed in

the table.

8.2.1.5 Setting Procedure

The setting procedure for a position adjustment checker is the same for binary or gray edge detection. Please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**

If the RUN menu is active, press **<OPE/SET>** to activate the SETUP menu.

2. Select **"Position Adj."** from the submenu and press **<ENTER>**
3. Select a checker number and press **<ENTER>** twice
4. Select **"Position Adjustment"**, then **"Binary Edge"** and press **<ENTER>**

The checker setting window appears.

Pos. Adj. (Binary Edge)		
Checker Settings		
Base Position		
Judgement	NG	
X Adj.	0.000	
Y Adj.	0.000	
Time(ms)	0.00	
Comment		
Camera	0	
Position Adjustment	No	
Priority	No	
Detect Center of Base 0, 1	No	
Detect Center of Base 2, 3	No	
Base Setting		
	Status	Judgement
Hor. Base Checker 0	Unset	--
Ver. Base Checker 2	Unset	--

5. Press **<ENTER>**
6. Set the camera number

7. Select the table and press <ENTER>

Pos. Adj.(Binary Edge)

Checker Settings

Base Position

Judgement

X Adj.

Y Adj.

Time(ms)

NG

0.000

0.000

0.00

Comment

Camera

Position Adjustment

Priority

Detect Center of Base 0, 1

Detect Center of Base 2, 3

Base Setting

0

No

No

No

No

	Status	Judgement
Hor. Base Checker 0	Unset	--
Ver. Base Checker 2	Unset	--

8. Press <ENTER> on "Hor. Base Checker 0"

The checker setting window for the base checker 0 appears. The parameters under "Edge Condition" and "Search Method" are the same as for the inspection checker for binary edge detection (see page 163), respectively gray edge detection (see page 168).

Binary Edge(Base Checker No.0)

Area Setting

Edge Condition

Search Method

Area

Set

Judgement

No. of Objects

Time(ms)

NG

0

0.00

No.	X	Y	Detect Color

9. Press <ENTER> twice

The screen displays the default shape (a green rectangle). At the same time, the "Area" menu appears on the left side of the screen.

Change

Change Shape

10. Press <ENTER> on "Change

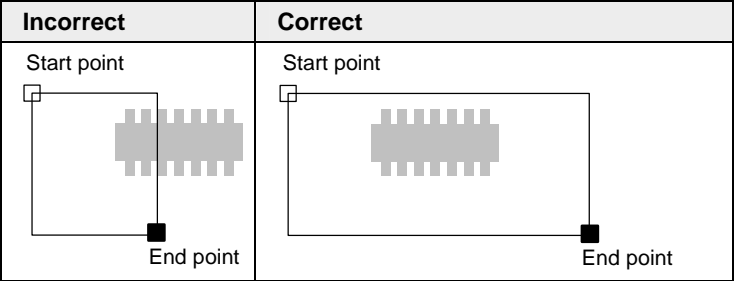
The shape turns orange. A table appears below the "Area Setting" menu with the coordinates for the rectangle's start (ST) and end point (ED).

As long as you see both the start and the end point displayed, you move the

complete checker by moving the cursor lever. Use the <SHIFT> key together with the cursor lever to move the shape by 10 pixels at once.

11. Set the checker area so that object edges can be detected from both sides

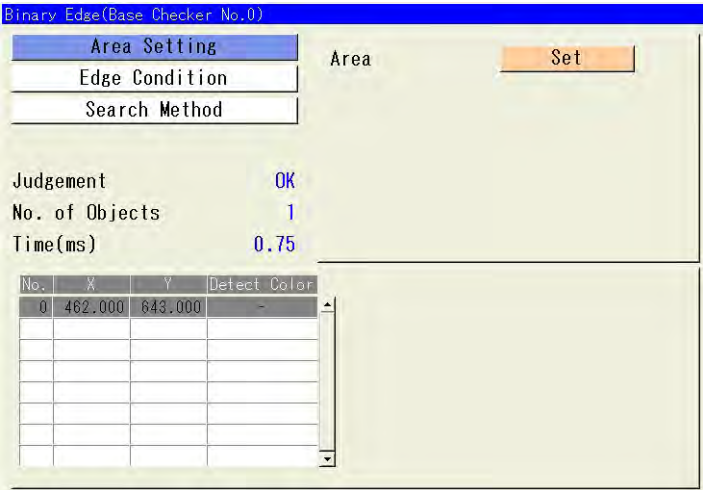
This saves you time when you set the second horizontal base checker.



12. Press <CANCEL>

13. Press <TRIG>

If the base checker detects an edge, it is displayed in the table.



14. Press <CANCEL> to return to the checker-setting window

The horizontal base checker 0 is displayed in the table with status "Set" and judgement "OK". Next, if you want to use the center point of the object for position adjustment, you need to create the second horizontal base checker. If you only want to use the coordinates of the base checkers' start points, proceed with registering the base position in step 20.

15. Press <CANCEL>

16. Set "Detect Center of Base 0, 1" to "Yes"

The horizontal base checker 1 is displayed in the table. As base checker 1 is a mirror copy of base checker 0, you only need to check whether the end edge is detected.

Pos. Adj.(Binary Edge)

Checker Settings

Base Position

Judgement

X Adj.

Y Adj.

Time(ms)

NG

0.000

0.000

0.78

Comment

Camera

Position Adjustment

Priority

Detect Center of Base 0, 1

Detect Center of Base 2, 3

Base Setting

0

No

No

Yes

No

	Status	Judgement
Hor. Base Checker 0	Set	OK
Hor. Base Checker 1	Set	NG
Ver. Base Checker 2	Unset	--

17. Press <TRIG>

If the base checker detects an edge, it is displayed in the table. The horizontal base checker 1 is displayed in the table with status "Set" and judgement "OK". If not, change the area setting as for base checker 0.

Next, you need to create the second horizontal base checker.

Pos. Adj.(Binary Edge)

Checker Settings

Base Position

Judgement

X Adj.

Y Adj.

Time(ms)

NG

0.000

0.000

1.11

Comment

Camera

Position Adjustment

Priority

Detect Center of Base 0, 1

Detect Center of Base 2, 3

Base Setting

0

No

No

Yes

No

	Status	Judgement
Hor. Base Checker 0	Set	OK
Hor. Base Checker 1	Set	OK
Ver. Base Checker 2	Unset	--

18. Repeat the setting procedure for vertical base checker 2 and 3

Pos. Adj.(Binary Edge)

Checker Settings

Base Position

Judgement **NG**

X Adj. 0.000

Y Adj. 0.000

Time(ms) 1.37

Comment

Camera 0

Posture Adjustment No

Priority No

Detect Center of Base 0, 1 Yes

Detect Center of Base 2, 3 Yes

Base Setting

	Status	Judgement
Hor. Base Checker 0	Set	OK
Hor. Base Checker 1	Set	OK
Ver. Base Checker 2	Set	OK
Ver. Base Checker 3	Set	OK

Next, you need to register the base position.

19. Press <CANCEL>

20. Select "Base Position" and press <ENTER>

There are two tables. The top table with the values for the base position is still empty. The bottom table shows the base checkers and their start point coordinates, which are equal to the coordinates of the first edge point in the base checker's scan direction.

Pos. Adj.(Binary Edge)

Checker Settings

Base Position

Judgement **NG**

X Adj. 0.000

Y Adj. 0.000

Time(ms) 1.36

Base Position

Register

	X	Y	Theta
Adjustment Amount			
Current Position			
Base Position			

Base Checker

	X	Y
Hor. Base Checker 0	463.000	643.000
Hor. Base Checker 1	1268.000	643.000
Ver. Base Checker 2	680.000	549.000
Ver. Base Checker 3	680.000	1075.000

21. Press <ENTER> on [Register]

A message asking for confirmation is displayed.

22. Select "Yes" and press <ENTER>

The base position is registered with the values derived from the base checkers' center point. The judgement for the position adjustment checker is "OK".

The screenshot shows the 'Pos. Adj. (Binary Edge)' window. It has a 'Checker Settings' tab with a 'Base Position' sub-tab. On the left, 'Judgement' is 'OK', 'X Adj.' is '0.000', 'Y Adj.' is '0.000', and 'Time(ms)' is '1.36'. On the right, there is a 'Base Position' table and a 'Base Checker' table.

	X	Y	Theta
Adjustment Amount	0.000	0.000	0.000
Current Position	865.500	812.000	0.000
Base Position	865.500	812.000	0.000

	X	Y
Hor. Base Checker 0	463.000	643.000
Hor. Base Checker 1	1268.000	643.000
Ver. Base Checker 2	680.000	549.000
Ver. Base Checker 3	680.000	1075.000

23. Close the setting window with pressing <CANCEL> twice

24. Save the settings



◆ NOTE

- If the [Register] button is grayed out, press [TRIG] to execute the base checker(s). If you still cannot register a base position, change the area setting of the base checker(s) and try again. Note that if there are two base checkers, they should not cover identical areas or share the same X-coordinates.
- If you have created several adjustment checkers and are not sure which is which because you have not entered any comments, check the info box below the list of checkers. It will tell you the type of the adjustment checker selected in the list.

The screenshot shows the 'Position Adj.' window. It has tabs for 'OPERATION', 'ENVIRONMENT', 'TYPE', and 'INSPECTI'. The 'Position Adj.' tab is selected. Below the tabs, there are fields for 'Block No.' (0) and 'Checker No.' (1). A list of checkers is shown, with columns for 'Checker No.', 'Comment', and 'Type'. The first three checkers (000, 001, 002) have comments '<Enter Comment>' and are highlighted in cyan. The remaining checkers (003-012) are empty. Below the list, there is a box labeled 'Pos/Rot Adjustment Matching (360-degree)'.

Checker No.	Comment	Type
000	<Enter Comment>	
001	<Enter Comment>	
002	<Enter Comment>	
003		
004		
005		
006		
007		
008		
009		
010		
011		
012		

Pos/Rot Adjustment Matching (360-degree)

8.2.2 Position Adjustment with Feature Extraction

The checker searches for an object of the selected color. The checker detects the center of gravity and uses this information to calculate the adjustment amount. You may set limits for the object size to filter out unwanted objects. The checker is very similar to the feature extraction checker used for inspection (see page 178).



◆ NOTE

To ensure stable detection and reliable position adjustment, make sure to use sorting and the area limits under "Extraction Condition" when there is a chance that the checker will detect several objects with the selected color. The first object detected will be used for position adjustment. By setting a sorting order you can define which object should be used.

8.2.2.1 Setting Procedure

In order to set up a checker for position adjustment by feature extraction, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Position Adj."** from the submenu and press **<ENTER>**
3. Select a checker number and press **<ENTER>** twice
4. Select **"Position Adjustment"**, then **"Feature Extraction"** and press **<ENTER>**

The checker setting window appears.

Checker	Status	Judgement
Checker 0	Unset	--

5. Press **<ENTER>**

6. Set the camera number**7. Select the table and press <ENTER> twice**

Feature Extraction(Base Checker No.0)

Area Setting		Area	Set
Inspection Condition			
Search Method			
Extraction Condition			
Judgement	OK		
No. of Objects	5		
Time (ms)	2.35		

No.	Area	Grav.X	Grav.Y	Principal Axis Angle	Perimeter	Proj. Width	Proj. Height
0	275120	809.598	577.211	0.000	0	0.000	0.000
1	1146	1491.769	1116.461	0.000	0	0.000	0.000
2	1409	1543.460	1118.153	0.000	0	0.000	0.000
3	1666	1337.178	1116.024	0.000	0	0.000	0.000
4	1059	1398.652	1124.542	0.000	0	0.000	0.000

8. Select "Inspection Condition"**9. Select a preprocessing group if you want to preprocess the image**

You can define up to 5 preprocessing groups (see page 109).

10. Select a slice level

The slice levels are used to create a binary image. You can define up to 8 slice level groups (A - H) (see page 114).

11. Set the color to be detected under "Target"

The default setting is "White".

12. Set a filter under "Filter", if necessary

In addition to the filters available under preprocessing (see page 109) you can add erosion and dilation filters (see page 115). The image display is updated automatically.

13. Set the number of objects to be detected in "Output: Objects 1 - x"

By default, the setting is 5. Later in the procedure you need to select which object should be used for position adjustment. To make sure that always the same object is detected and used for position adjustment when there is more than one object present in the camera image, use and combine this parameter with the parameters in the table.

Function	Parameter
Select objects of a certain size	<ul style="list-style-type: none"> Use the limits "Min./Max. Object Area" under "Extraction condition" Use "Sorting" and "Sorting Order" under "Inspection Condition"
Select objects at a certain position	Use "Sorting" and "Sorting Order" under "Inspection Condition"

The limit will be applied after sorting if you have set a sorting order (see page 180). If sorting is not activated, the results will be listed in order of appearance.

14. Set "Sorting" to sort the extracted objects

You can sort extracted objects in ascending or descending order according to area size, X-, or Y-coordinate (see page 180).

15. If you have activated "Sorting", set the "Sorting Order"

16. Set the parameters under "Search Method" and "Extraction Condition" as required

The parameters under "Inspection Condition", "Search Method", and "Extraction Condition" are the same as for the feature extraction checker (see page 179).

17. Select "Area Setting" and press <ENTER> twice

The default shape is displayed on the screen.

18. Set the inspection area of the checker

The shapes available are rectangle, ellipse, circle, and polygon (see page 124).

19. Add one or more masks, if necessary

Masks allow you to exclude parts of the checker area from the inspection. You can set up to 16 masks (see page 137).

20. When you have finished setting the checker shape, press <CANCEL> to return to the checker-setting window

21. Press <TRIG> to execute the checker for testing

The detected objects are listed in a table. When you select the table and press <ENTER>, you can scroll through the results. When a table row is highlighted, the cross marking the center of gravity of the corresponding object is displayed in pink in the image. The other object's crosses are displayed in cyan.

Judgement	OK						
No. of Objects	5						
Time (ms)	2.35						
No.	Area	Grav.X	Grav.Y	Principal Axis Angle	Perimeter	Proj. Width	Proj. Height
0	275120	809.598	577.211	0.000	0	0.000	0.000
1	1146	1491.769	1116.461	0.000	0	0.000	0.000
2	1409	1543.460	1118.153	0.000	0	0.000	0.000
3	1666	1337.178	1116.024	0.000	0	0.000	0.000
4	1059	1398.652	1124.542	0.000	0	0.000	0.000

Next, you need to select the object you want to use to register the base position.

22. Press <CANCEL>

23. Select "Base Position" and press <ENTER>

There are two tables. The top table with the values for the base position is still

empty. The bottom table shows the base checker and the coordinates of the first detected object's center of gravity.

Pos. Adj.(Feature Extraction)

Checker Settings

Base Position

Judgement **NG**

X Adj. **0.000**

Y Adj. **0.000**

Time(ms) **2.38**

Base Position

	X	Y	Theta
Adjustment Amount			
Current Position			
Base Position			

Base Checker

	X	Y	Theta
Checker 0	809.598	577.211	0.000

24. Press <ENTER> on [Register]

A window appears with a table listing all the objects detected by the base checker. When a table row is highlighted, the cross marking the center of gravity of the corresponding object is displayed in pink in the image.

Select Detect Position of Base 0 No. 0

No.	Area	Grav.X	Grav.Y	Principal Axis Angle
0	275120	809.598	577.211	0.000
1	1146	1491.769	1116.461	0.000
2	1409	1543.460	1118.153	0.000
3	1666	1337.178	1116.024	0.000
4	1059	1398.652	1124.542	0.000

Register Base

	X	Y	Theta
Checker 0	809.598	577.211	0.000

25. Press <ENTER>

26. Select the object that should be used for position adjustment and press <CANCEL>

If you have configured the search method and extraction conditions to find only one object, there will be only one object to select.

Select Detect Position of Base 0 No. 0

No.	Area	Grav.X	Grav.Y	Principal Axis Angle
0	275120	809.598	577.211	0.000
1	1146	1491.769	1116.461	0.000
2	1409	1543.460	1118.153	0.000
3	1666	1337.178	1116.024	0.000
4	1059	1398.652	1124.542	0.000

Register Base

27. Select [Register Base] and press <ENTER>

A message asking for confirmation is displayed.

28. Select "Yes" and press <ENTER>

The base position is registered with the coordinates derived from the base object's point of gravity. The judgement for the position adjustment checker is "OK".

Pos. Adj. (Feature Extraction)			
Checker Settings			
Base Position			
Judgement	OK		
X Adj.	0.000		
Y Adj.	0.000		
Time(ms)	2.38		
Base Position			
Adjustment Amount	X	Y	Theta
	0.000	0.000	0.000
Current Position	809.598	577.211	0.000
Base Position	809.598	577.211	0.000
Base Checker			
	X	Y	Theta
Checker 0	809.598	577.211	0.000

29. Close the setting window with pressing <CANCEL> twice**30. Save the settings****8.2.3 Position Adjustment with Smart Matching**

The checker searches for an object matching the pre-registered template image within the search region and uses the output point to calculate the adjustment amount. The checker is very similar to the smart matching checker used for inspection (see page 189).

**◆ NOTE**

To ensure stable detection and reliable position adjustment, make sure to use sorting when there is a chance that the checker will detect several objects matching the template. The first object detected will be used for position adjustment. By setting a sorting order you can define which object should be used.

8.2.3.1 Setting Procedure

In order to set up a checker for position adjustment by matching, please proceed as follows:

**◆ Procedure**

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Position Adj."** from the submenu and press **<ENTER>**

- 3. Select a checker number and press <ENTER> twice
 - 4. Select "Position Adjustment", then "Matching" and press <ENTER>
- The checker setting window appears.

Pos. Adj.(Matching)

Condition

Base Position

Comment

Camera

Position Adjustment

Base Setting

Judgment

X Adj.

Y Adj.

Time(ms)

NG

0.000

0.000

0.00

0

No

	Status	Judgment
Checker 0	Unset	--

- 5. Press <ENTER>
- 6. Set the camera number
- 7. Under "Position Adjustment" you can enter the number of a position or rotation adjustment checker

This option is only available if a position or rotation adjustment checker has been set at a lower checker number.

- 8. Select the table and press <ENTER> twice

Matching(Base Checker No.0)

Area Setting

Inspection Condition

Sequence

Template

Search Area

Set

Set

Judgment

Detected Count

Time (ms)

NG

0

0.00

No.	Template No.	Correlation Value	X	Y	Angle	Max. Subtraction	Subtraction Count

First, you need to select or register a template.

- 9. Set a template
- Depending on whether you use common templates or individual templates, follow

the correct registration procedure (see page 192).

10. Press <CANCEL>

11. Select "Inspection Condition" and press <ENTER>

12. Set the parameters as required

The parameters are the same as for the smart matching checker (see page 200).

13. Set the parameters under "Sequence "

The parameters are the same as for the smart matching checker (see page 203).

14. Press <TRIG> to execute the checker for testing

The detected object is listed in a table. Next, you need to register the base position.

Matching(Base Checker No.0)

Area Setting		Recommendation Value					
Inspection Condition		Acc.	Max.Count	Min.Corr.	Count	Corr.	
Sequence		1ST	16	1	0.600	1	1.000
		2ND	8	1	0.600	1	1.000
		3RD	4	1	0.600	1	1.000
		4TH	2	1	0.600	1	1.000
		5TH	8	1	0.600	1	1.000
		6TH	0	0	0.000	0	0.000

Judgment OK
Detected Count 1
Time (ms) 10.26

Square Correlation No

No.	Template No.	Correlation Value	X	Y	Angle	Max. Subtraction	Subtraction Count
0	0	1.000	729.000	520.000	0.000	0	0

15. Press <CANCEL> until you can select "Base Position" and press <ENTER>

There are two tables. The top table with the values for the base position is still empty. The bottom table shows the base checker and the coordinates of the first detected object's center of gravity.

Pos. Adj.(Matching)

Condition		Base Position			
Base Position		Register			
		X	Y	Theta	
Judgment	NG	Adjustment Amount			
X Adj.	0.000	Detection Position			
Y Adj.	0.000	Base Position			
Time(ms)	10.30				

Base Checker

	X	Y	Detect Angle	Corr.
Checker 0	729.000	520.000	0.000	1.000

16. Press <ENTER> on [Register]

A window appears with a table listing the object(s) detected by the base checker. When a table row is highlighted, the cross marking the center of gravity of the corresponding object is displayed in pink in the image.

No.	X	Y	Angle	Correlation Value
0	729.000	520.000	0.000	1.000

Register Base

Y	Theta

Y	Detect	Angle	Corr.

Checker 0 729.000 520.000 0.000 1.000

If there is only one object, it will already be selected. Proceed with step 18.

17. Press <ENTER>**18. Select the object that should be used for position adjustment and press <CANCEL>****19. Select [Register Base] and press <ENTER>**

A message asking for confirmation is displayed.

20. Select "Yes" and press <ENTER>

The base position is registered with the coordinates derived from the template's output point. The judgement for the position adjustment checker is "OK".

Pos. Adj. (Matching)

Condition: Base Position

Judgment: OK

X Adj.: 0.000

Y Adj.: 0.000

Time(ms): 10.30

Base Position: Register

	X	Y	Theta
Adjustment Amount	0.000	0.000	0.000
Detection Position	729.000	520.000	0.000
Base Position	729.000	520.000	0.000

Base Checker

	X	Y	Detect	Angle	Corr.
Checker 0	729.000	520.000	0.000	1.000	

21. Close the setting window with pressing <CANCEL> twice**22. Save the settings**

8.3 Position/Rotation Adjustment

Position/rotation adjustment checkers are used if inspection checkers need not only be moved in X- or Y-direction, but also need to be rotated to fit the object orientation.

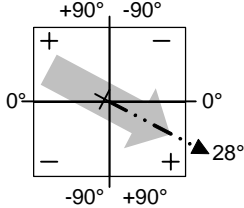
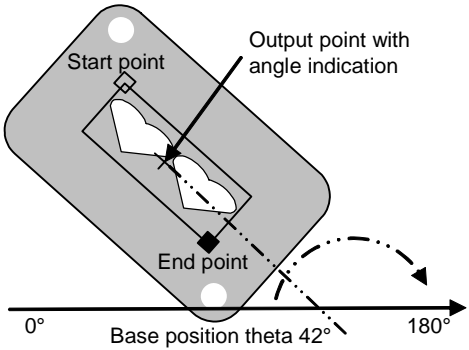
The object position for position/rotation adjustment can be established in four ways:

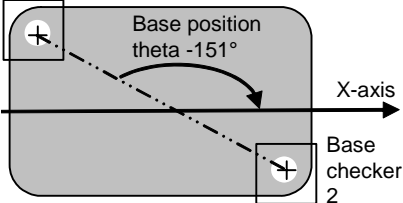
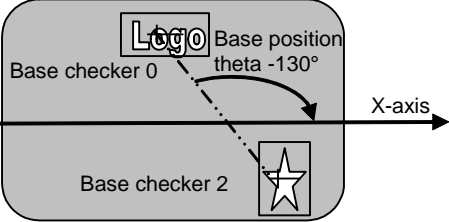
- Feature extraction with principal axis angle (see page 300)
- 360°-degree matching (see page 301)
- Feature extraction with 2 checkers (see page 301)
- Matching with 2 checkers (see page 302)

The setting procedure is the same as for position adjustment checkers (see page 290) combined with the parameters specific for the checker type (feature extraction or matching). Please refer to the corresponding checker sections for details.

8.3.1 Calculation of the Base Position and Angle

The first step is to register the base position and base angle (theta). The calculation method varies depending on the selected position/rotation adjustment type.

Checker	Base position	Base angle	Example
Feature extraction with principal axis angle	X-, Y-coordinate of the center of gravity of an object	Angle of the principal axis of inertia to the X-axis	
360°-degree matching	X-, Y-coordinate of the output point	Angle between the X-axis and a virtual line parallel to the checker shape as defined by the start and end point	

Checker	Base position	Base angle	Example
Feature extraction with 2 checkers	X-, Y-coordinate of the center of gravity of each of the two objects detected	Angle between the X-axis and the virtual line connecting the two objects' centers of gravity	
Matching with 2 checkers	X-, Y-coordinates of the output points	Angle between the X-axis and the virtual line connecting the two output points	

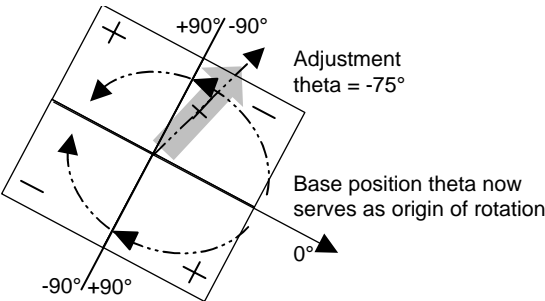


◆ NOTE

- Position/rotation adjustment with feature extraction will only work for objects with a distinctive principle axis. It will not work on perfectly round or perfectly square objects.
- To obtain reliable and unambiguous results when using position/rotation adjustment with two feature extraction checkers, set the start point of base checker 0 to the left of the start point of base checker 2. The checker areas may overlap.

8.3.2 Calculation of the Adjustment Amount

For all types of position/rotation adjustment, the base position you register becomes the origin of the rotation, i.e. the 0°-axis. The adjustment amount is calculated as the difference between the current position of the object serving as a reference point and the registered base position.



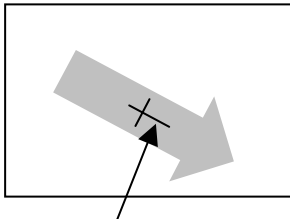
8.3.3 Feature Extraction (Principal Axis Angle)

This adjustment checker works like the position adjustment checker (see page 274) combined with the feature extraction checker (see page 178). For setting options and setting procedure refer to the position adjustment checker (see page 290).

This is how the checker works:

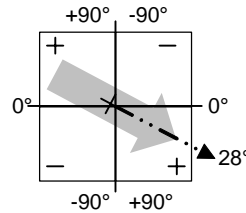
1. Set a checker area and define the target color.
2. To determine the base position, the Imagechecker detects an object with the selected color and determines the principle axis of inertia. The center of the object is the base position. The orientation of the longer line of the cross indicates the angle "Base Pos. Theta".

Checker area



Base position with principal axis of inertia

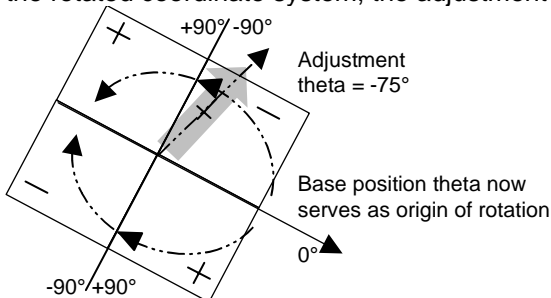
Calculation method for base position theta:



Base position values for this object:

Base Pos. X	306.7
Base Pos. Y	269.2
Base Pos. Theta	28.5

3. For calculating the correct adjustment amount, the Imagechecker defines the registered base position theta as the origin of the rotation, i.e. 0 degrees, and rotates the coordinate system used for calculating the base position theta. The coordinate system is needed to determine whether the adjustment angle is negative or positive.
4. During inspection, the Imagechecker searches for an object of the selected color and determines the principal axis of inertia. Depending on the orientation of the object in the rotated coordinate system, the adjustment angle is positive or negative:



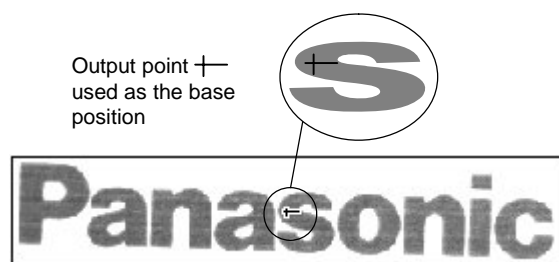
◆ NOTE

To ensure stable detection and reliable position adjustment, make sure to use sorting when there is a chance that the checker will detect several objects with the selected color. The first object detected will be used for position

adjustment. By setting a sorting order you can define which object should be used.

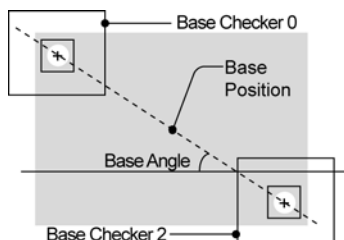
8.3.4 Matching (360 Degrees)

This adjustment checker works like the smart matching checker (see page 189), but without the subtraction function. For setting options and setting procedure refer to the position adjustment checker (see page 197). The output point is used as the base position. The base angle is always 0. The angle is indicated by the elongated cross bar and is assumed to be parallel to the X-axis when you first register the base position.



8.3.5 Feature Extraction (2 Checkers)

This adjustment checker uses two feature extraction checkers, which will detect two centers of gravity. The base position is the center point between the two centers of gravity. The line connecting the two centers of gravity forms an angle with the X-axis and this is the base angle.



You need to select two objects to register the base position, one for each feature extraction checker. When there are several objects detected, scroll through the list with the cursor. When a table row is highlighted, the corresponding object is displayed in pink in the image. The other detected objects are displayed in cyan.

Select Detect Position of Base 0 No. 0				
No.	Area	Grav.X	Grav.Y	Principal Axis Angle
0	13546	568.838	494.545	26.664
1	12964	217.506	332.412	-180.000
2	10934	396.634	433.613	24.840

Select Detect Position of Base 2 No. 0				
No.	Area	Grav.X	Grav.Y	Principal Axis Angle
0	14029	996.440	837.648	13.299

Register Base

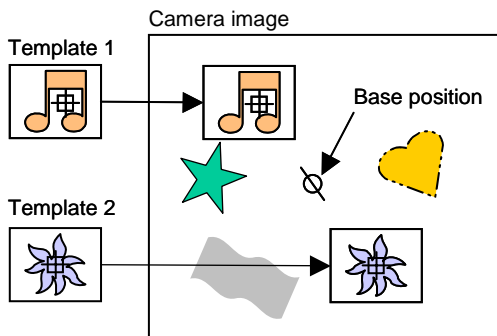
Pos/Rot Adjustment
Feature Extraction (2 checkers)
Register a Base Position.

8.3.6 Matching (2 Checkers)

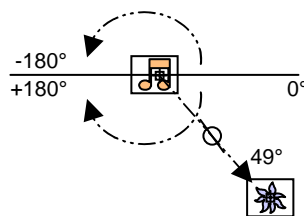
In principle, this checker works like the inspection checker for smart matching (see page 189). The difference is that you set two areas and register two templates. You must use the same memory setting for both areas.

This is how the matching checker used for rotation adjustment works:

1. Set two checker areas.
2. To determine the base position, the Imagechecker finds a matching object in each of the two areas you have set. In each area, the shape's output point will serve as the detection point. Then the Imagechecker draws a virtual line between the two detection points. The center of the virtual line is marked by a circle with a line. This is the base position, the orientation of the line indicates the angle "Base Pos. Theta".



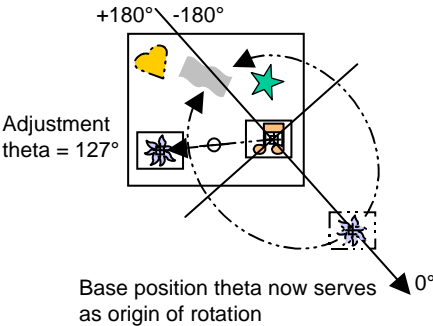
Calculation method for base position theta:



Base position values:

Base Pos. X 231.1
Base Pos. Y 312.7
Base Pos. Theta 49.1

- 3. For calculating the correct adjustment amount, the Imagechecker defines the registered base position theta as the origin of the rotation, i.e. 0 degrees.
- 4. During inspection, the Imagechecker searches for two matching objects and again draws a virtual line between the two detected objects. The angle between the line connecting the detected objects and the line registered as the base position is the adjustment theta. Depending on the rotation direction of the detected object, the adjustment angle is positive (clockwise rotation as compared to base position) or negative (counterclockwise rotation as compared to base position):



You need to select two objects to register the base position, one for each matching checker. When there are several objects detected, scroll through the list with the cursor. When a table row is highlighted, the corresponding object is displayed in pink in the image. The other detected objects are displayed in cyan.

Select Detect Position of Base 0 No. 0

No.	X	Y	Angle	Correlation Value
0	918.315	814.925	0.000	0.916

Select Detect Position of Base 2 No. 0

No.	X	Y	Angle	Correlation Value
0	724.479	791.266	0.000	0.939

Register Base

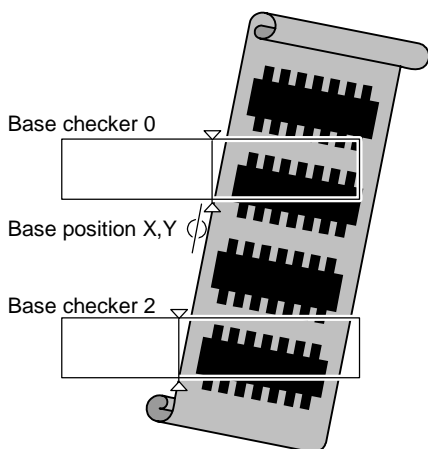
8.4 Rotation Adjustment

The rotation adjustment checkers help to adjust checkers in one direction (horizontal or vertical) and to balance a misorientation of up to 180° degrees. For object displacements in more than one direction or with higher angle misorientation, use a position/rotation adjustment checker (see page 298).

This is how the rotation adjustment works:

1. Select checker type (binary or gray value) and scanning direction (horizontal or vertical)
2. Set the areas for base checker 0 and base checker 2 (see note) and define the inspection condition and search method. The base checkers work like normal edge-detection checkers.
3. To determine the base position, the Imagechecker detects two edges with the selected properties. The base position is then calculated as described below (see page 306). The orientation of the longer line of the cross indicates the angle "Base Pos. Theta".

Calculation method for base position and theta:

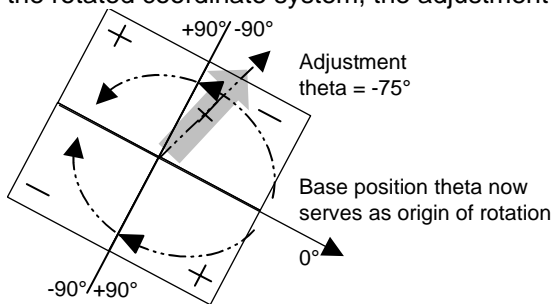


$$\text{Base Pos. X} = \frac{X_{\text{Base Checker 0}} + X_{\text{Base checker 2}}}{2}$$

$$\text{Base Pos. Y} = \frac{Y_{\text{Base Checker 0}} + Y_{\text{Base checker 2}}}{2}$$

Base Pos. Theta (see page 306)

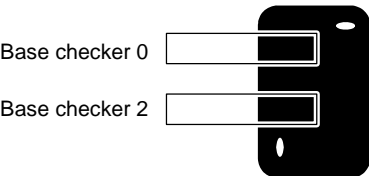
- 4. For calculating the correct adjustment amount, the Imagechecker defines the registered base position theta as the origin of the rotation, i.e. 0 degrees, and rotates the coordinate system used for calculating the base position theta. The coordinate system is needed to determine whether the adjustment angle is negative or positive.
- 5. During inspection, the Imagechecker searches for an object of the selected color and determines the principal axis of inertia. Depending on the orientation of the object in the rotated coordinate system, the adjustment angle is positive or negative:



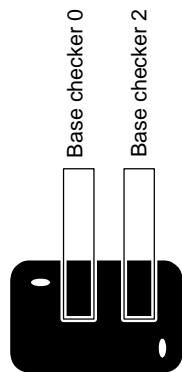
◆ NOTE

To obtain reliable and unambiguous results when using rotation adjustment, set the start point of base checker 0 as follows:

- For a horizontal rotation adjustment above the start point of base checker 2



- For a vertical rotation adjustment to the left of the start point of base checker 2



The checker areas may overlap.

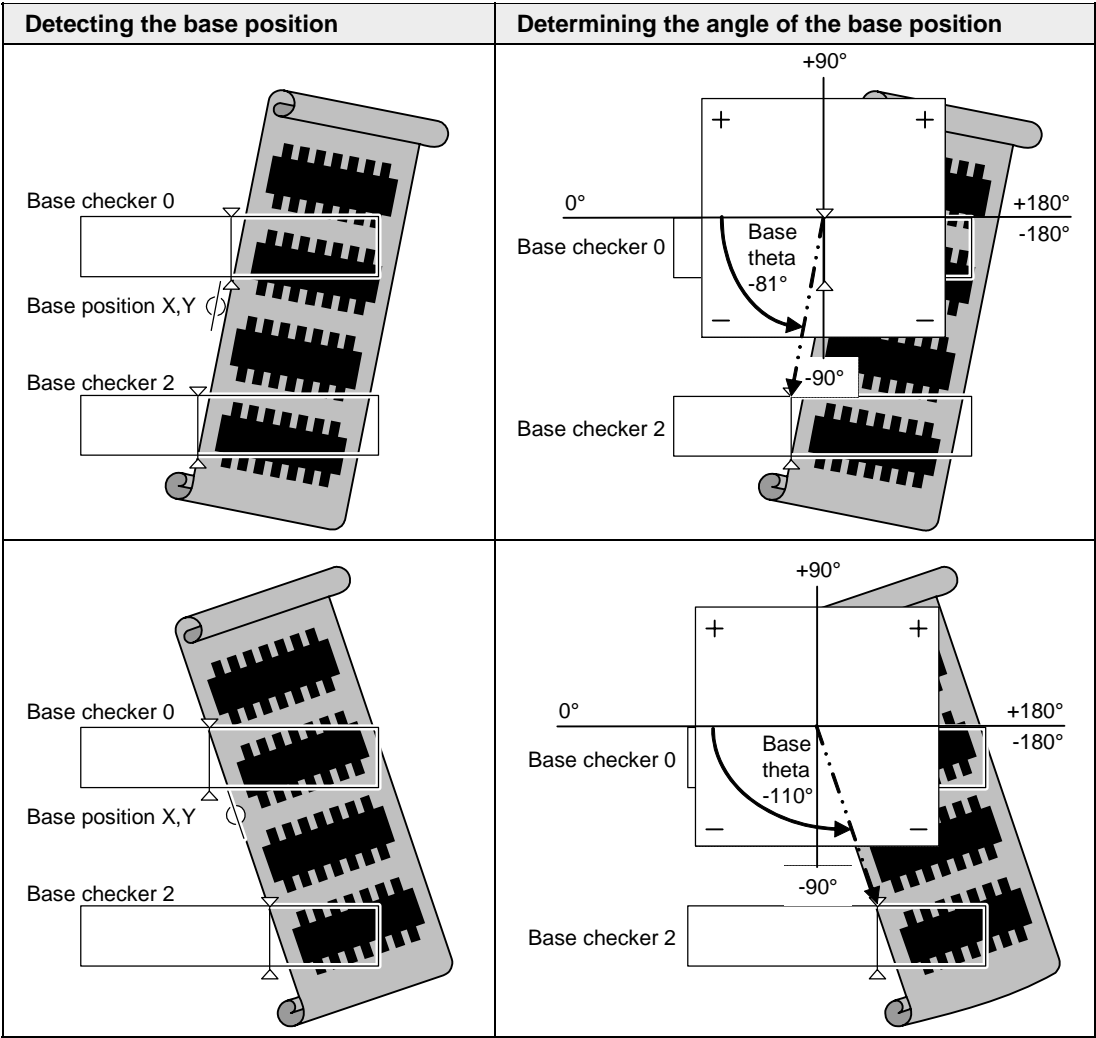
8.4.1 How the Angle of the Base Position Is Determined

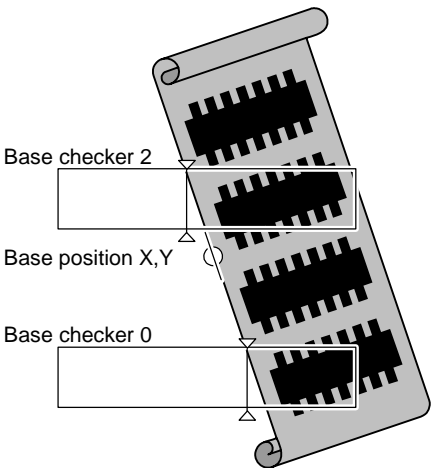
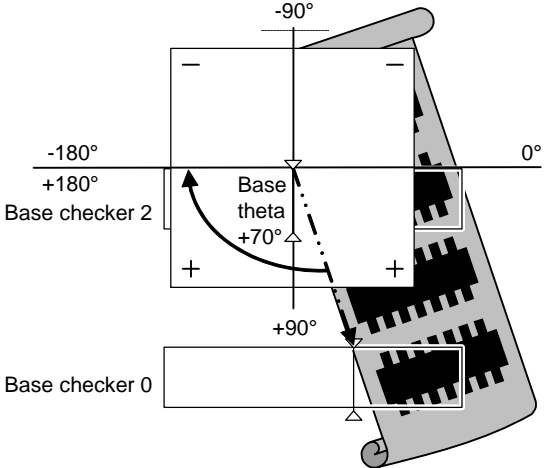
The angle is always established from base checker 0 to checker 2 as shown in the example below with rotation adjustment using a horizontal binary edge.



◆ NOTE

The example assumes that you are using the default coordinate system of the Imagechecker with the positive direction rightward - downward as defined in TYPE → Type Setting → Camera Setting under "Calibration".



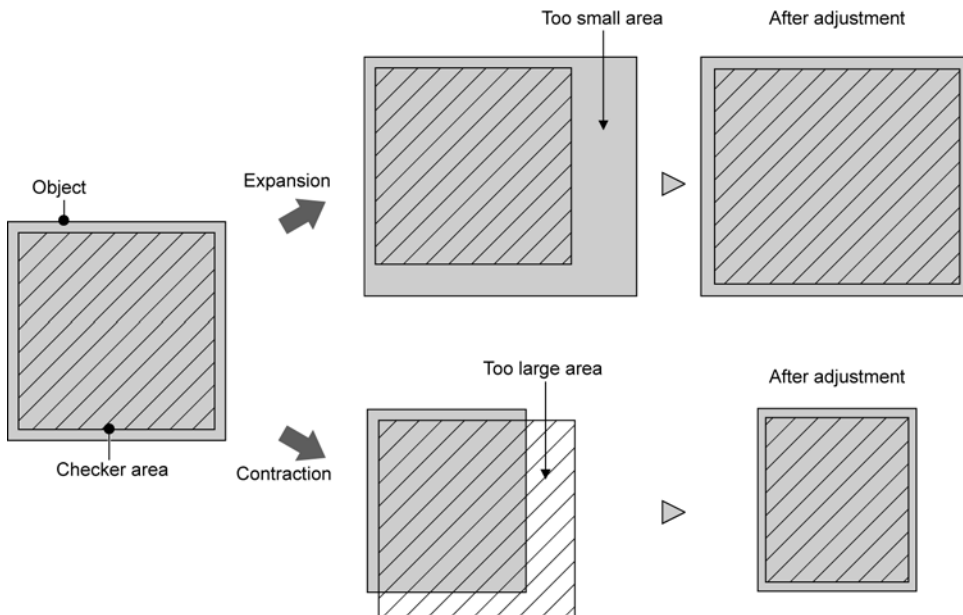
Detecting the base position	Determining the angle of the base position
<div><p>Base checker 2</p><p>Base position X,Y</p><p>Base checker 0</p><p>Note that when you swap the positions of base checker 0 and base checker 2 so that base checker 0 comes after base checker 0 (in the sense of having a higher X- and/or Y-coordinate), the coordinate system is mirrored.</p></div>	<div><p>-90°</p><p>-180°</p><p>+180°</p><p>0°</p><p>Base checker 2</p><p>Base theta +70°</p><p>Base checker 0</p></div>

Chapter 9

Area Size Adjustment

9.1 Introduction to Area Size Adjustment

This function expands or contracts the inspection area or mask area to fit a variable-sized object based on object properties such as edges or register marks and the coordinates of the object.



There are 4 types of area size adjustment checkers available:

- Binary edge (see page 161)
- Gray edge (see page 167)
- Feature extraction (see page 178)
- Matching (see page 189)

In principle, the area size adjustment checkers works just like the inspection checkers of the same name. However, the area size adjustment checkers only provide reference coordinates as their result, which makes them similar to position and rotation adjustment checkers. Like position and rotation adjustment checkers, area size adjustment checkers are assigned to the inspection checker they are supposed to adjust.

The following steps need to be taken regardless of whether the area size adjustment takes place in one or more directions:

1. Set and execute the adjustment checker area(s)
2. Assign the adjustment checker to an inspection checker



◆ NOTE

- Use the "Comment" field in the checker-setting window to give each area size adjustment checker a unique name.

- The area size adjustment checker always uses object number 0 for the adjustment. If it is possible that more than one objects are detected (i.e. when you use a feature extraction checker for area size adjustment), make sure to sort the detected objects so that the correct reference object is detected first (see page 180).
- When counting checkers, position/rotation adjustment and area size adjustment checkers are added. Please note that the maximum number of adjustment checkers (position and area size together) is 1000 checkers.
- When you use area size adjustment, the shape of the adjusted inspection checker is shown with the modified size. However, when you enter the checker setting window, you will see the original, unadjusted, coordinate values.

9.1.1 Availability of the Area Size Adjustment Function

Area size adjustment is available for the following inspection checkers. Checkers not listed here cannot have their checker area adjusted in size.

Adjustable	Non-Adjustable
<ul style="list-style-type: none">• Line checkers• Binary window• Gray window• Binary edge• Gray edge• Feature extraction• Flaw detection• Connector (binary window)• Connector (gray window)	<ul style="list-style-type: none">• Smart matching• Connector (gray edge)• Position/rotation adjustment checkers• Area size adjustment checkers

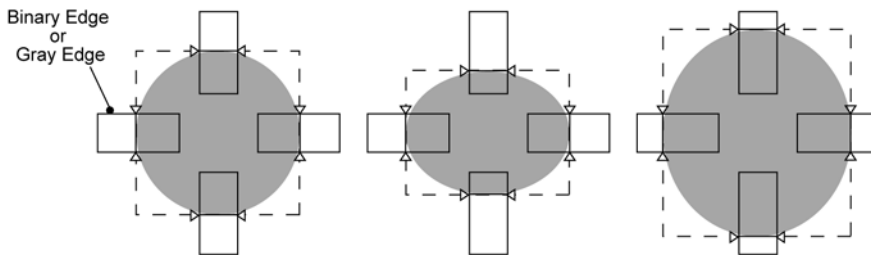
9.1.2 Examples of Area Size Adjustment

Area size adjustment can be used when similar objects of varying sizes need to be checked by one single inspection checker. Depending on the checker type, you can adjust the inspection checker in up to 4 directions.

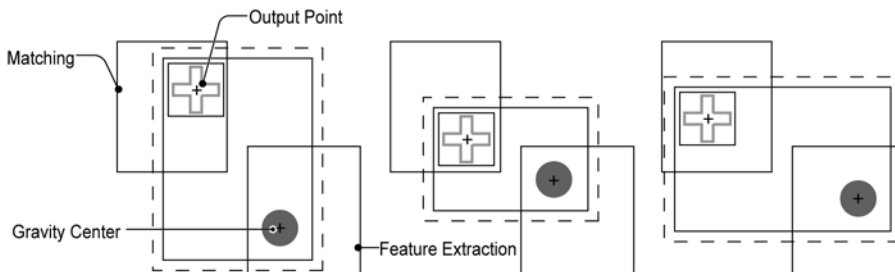


◆ EXAMPLE

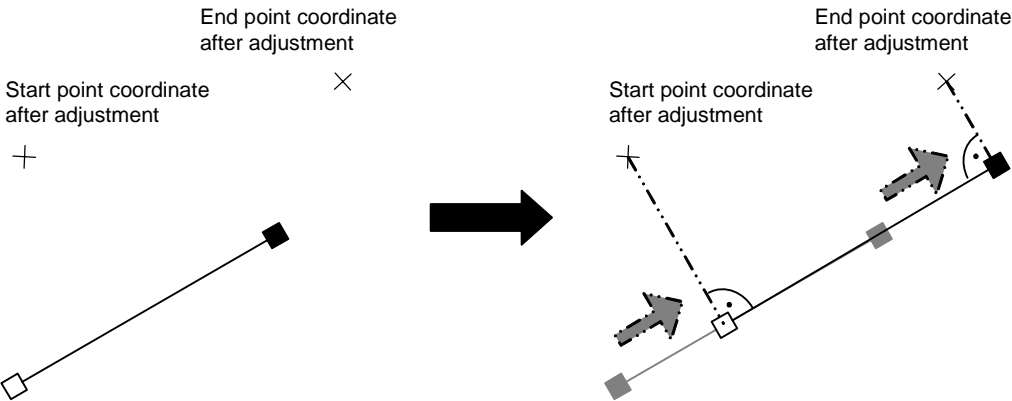
The first example shows a feature extraction checker (dotted line) that is used to check rounded objects. It is adjusted in size by 4 area size adjustment checkers (normal lines).



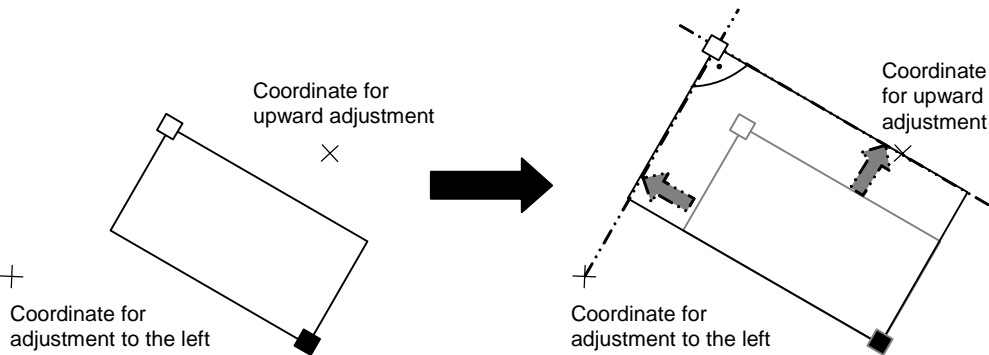
Depending on the object properties, 2 area size adjustment checkers will suffice.



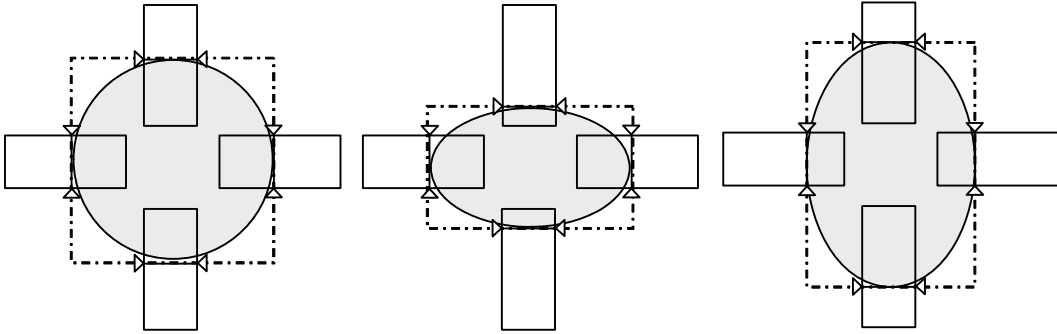
Area size adjustment works also for objects that appear at an angle; i.e. objects which do not have a strict horizontal or vertical orientation. Area size adjustment for a diagonal line checker means that only the coordinates of the start and end point are changed. The orientation of the line remains unchanged.



Area size adjustment for a diagonal rectangular checker means that only the side lines are adjusted parallel to the original rectangle.. The orientation of the rectangle remains unchanged.



9.2 Setting Procedure



To set up the feature extraction checker (dotted checker shape) which is adjusted in size by 4 binary area size adjustment checkers as shown in the example, please proceed as follows:

1. Set up the area size adjustment checkers in the order top, bottom, left, right adjustment
2. Create the feature extraction checker and assign the area size adjustment checkers

Set the area size adjustment checkers for top and bottom adjustment



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
3. Select **"Area Size Adj."** from the submenu and press **<ENTER>**

4. Select checker number 000 and press <ENTER> twice

Area Size Adj. (Binary Edge)

Area Setting	Comment	
Inspection Condition	Camera	0
Search Method	Position Adj.	No
	Area	Set

Judgment **NG**
 Detected Count **0**
 Time(ms) **0.00**

No.	X	Y	Detect Color

5. Select "Inspection Condition"

6. Select "Scan Direction" and press <ENTER>

7. Select "Vertical"

Area Size Adj. (Binary Edge)

Area Setting	Preprocess	No
Inspection Condition	Slice Level	A
Search Method	Scan Direction	Vertical
	Target	Both
	Filter	No

Judgment **OK**

8. Press <Cancel>

9. Select "Area Setting" and press <ENTER> twice

This takes you to the "Comment" field. It is important to label the area size adjustment checkers clearly if you will be using more than one. The Imagechecker displays the virtual keyboard.

10. Enter "Top" as the comment

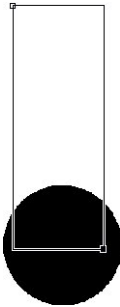
As the area size adjustment checkers are assigned in the order up, down, left, right, it makes sense to set the checkers in this order. For more information on how to use the virtual keyboard (see page 51).

11. Select the button [Set] next to "Area Setting" and press <ENTER>

12. Press <ENTER>

13. Set the area

Make sure to set the area big enough to cover all possible object sizes and positions.



14. Press <TRIG> to execute the checker for testing

When the Imagechecker detects the edge of the current object, the coordinate of the first edge point are displayed in the results table.

No.	X	Y	Detect Color
0	653.000	508.000	-

15. Press <Cancel>

This takes you back to the list of area size adjustment checkers. Next, set the bottom adjustment checker by copying the top adjustment checker.

16. Select checker number 000 "Top" and press <FUNC>

17. Select "Copy"

18. Select checker number 001 and press <FUNC>

19. Select "Paste"

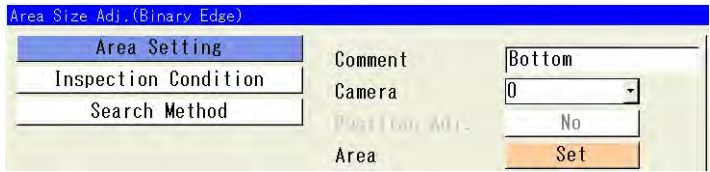
20. Press <ENTER> three times

This takes you to the "Comment" field.

21. Use the button [BS] to delete "Top"

BS stands for backspace.

22. Enter "Bottom" as the comment

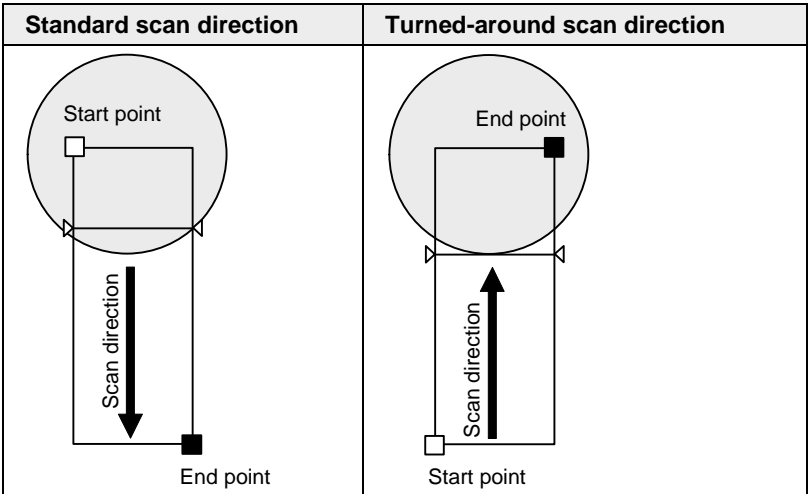


23. Select the button [Set] next to "Area Setting" and press <ENTER>

For the area size adjustment from the bottom upwards, it makes sense to turn the scanning direction around so that the checker searches vertically, but from the bottom to the top of the image.

24. Set the area

Move the start point of the checker shape over and beyond the end point of the checker to turn the scan direction around. This way, the lower edge of the rounded object is detected. Compare the position of start and end points and its influence on the scan direction of the checker.



The Inspection Condition remain the same.

25. Press <TRIG> to execute the checker for testing

When the Imagechecker detects the edge of the current object, the coordinate of the first edge point are displayed in the results table.

26. Press <CANCEL> to return to the list of area size adjustment checkers

Next, set the left adjustment checker.

Set the area size adjustment checkers for left and right adjustment



◆ Procedure

1. In the list of area size adjustment checkers, select checker number 002 and press <ENTER>

2. Select "Area Setting" and press <ENTER> twice
3. Enter "Left" as the comment
4. Set the area

Make sure to set the area big enough to cover all possible object sizes and positions. The Inspection Condition may remain at the default settings.

5. Press <TRIG> to execute the checker for testing

When the Imagechecker detects the edge of the current object, the coordinate of the first edge point are displayed in the results table.

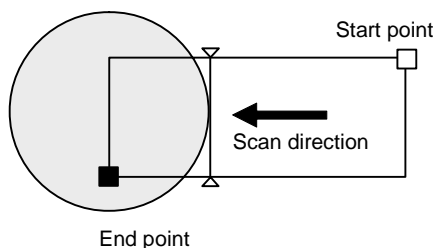
No.	X	Y	Detect Color
0	625,000	566,000	-

6. Press <CANCEL>

This takes you back to the list of area size adjustment checkers. Next, set the right adjustment checker by copying the left adjustment checker.

7. Select checker number 002 "Left" and press <FUNC>
8. Select "Copy"
9. Select checker number 003 and press <FUNC>
10. Select "Paste"
11. Press <ENTER> three times
12. Change the "Comment" field to "Right"
13. Select the button [Set] next to "Area Setting" and press <ENTER>

For the area size adjustment from the right side, it makes sense to turn the scanning direction around so that the checker searches from right to left. Move the start point of the checker shape over and beyond the end point of the checker to invert the scan direction.



Now that all area size adjustment checkers have been set, proceed to set the feature extraction checker and assign the area size adjustment checkers.

14. Press <CANCEL>

Create the feature extraction checker and assign the area size adjustment checkers

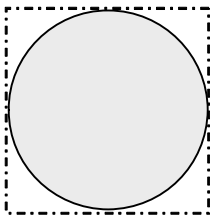


◆ Procedure

1. Create a feature extraction checker

The setting procedure is explained elsewhere in detail (see page 184).

2. Set the area to fit the object



3. Select the table under "Area Size Adj."

Area Setting	
Inspection Condition	
Search Method	
Extraction Condition	
Judgment Condition	

Comment:

Camera:

Position Adj.:

Area:

Area Size Adj.

Checker	Offset
Up	
Down	
Left	
Right	

Judgment: NG

Detected Count: 0

Time (ms): 0.00

4. Press <ENTER>

The list of area size adjustment checkers set so far is displayed. The first checker is selected in the list. The corresponding area size adjustment checker shape is displayed in orange. The feature extraction checker shape is displayed in green.

Area Size Adjustment

Block No.:

Checker No.:

No	
000	Top
001	Bottom
002	Left
003	Right

5. Select checker 000 and press <ENTER>

The selected area size adjustment checker is entered in the row "Up". You can enter an offset value (see page 321), if you like.

Feature Extraction

Area Setting		Comment	
Inspection Condition		Camera	0
Search Method		Position Adj.	No
Extraction Condition		Area	Set
Judgment Condition		Area Size Adj.	

Judgment **NG**

Detected Count **0**

Time (ms) **0.00**

	Checker	Offset
Up	No.000 Top	0
Down		
Left		
Right		

6. Assign the area size adjustment checkers for the remaining directions

Feature Extraction

Area Setting		Comment	
Inspection Condition		Camera	0
Search Method		Position Adj.	No
Extraction Condition		Area	Set
Judgment Condition		Area Size Adj.	

Judgment **OK**

Detected Count **1**

Time (ms) **0.63**

	Checker	Offset
Up	No.000 Top	0
Down	No.001 Bottom	0
Left	No.002 Left	0
Right	No.003 Right	0

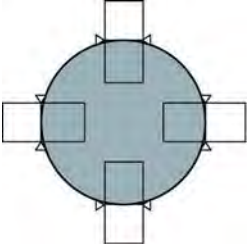
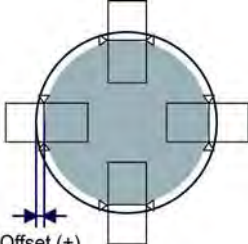
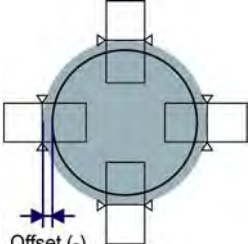
No.	Area	Grav.X	Grav.Y	Principal Axis Angle	Perimeter	Proj. Width	Proj. Height
0	79717	773.912	693.842	-180.000	1059	316.000	321.000

7. Press <TRIG> to execute the checker for testing

When the Imagechecker detects the object, the object properties are displayed in the results table. In the camera image, you see the feature extraction checker shape displayed in green and the area size adjustment checker shape in red (if you have selected one in the table).

9.3 Using Offset

With the offset you can change the adjusted area by adding or subtracting a defined amount. Entering a positive value will make the adjusted area bigger, entering a negative value will make it smaller. You can specify an offset value for each adjustment direction separately.

Offset = 0	Offset = +1 to +128	Offset = -1 to -128
		

Chapter 10

Calculation, Analysis, and Output

10.1 Overview

The Imagechecker offers different tools for calculating and analyzing the inspection results:

- Numerical calculations (user-definable arithmetic formulas (see page 326))
- Judgements on inspection results and results from numerical calculations (see page 344)
- Checker list (see page 359)

The inspection, judgement, and numerical calculation results can be output on the screen or to external devices.

10.1.1 Functionality of the Calculation and Analysis Tools

Tool	Description
Numerical calculation (see page 336)	Allows you to calculate with the inspection results and absolute values using four arithmetic operations and three trigonometric functions (Sin, Cos, Atan). In addition, this function judges whether the calculation results are within the maximum/minimum values. You can define up to 1000 numerical calculation and judgement formulas (the two kinds of formulas are added together).
Judgement (see page 348)	Judges the results of inspections or numerical calculations. You can output the results to external devices via the parallel ports D1 to D8 and via the serial ports. You can define up to 1000 numerical calculation and judgement formulas (the two kinds of formulas are added together).
Data R/W (see page 373)	Displays the results of numerical calculations, judgement formulas, and statistics in table form during inspection. In run mode, it is also possible to change the maximum and minimum values for the numerical calculations displayed.

10.1.2 Outputting Data to External Devices

There are different possibilities to output the selected data to external devices:

- Parallel output terminals (see page 364)
- RS232C interface/Ethernet (see page 370)
- SD memory cards (see page 370)

10.1.3 Common Functions for Numerical Calculation and Judgement Formulas

Both numerical calculation and judgement formulas are created in a formula editor window. When the formula editor is displayed, the key guide at the bottom of the screen (see page 64) displays the functions available:

Function	Details	Available where
Copy	To copy a formula, select the formula with the cursor and press <FUNC>, then select "Copy"	from the pop-up menu when you press <FUNC>
Paste	To paste a copied formula, select the destination location with the cursor and press <FUNC>, then select "Paste"	from the pop-up menu (only after you have copied a formula)

Function	Details	Available where
Replace	To replace a formula item, select the element with the cursor and press <F1>	in the "Expression" field in the formula editor
Delete	To delete a formula item, select the element with the cursor and press <F2>.	in the "Expression" field in the formula editor
Delete	To delete a formula, select the formula with the cursor and press <FUNC>, then select "Delete"	In the list of numerical calculation formulas
Delete all	To delete the complete formula and start again, press <F3>.	in the "Expression" field in the formula editor
Run test	Press <TRIG>	In the list of numerical calculation formulas



◆ NOTE

- All formulas are carried out in ascending order of formula number. If you wish to use the result of a formula within another formula, make sure the formula referencing a formula result has a higher number than the formula providing the result. This means, formula CAC022 can use results from formulas CAC001 to CAC021, but not from CA023 to CA999, because they will be calculated only after CA022.
- You can obtain information about a formula item by selecting the element in the formula editor. The field "Expression Description" provides details about the currently selected formula item.

10.2 Numerical Calculation

You can create formulas to carry out numerical calculations on respectively with the checker result.

10.2.1 Restrictions

The following restrictions apply when you work with numerical calculations.

- You can set up to a maximum of 1000 formulas for numerical calculations and judgement formulas per type when 10 blocks are used.
- The formula may contain up to 16 items or 256 characters.
- The formula comment can be 16 characters long.
- Fixed values can be input in a range from -9,999,999.999 to +9,999,999.999.
- The Imagechecker can handle results from -2147483648.000 to +2147483647.000, which are $-(2^{31})$ to $(2^{31}-1)$, during calculation. When a calculation result exceeds the range, it is considered as an error (ER) and an error signal (ERROR0) is output. In that case, calculation result is output as "0".
- The variable "Scan Count" is reset when you turn on the power, when the statistics data are reset or when you switch to a different type.

10.2.2 Symbols for Numerical Calculations

The following checker and formula results can be used in numerical calculations.

10.2.2.1 Statistic Data Symbols

There are two types of statistic data you can select. Which type of statistic data is available depends on the result you have selected. The text in brackets is displayed in the formula expression on the screen.

Statistic data type 1	
Scan Count	(@TIME)
OK count	(@OK)
NG count	(@NG)

Statistic data type 2	
Minimum value	(@MIN)
Maximum value	(@MAX)
Average	(@AV)
Range	(@RG)
Disperse	(@DV)
Min. OK Judg.	(@OKMIN)
Max. OK Judg.	(@OKMAX)

Statistic data type 2	
OK average	(@OKAV)
OK range	(@OKRG)
OK disperse	(@OKDV)
Min. NG Judg.	(@NGMIN)
Max. NG Judg.	(@NGMAX)
NG average	(@NGAV)
NG range	(@NGRG)
NG disperse	(@NGDV)

10.2.2.2 Checker Data Symbols

The formula expressions consist of several parts. The first three letters indicates the checker or other formula type, e.g. PAC for a position/rotation adjustment checker, the numbers refer to the checker or formula number, the next letter indicated the data referred to, e.g. JUDGE for judgement.

The following items can be used in numerical calculation formulas:

Item	Result type	Stat. type	Details
Position Adjustment (PAC) No. 0-999	Judgement (JUDGE)	1	Output data OK=1, NG=0
	Inspection Time (TIME)	2	
	X Adjustment Amount (AJX)	2	
	Y Adjustment Amount (AJY)	2	
	Theta Adjustment Amount (AJA)	2	
	Detected Position X (X)	2	
	Detected Position Y (Y)	2	
	Theta (ANG)	2	
	Base checker judgement (BJUDGE) No. 0-3	1	Output data OK=1, NG=0
	Base checker inspection time (BTIME) No. 0-3	2	
	Base checker X (BX) No. 0-3	2	
	Base checker Y (BY) No. 0-3	2	
	Base checker projection X (BPX) No. 0-3	2	
	Base checker projection Y (BPY) No. 0-3	2	
Area Size Adjustment (AUC) No. 0-999	Judgement (JUDGE)	1	Output data 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	Output data OK=1, NG=0
	Inspection Time (TIME)	2	

Item	Result type	Stat. type	Details
	Dot count judgement (DJ)	1	Output data OK=1, NG=0
	Land count judgement (LJ)	1	Output data OK=1, NG=0
	Dot count (DCNT)	2	Output value: 0 - 125938
	Land count (DCNT)	2	Output value: 0 - 41979
Binary Window (BWC) No. 0-999	Judgement (JUDGE)	1	Output data OK=1, NG=0
	Inspection Time (TIME)	2	
	Area (AREA)	2	Output value: 0 - 1920000

Item	Result type	Result No.	Stat. type	Details
Gray Window (GWC) No. 0-999	Judgement (JUDGE)	---	1	Output data OK=1, NG=0
	Inspection Time (TIME)	---	2	
	Gray Average (AVE)	---	2	Output value: 0 - 255
Binary Edge (BEC) No. 0-999	Judgement (JUDGE)	---	1	Output data OK=1, NG=0
	Inspection Time (TIME)	---	2	
	Detection count (COUNT)	---	2	Output value: 0 - 256
	X-coordinate (X)	0-255	2	
	Y-coordinate (Y)	0-255	2	
	Detected color (COLOR)	0-255	2	Result Output "White > Black", "Black > White"
	Projection distance of X (PX)	0-255	2	
	Projection distance of Y (PY)	0-255	2	
Gray Edge (GEC) No. 0-999	Judgement (JUDGE)	---	1	Output data OK=1, NG=0
	Inspection Time (TIME)	---	2	
	Detection count (COUNT)	---	2	Output value: 0 - 256
	X-coordinate (X)	0-255	2	
	Y-coordinate (Y)	0-255	2	
	Differential Value (DEF)	0-255	2	Output value: 0 - 255
	Projection distance of X (PX)	0-255	2	
	Projection distance of Y (PY)	0-255	2	
Feature Extraction (FEC) No. 0-999	Judgement (JUDGE)	---	1	Output data OK=1, NG=0
	Inspection Time (TIME)	---	2	
	Detection count (COUNT)	---	2	Output value: 0 - 10000
	Area (AREA)	0-9999	2	Output value: 0 - 1920000
	X-coordinate of gravity center (X)	0-9999	2	
	Y-coordinate of gravity center (Y)	0-9999	2	
	Projection width (PWX)	0-9999	2	Output value: 0 - 2000
	Projection height (PWY)	0-9999	2	Output value: 0 - 2000

Item	Result type	Result No.	Stat. type	Details
	X-coordinate of the upper left point of circumscribing rectangle (LUX)	0-9999	2	
	Y-coordinate of the upper left point of circumscribing rectangle (LUY)	0-9999	2	
	X-coordinate of the upper right point of circumscribing rectangle (RUX)	0-9999	2	
	Y-coordinate of the upper right point of circumscribing rectangle (RUY)	0-9999	2	
	X-coordinate of the lower left point of circumscribing rectangle (LDX)	0-9999	2	
	Y-coordinate of the lower left point of circumscribing rectangle (LDY)	0-9999	2	
	X-coordinate of the lower right point of circumscribing rectangle (RDX)	0-9999	2	
	Y-coordinate of the lower right point of circumscribing rectangle (RDY)	0-9999	2	
	Perimeter (PLEN)	0-9999	2	
	Principal axis angle (ANG)	0-9999	2	Output value: -89.9 - 90.0
	Projection distance of X (PX)	0-9999	2	
	Projection distance of Y (PY)	0-9999	2	
Smart Matching (SMC) No. 0-999	Judgement (JUDGE)	---	1	Output data OK=1, NG=0
	Inspection Time (TIME)	---	2	
	Detection count (COUNT)	---	2	Output value: 0 - 255
	Detect Template No. (TEMP)	0-255	2	
	Correlation (COR)	0-255	2	
	X-coordinate (X)	0-255	2	
	Y-coordinate (Y)	0-255	2	
	Theta(ANG)	0-255	2	Output value: -179.9 - -180.0

Item	Result type	Result No.	Stat. type	Details
	Max. subtraction (AREA)	0-255	2	
	Max. OK No. of subtracted objects (LCNT)	0-255	2	Output value: 0 - -128
	Projection distance of X (PX)	0-255	2	
	Projection distance of Y (PY)	0-255	2	
	Interim detection count (SCNT)	0-5	2	Output value: 0 - -256
	Interim correlation (SS)	0-5	2	Output value: 0.001 - -1,000
Flaw Detection (FWC) No. 0-999	Judgement (JUDGE)	---	1	Output data OK=1, NG=0
	Inspection Time (TIME)	---	2	
	Detection count (COUNT)	---	2	Output value: 0 - -512
	Flaw size (SIZE)	0-511	2	Output value: 1 - 254
	Top cell No. (FCELL)	0-511	2	Output value: 1 - -255
	X-coordinate (X)	0-511	2	
	Y-coordinate (Y)	0-511	2	
	Projection distance of X (PX)	0-511	2	
	Projection distance of Y (PY)	0-511	2	
Connector - Binary Window (CBW) No. 0-999	Judgement (JUDGE)	---	1	Output data OK=1, NG=0
	Inspection Time (TIME)	---	2	
	Detection count (COUNT)	---	2	Output value: 0 -
	Area (AREA)	0-99	2	
	Individual judgement (PJ)	0-99	1	Output data OK=1, NG=0
Connector Gray Window (CGW) No. 0-999	Judgement (JUDGE)	---	1	Output data OK=1, NG=0
	Inspection Time (TIME)	---	2	
	Detection count (COUNT)	---	2	Output value: 0 -
	Gray Average (AVE)	0-99	2	Output value: 0 - -255

Item	Result type	Result No.	Stat. type	Details
	Individual judgement (PJ)	0-99	1	Output data OK=1, NG=0
Connector Gray Edge (CGE) No. 0-999	Judgement (JUDGE)	---	1	Output data OK=1, NG=0
	Inspection Time (TIME)	---	2	
	Detection count (COUNT)	---	2	Output value: 0 -
	Pitch total judgement (PTJG)	---	1	Output data OK=1, NG=0
	Pitch dispersion total judgement (UPJG)	---	1	Output data OK=1, NG=0
	Max. Pitch (PMAX)	---	2	
	Min. Pitch (PMIN)	---	2	
	Average Pitch (PAVE)	---	2	
	Edge X-coordinate 0 of area 0 (X1)	0-99	2	
	Edge X-coordinate 1 of area 1 (X2)	0-99	2	
	Edge Y-coordinate 0 of area 0 (Y1)	0-99	2	
	Edge Y-coordinate 1 of area 1 (Y2)	0-99	2	
	Edge differential 0 of area 0 (D1)	0-99	2	Output value: 0 - -255
	Edge differential 1 of area 1 (D2)	0-99	2	Output value: 0 - -255
	Pitch (PT)	0-99	2	
	Pitch Dispersion (UPT)	0-99	2	
	Pitch Individual Judgement (JG)	0-99	1	Output data OK=1, NG=0
	Dispersion individual judgement (UJG)	0-99	1	Output data OK=1, NG=0

10.2.2.3 Numerical Calculation Symbols

Item	Result type	Stat. type	Details
Numerical Calculation (CAC) No. 0-999 (see note)	Judgement (JUDGE)	1	Output data OK=1, NG=0
	Result (VALUE)	1	
Previous Result (OCA) No. 0-999	Judgement (JUDGE)	1	Output data OK=1, NG=0
	Result (VALUE)	1	



◆ EXAMPLE

Correct:	$CAC000 = GWC000_AVE + GWC001_AVE$
	$CAC001 = CAC000 * 100$
Incorrect:	$CAC000 = CAC001 + 100$
	$CAC001 = GWC000_AVE + GWC001_AVE$

10.2.2.4 Judgement Formula Symbols

Item	Result type	Stat. type	Details
Judgement Internal (JRC) No. 0-999	Judgement (JUDGE)	1	Only statistics
Judgement External (JDC) No. 0-999	Judgement (JUDGE)	1	Only statistics

10.2.2.5 Other Symbols

Item	Result type	Stat. type	Details
Value	Input value: 0.000 to 9999999.999	---	
General register (SYS: REG) No. 0-7	The general register store default values.	---	Output value: 0.000 to 9999999.999
Scan count (SYS)	Number of scans (COUNT)	---	

10.2.3 Calculation Operators

The following operators and functions are available:

10.2.3.1 Operators

Calculation	Symbol	Details
Addition	+	A+B
Subtraction	-	A-B
Multiplication	*	A*B
Division	/	A/B If the denominator becomes "0", the calculation will be terminated and an error signal (ERROR1) will be output.
Left and right brackets	()	A+(B-C) You can use up to 3 consecutive brackets. Correct: (((A+B)-C+D)+E), Wrong: (((A+B)-C+D)+E)+F)

10.2.3.2 Arithmetic Functions / Num Calc

Function	Details	Example
MOD (S0, S1)	Remainder when S0 is divided by S1	MOD (9,4) = 1
POW (S0, S1)	Value of S0 multiplied by S1.	POW (3, 2) = 9
LOG10 (S)	Common logarithm of S	LOG10 (100) = 2
SQRT (S)	Square root of S	SQRT (144) = 12
ABS (S)	Absolute value of S	ABS (-255) = 255
PI	Pi (fixed value)	PI = 3.142
INT (S)	Integer portion of S	INT (-1.8) = -1
ROUND (S)	Round S to a whole number	ROUND (1.485) = 1
FLOOR (S)	Round S down to a whole number	FLOOR (1.485) = 1
CEIL (S)	Round S up to a whole number	CEIL (-1.3) = -1



◆ NOTE

Note the differences between the arithmetic functions 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

10.2.3.3 Statistic Functions

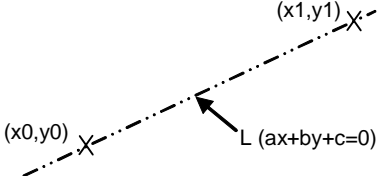
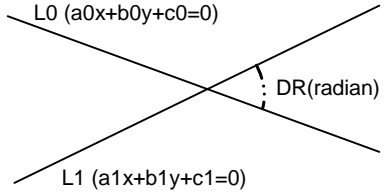
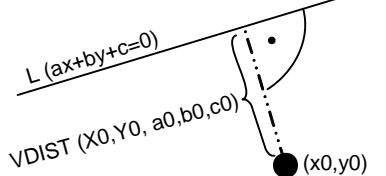
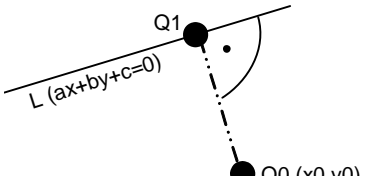
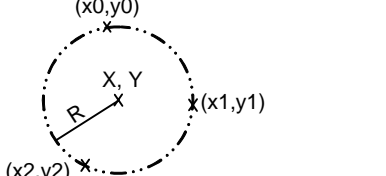
Function	Details	Example
MAX(C,S)	Maximum value from S-number of results of numerical calculation No. C	CAC000=10 CAC001=5.8 If CAC002=3 MAX(0, 3) = 10 MIN(0, 3) = 3 AVE(0, 3) = 6.267 SUM (0, 3) = 18.8 SORT(0,3, 1,1)=3
MIN(C,S)	Minimum value from S-number of results of numerical calculation No. C	
AVE(C,S)	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).	

10.2.3.4 Trigonometric Functions

Function	Details	Example
SIN(DR)	Sine of angle DR (radian)	
COS(DR)	Cosine of angle DR (radian)	
TAN(DR)	Tangent of angle DR (radian)	TAN(0.785) = 0.999
ASIN(DR)	Arcsine of angle DR (radian)	
ACOS(DR)	Arccosine of angle DR (radian)	
ATAN(DR)	Arctangent of angle DR (radian)	
SIND(D)	Sine of angle D	SIN(90) = 1
COSD(D)	Cosine of angle D	COS(60) = 0.5
TAND(D)	Tangent of angle D	TAN(45) = 1
ASIND(S)	Arcsine of angle D	ASIN(1) = 90
ACOSD(S)	Arccosine of S	ACOS(60) = 0.5
ATAND(S)	Arctangent of S	ATAN(1) = 45
RAD(D)	Radian of angle D	RAD(45) = $45 / 360 \times 2\pi = 0.785$
DEG(RD)	Angle of radian RD	DEG(0.785) = 45

10.2.3.5 Geometric Functions

Function	Details	Example
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 ($a_0x+b_0y+c_0=0$) and L1 ($a_1x+b_1y+c_1=0$) If two lines are parallel, the judgement will be "ERR".	

Function	Details	Example
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,x2,y2) CIRCLEY (x0,y0,x1,x2,y2) CIRCLER (x0,y0,x1,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. If it cannot be calculated, the judgement will be "Error".	

10.2.3.6 Compare Functions

Function	Full name	Details	Example
EQ (S0, S1)	Equal to	Returns "1" when $S0=S1$, otherwise "0".	EQ (85, 85) = 1
NE (S0, S1)	Not equal to	Returns "1" when $S0 \neq S1$, otherwise "0".	NE (85, 85) = 0
LT (S0, S1)	Lower than	Returns "1" when $S0 < S1$, otherwise "0".	LT (85, 85) = 0
LE (S0, S1)	Lower than or	Returns "1" when $S0 \leq S1$, otherwise "0".	LE (85, 85) = 1

Function	Full name	Details	Example
	equal to		
GT (S0, S1)	Greater than	Returns "1" when $S0 > S1$, otherwise "0".	GT (215, 85) = 1
GE (S0, S1)	Greater than or equal to	Returns "1" when $S0 \geq S1$, otherwise "0".	GE (215, 85) = 1

10.2.4 Working with Numerical Calculations

The following sections explain how to create an arithmetic formula for a numerical calculation, how to specify the maximum and minimum values to judge the numerical calculation, and how to copy, paste, and delete numerical calculations.



◆ NOTE

- By default, all numerical calculation formulas are set to output their results. If you don't want to output the results of a formula, set the "Output" field to "No".

No.	Expression	Result	Judge.	Max.	Min.	Output
CAC000	ABS(GEC000_X_000-GEC	1366.370	OK	1400.000	1000.000	Yes
CAC001	Unset					Yes
CAC002	Unset					Yes
CAC003	Unset					No
CAC004	Unset					No

Note that the general output for numerical calculation formulas needs to be activated by setting "Numerical Calculation" to "Output" under ENVIRONMENT → Input/Output → Parallel Output.

- You can obtain information about a formula item by selecting the element in the formula editor. The field "Expression Description" provides details about the currently selected formula item.

10.2.4.1 Creating a Numerical Calculation Program

As an example, here we will explain a calculation program that calculates dimensions using the operator D (absolute value of the difference) and the edges detected by gray checkers No. 1 and No. 2. The D operator subtracts two values, and gives the absolute value of the result.

CAC000 = absolute value (x-coordinate of the first edge detected by gray edge checker 000 - x-coordinate of the first edge detected by gray edge checker 001)



◆ Procedure

- In the SETUP menu, select "INSPECTION" from the menu bar and press <ENTER>
- Select "Num. Calcu." from the submenu and press <ENTER>

The list of formulas is displayed.

No.	Expression	Result	Judge	Max.	Min.	Output
CAC000	Unset					
CAC001	Unset					
CAC002	Unset					
CAC003	Unset					
CAC004	Unset					
CAC005	Unset					
CAC006	Unset					
CAC007	Unset					
CAC008	Unset					
CAC009	Unset					
CAC010	Unset					
CAC011	Unset					
CAC012	Unset					
CAC013	Unset					
CAC014	Unset					
CAC015	Unset					
CAC016	Unset					
CAC017	Unset					

3. Select the first row "CAC000" in the table and press <ENTER> twice

The formula editor is displayed.

Numerical Calculation CAC000

Comment

Expression

Function Description

Maximum 0.000

Minimum 0.000

Output Yes

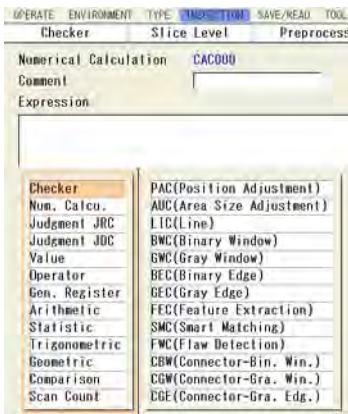
Result

Judgment

Expression Description

4. Press <ENTER> twice

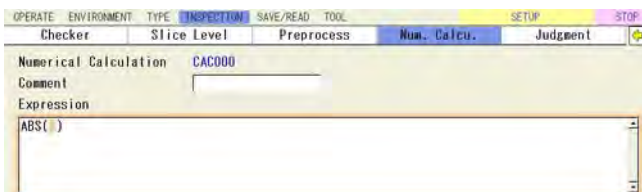
The item selection menu is displayed.



5. Select "Arithmetic" and press <ENTER>

6. Select "ABS" and press <ENTER>

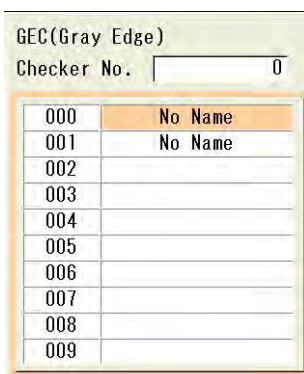
The absolute function is entered in the formula. The cursor is located between the brackets.



7. Press <ENTER> twice

8. Select "GEC(Gray Edge)"

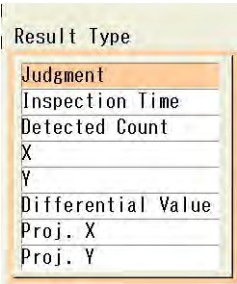
The list with all gray-edge detection checkers is displayed.



9. Select checker 000 and press <ENTER>

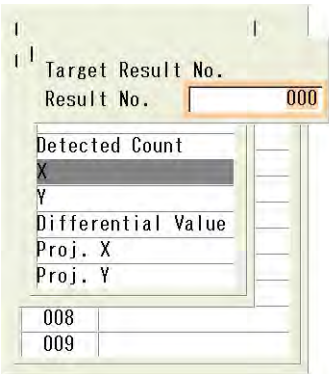
In the camera image, all checker shapes of the selected type are displayed in green. The currently selected checker is displayed in orange.

The result type menu is displayed.



10. Select "X"

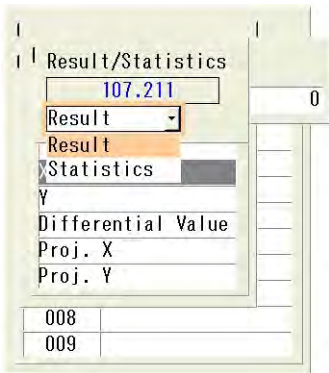
11. Select "000" to use the X-coordinate of the very first edge

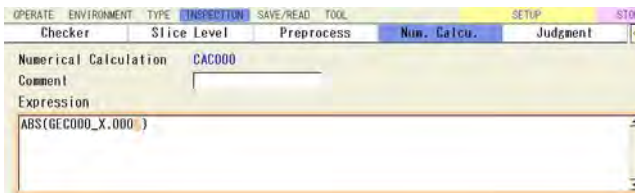


The corresponding edge is displayed in pink. All other edges detected by the selected checker are detected in cyan.

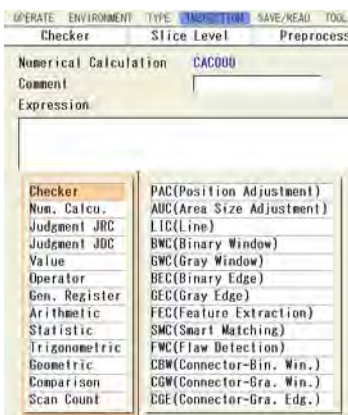
12. Press <ENTER>

The current X-coordinate value is displayed in blue.

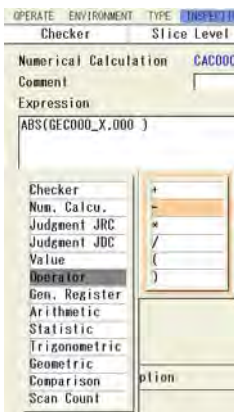


13. Select "Result" and press <ENTER>**14. Press <ENTER>**

The item selection menu is displayed.

**15. Select "Operator" and press <ENTER>**

The operators available appear in a submenu

**16. Select "-" and press <ENTER>****17. Press <ENTER>****18. Select "GEC(Gray Edge)"**

The list with all gray-edge detection checkers is displayed.

19. Select checker 001 and press <ENTER>

In the camera image, all checker shapes of the selected type are displayed in

green. The currently selected checker is displayed in orange. The result type menu is displayed.

20. Select "X"

21. Select "000" to use the X-coordinate of the very first edge

The corresponding edge is displayed in pink. All other edges detected by the selected checker are detected in cyan.

22. Press <ENTER>

The current X-coordinate value is displayed in blue.

23. Select "Result" and press <ENTER>

OPERATE	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ
Checker		Slice Level		Prepr
Numerical Calculation		CAC000		
Comment				
Expression				
ABS(GEC000_X.000-GEC001_X.000)				

The formula for the numerical calculation example is now complete. Proceed with entering maximum and minimum limits if you want to judge the numerical calculation formula.

24. To save the formula, press <CANCEL> and select "Yes"

If the formula syntax is correct, the formula is saved and you are returned to the list of numerical calculation formulas. If not, the message "Syntax error" is displayed in the box "Expression Description" and the cursor is moved to the position where the syntax error has been detected.



◆ NOTE

If the formula contains errors, you will not be able to register it. Instead, the Imagechecker displays the error message "Syntax error" and moves the cursor to the position in the formula where the error has been detected. Check your input for errors like missing operators, etc. For more information, please see the complete list of error codes (see page 144).

10.2.4.2 Entering Maximum/Minimum Values for Judging

There are two ways to enter the maximum and minimum values for judging a numerical calculation.

- In the formula editor when you create the numerical calculation formula
- In the list of numerical calculation formulas

In the formula editor



◆ Procedure

1. In the formula editor window, select "Maximum" and press <ENTER>
If the cursor is still inside the "Expression" field, press <CANCEL> first.
2. Enter the maximum value for the formula to be judged OK
Use the entry in "Result" as a guide.

Operate	Environment	Type	Inspection	Save/Read	Tool	Setup	Stop
Checker	Slice Level	Preprocess	Num. Calcu.	Judgment			

Numerical Calculation CAC000

Comment

Expression
ABS(GEC000_X,000-GEC001_X,000)

Function Description

Maximum	0000000000.000
Minimum	0.000
Output	Yes
Result	1011.829
Judgment	NG

3. Select "Minimum" and press <ENTER>
4. Enter the minimum value for the formula to be judged OK
5. Press <TRIG> to run a test
6. To save the formula, press <CANCEL> and select "Yes"

No.	Expression	Result	Judge	Max.	Min.	Output
CAC000	ABS(GEC000_X,000-GEC001_X,000)	1011.829	OK	1100.000	1000.000	Yes
CAC001	Unset					
CAC002	Unset					
CAC003	Unset					

In the list of numerical calculation formulas



◆ Procedure

1. In the formula editor window, select "Maximum" and press <ENTER>
A subwindow appears where you can enter a value.

No.	Expression	Result	Judge	Max.	Min.	Output
CAC000	ABS(GEC000_X,000-GEC001_X,000)	1366.892	NG	1100.000	1000.000	Yes
CAC001	Unset					
CAC002	Unset					
CAC003	Unset					

2. Enter the maximum value for the formula to be judged OK

Use the entry in "Result" as a guide.

3. Select "Minimum" and press <ENTER>**4. Enter the minimum value for the formula to be judged OK****5. Press <TRIG> to run a test**

10.3 Judgement

You can create judgement formulas to judge checkers and numerical calculations. You can set up to a maximum of 1000 formulas for numerical calculations and judgement formulas per type when 10 blocks are used.



◆ NOTE

When the option "Execution Mode" is set to "Automatic Switch", you need to set judgements for every branch condition (see page 354).

There are two types of judgement formulas:

- JDC (External): The result of this judgement formulas can be output to the external devices.
- JRC (Internal): The result of this judgement formulas cannot be output. use this type of judgement formula if you want to have a backup of a JDC formula and as a condition to save or output images.

10.3.1 Main Functions

The judgement tool offers the following functions:

Function	Description
Judging inspection results	You can judge any checker or calculation result with a judgement formula. If the formula expression is true, the judgement is OK. If it is not true, the judgement is NG.
Output to external devices	You can specify formulas for the parallel outputs, the serial port, the Ethernet port, or the SD memory card. If the judgement is OK, "1" is output; if it is NG, "0" will be output.
Total judgement	You can assign one judgement formula to the total judgement. The judgement of this formula will be displayed in green (OK) or red (NG) in the status display area (see page 65, see page 68).
Saving and outputting NG images	You can set up a judgement formula to save the current memory image every time the formula is judged NG. For further information on image saving (see page 458).

10.3.2 Symbols for Judgement Formulas

The formula expressions consist of several parts. The first three letters indicates the checker or other formula type, e.g. PAC for a position/rotation adjustment checker, the numbers refer to the checker or formula number, the next letter indicated the data referred to, e.g. JUDGE for judgement.

The following items can be used in judgement formulas:

Position and rotation adjustment checkers (PAC) No. 0-999

Checker	Item	Formula text	Will Be Judged OK If:
Any position and rotation adjustment checker	Judgement	JUDGE	The base checker can detect an edge or object.
Position Adjustment Binary/Gray Edge	Base judgement of horizontal base checker 0	BJUDGE.0	The base checker can detect an edge or object.
	Base judgement of horizontal base checker 1	BJUDGE.1	The base checker can detect an edge or object.
	Base judgement of vertical base checker 0	BJUDGE.2	The base checker can detect an edge or object.
	Base judgement of vertical base checker 1	BJUDGE.3	The base checker can detect an edge or object.
Position/Rotation Adjustment Feature Extraction/Matching (2 checkers)	Base judgement of base checker 0	BJUDGE.0	The base checker can detect an edge or object.
	Base judgement of base checker 2	BJUDGE.2	The base checker can detect an edge or object.
Rotation Adjustment	Base judgement of base checker 0-0	BJUDGE.0	The base checker can detect an edge or object.
	Base judgement of base checker 0-1 (center detection)	BJUDGE.1	The base checker can detect an edge or object.
	Base judgement of base checker 1-0	BJUDGE.2	The base checker can detect an edge or object.
	Base judgement of base checker 1-1 (center detection)	BJUDGE.3	The base checker can detect an edge or object.

All other checkers and formulas

Checker	Item and formula text	Will Be Judged OK If:
Area Size Adjustment (AUC) No. 0-999	Judgement (JUDGE)	The specified object or edge is detected.
Line (LIC) No. 0-999	Judgement (JUDGE)	Dot count judgement and land count judgement are both OK.
	Dot count judgement (DJUDGE)	The number of dots does not exceed the limits set with "OK Judge. Max./Min.".
	Land count judgement (LJUDGE)	The number of lands does not exceed the limits set with "OK Judge. Max./Min.".
Binary Window (BWC) No. 0-999	Judgement (JUDGE)	The area value does not exceed the limits set with "OK Judge. Max./Min.".
Gray Window (GWC) No. 0-999	Judgement (JUDGE)	The average gray value does not exceed the limits set with "OK Judge. Max./Min.".

Checker	Item and formula text	Will Be Judged OK If:
Binary Edge (BEC) No. 0-999	Judgement (JUDGE)	The number of detected edges does not exceed the limits set with "OK Judge. Max./Min.".
Gray Edge (GEC) No. 0-999	Judgement (JUDGE)	The number of detected edges does not exceed the limits set with "OK Judge. Max./Min.".
Feature Extraction (FEC) No. 0-999	Judgement (JUDGE)	The number of detected objects does not exceed the limits set with "OK Judge. Max./Min.".
Smart Matching (SMC) No. 0-999	Judgement (JUDGE)	The number of detected objects at the last phase is equal to the upper limit of detected objects that was set at the last phase of the sequence.
Flaw Detection (FWC) No. 0-999	Judgement (JUDGE)	The number of detected flaws does not exceed the limits set with "OK Judge. Max./Min.".
Connector - Binary Window (CBW) No. 0-999	Judgement (JUDGE)	
	Individual Judgement (PJUDGE) No. 0-99	
Connector Gray Window (CGW) No. 0-999	Judgement (JUDGE)	
	Individual Judgement (PJUDGE) No. 0-99	
Connector Gray Edge (CGE) No. 0-999	Judgement (JUDGE)	Pitch total judgement and dispersion total judgement are both OK.
	Pitch total judgement (PTJUDGE)	All pitch judgements are OK.
	Dispersion Total Judgement (UTJUDGE)	All dispersion judgements are OK.
	Judgement of each pitch (PJUDGE) No. 0-99	The detected pitches are within the range of OK Judgement.
	Judgement of each dispersion (UJUDGE) No. 0-99	The detected dispersion is within the range of OK Judgement.
Numerical Calculation (CAC) No. 0-999	Judgement (JUDGE)	The calculation results do not exceed the limits set with "Max/Min".
Previous result of a numerical calculation (OCA) No. 0-999	Judgement (JUDGE)	The calculation results do not exceed the limits set with "Max/Min".
Judgement Internal (JRC) No. 0-999	Judgement (JUDGE)	The judgement formula is judged OK.
Judgement External (JDC) No. 0-999	Judgement (JUDGE)	The judgement formula is judged OK.

10.3.3 Operators

The table below lists the judgement operators available.

Name	Symbol	Meaning	Detail															
Logical sum	+	OR	Returns "OK (1)" if the result of either A or B is OK (1). Example: JDC000 = A + B <table><tr><td>A</td><td>B</td><td>Judgement result of JDC000</td></tr><tr><td>OK (1)</td><td>OK (1)</td><td>OK (1)</td></tr><tr><td>OK (1)</td><td>NG (0)</td><td>OK (1)</td></tr><tr><td>NG (0)</td><td>OK (1)</td><td>OK (1)</td></tr><tr><td>NG (0)</td><td>NG (0)</td><td>NG (0)</td></tr></table>	A	B	Judgement result of JDC000	OK (1)	OK (1)	OK (1)	OK (1)	NG (0)	OK (1)	NG (0)	OK (1)	OK (1)	NG (0)	NG (0)	NG (0)
A	B	Judgement result of JDC000																
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	*	AND	Returns "OK (1)" if the results of both A and B are OK (1). Example: JDC000 = A * B <table><tr><td>A</td><td>B</td><td>Judgement result of JDC000</td></tr><tr><td>OK (1)</td><td>OK (1)</td><td>OK (1)</td></tr><tr><td>OK (1)</td><td>NG (0)</td><td>NG (0)</td></tr><tr><td>NG (0)</td><td>OK (1)</td><td>NG (0)</td></tr><tr><td>NG (0)</td><td>NG (0)</td><td>NG (0)</td></tr></table>	A	B	Judgement result of JDC000	OK (1)	OK (1)	OK (1)	OK (1)	NG (0)	NG (0)	NG (0)	OK (1)	NG (0)	NG (0)	NG (0)	NG (0)
A	B	Judgement result of JDC000																
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	#	XOR	Returns "OK (1)" if the results of both A and B are not the same. Example: JDC000 = A # B <table><tr><td>A</td><td>B</td><td>Judgement result of JDC000</td></tr><tr><td>OK (1)</td><td>OK (1)</td><td>NG (0)</td></tr><tr><td>OK (1)</td><td>NG (0)</td><td>OK (1)</td></tr><tr><td>NG (0)</td><td>OK (1)</td><td>OK (1)</td></tr><tr><td>NG (0)</td><td>NG (0)</td><td>NG (0)</td></tr></table>	A	B	Judgement result of JDC000	OK (1)	OK (1)	NG (0)	OK (1)	NG (0)	OK (1)	NG (0)	OK (1)	OK (1)	NG (0)	NG (0)	NG (0)
A	B	Judgement result of JDC000																
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	/	NOT	Inverts the judgement results Example: JDC000 = /A <table><tr><td>A</td><td>Judgement result of JDC000</td></tr><tr><td>OK (1)</td><td>NG (0)</td></tr><tr><td>NG (0)</td><td>OK (1)</td></tr></table> <p>If you want to use the operator "NOT" for multiple items, you must repeat it for every item. Do not use brackets.</p> <p>Correct: JDC000 = /A + /B</p> <p>Wrong: JDC000 = /(A + B)</p>	A	Judgement result of JDC000	OK (1)	NG (0)	NG (0)	OK (1)									
A	Judgement result of JDC000																	
OK (1)	NG (0)																	
NG (0)	OK (1)																	
Left bracket	(-	Judge the contents in brackets by priority.															
Right bracket)	-																

10.3.3.1 Creating a Judgement Formula

The example procedure shows how to create a judgement formula to check whether the results of a position adjustment checker and a contour matching checker are OK.



◆ Procedure

- 1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
- 2. Select **"Judgement"** from the submenu and press **<ENTER>**

The list of formulas is displayed.

OPERATEENVIRONMENTTYPEINSPECTIONSAVE/READTOOLSETUPSTOP

PreprocessNum. Calcu.JudgmentChecker ListGroup Move

Block No.0

TypeJDC(External)

Checker No.0

No.	Expression	Judge	Comment
JDC000	Unset		
JDC001	Unset		
JDC002	Unset		
JDC003	Unset		
JDC004	Unset		
JDC005	Unset		
JDC006	Unset		
JDC007	Unset		

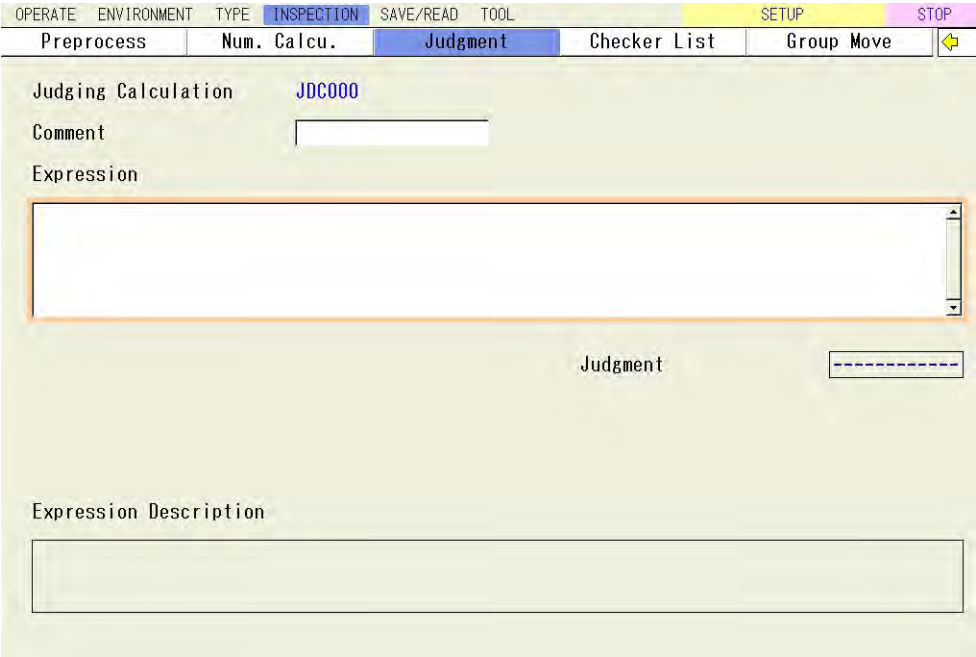
ConditionSetting

Branch ConditionSetting

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

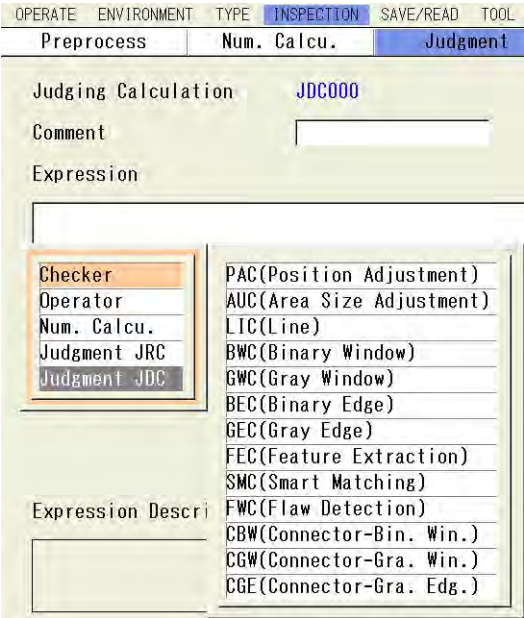
- 3. Select the table and press **<ENTER>** twice

The formula editor is displayed.



4. Press <ENTER> twice

The item selection menu is displayed.



5. Press <ENTER> on "Checker"

6. Select "PAC (Position Adjustment)" and press <ENTER>

The list with all position adjustment checkers is displayed.

PAC(Position Adjustment)

Checker No.

000	No Name
001	No Name
002	
003	No Name
004	
005	
006	
007	
008	
009	

7. Select checker 000 and press <ENTER>

In the camera image, all checker shapes of the selected type are displayed in green. The currently selected checker is displayed in orange.

The result type menu is displayed. The current judgement is displayed as well: Blue if it is OK, red if it is NG.

PAC(Position Adjustment)

Checker No.

000	No Name
001	Judgment Type
002	<input type="button" value="OK"/>
003	Judgment
004	Judgment
005	Judgment
006	Base Judgment
007	
008	
009	

8. Press <ENTER> on "Judgement"

The selected judgement is inserted into the judgement formula.

OPERATE	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL
Checker		Slice Level		Preprocess	
Judging Calculation		JDC000			
Comment		<input type="text"/>			
Expression		<div>PAC000_JUDGE</div>			

9. Press <ENTER>

The item selection menu is displayed.

10. Select "Operator" and press <ENTER>

The list of operators is displayed.

Expression

PAC000_JUDGE

Checker

Operator

Num. Calcu.

Judgment JRC

Judgment JDC

+ Logical Sum

* Logical Product

Exclusive OR

/ Negation

(

)

11. Press <ENTER> on "+ Logical Sum"

The selected operator is inserted into the judgement formula.

Judging Calculation	JDC000
Comment	<input type="text"/>
Expression	<div>PAC000_JUDGE+</div>

12. Press <ENTER>

The item selection menu is displayed.

13. Press <ENTER> on "Checker"

14. Select "SMC (Smart Matching)" and press <ENTER>

The list with all smart matching checkers is displayed. The judgement of the currently selected checker is displayed as well: Blue if it is OK, red if it is NG.

No	Name
000	No Name
001	No Name
002	No Name
003	
004	
005	
006	
007	
008	
009	

15. Select the checker and press <ENTER>

The selected checker is inserted into the judgement formula.

Checker	Slice Level
Judging Calculation	JDC000
Comment	
Expression	PAC000_JUDGE+SMC000_JUDGE

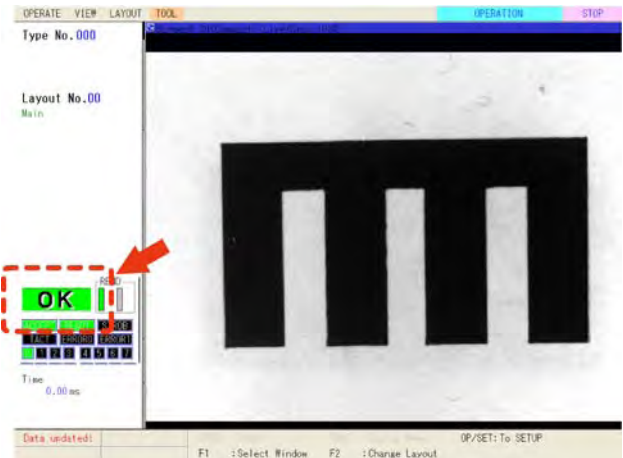
16. Press <CANCEL> twice

The formula editor checks the validity of the formula. If the formula is grammatically correct, you can save (register) it. If not, the Imagechecker will not let you save the formula and moves the cursor to the position of the first fault.

17. Register the formula by selecting "Yes"

10.3.4 Registering a Total Judgement

With this option you select one formula register for judging the type. The result of the formula register will appear in large letters and color in the status display (see page 64). When you use the execution mode "User-Defined" or "Automatic Switch", you can register one judgement formula per block as the total judgement.



Before you can register a total judgement, you need to set up the judgement formula (see page 348).

10.3.4.1 Execution Mode "Execute All"

To set up the total judgement for a type using execution mode "Execute All" (see page 57), please proceed as follows:



◆ Procedure

- 1. In the judgement formula window, select [Setting] next to "System Settings" and press <ENTER>

The condition window is opened at the top of the screen.

OPERATE	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETUP	STOP
Checker	Slice Level	Preprocess	Num. Calcu.	Judgment			
Total Judg.	Condition	Checker No.	Result	Description			
Save Img Memory	No		No	Save JRC/JDC at NG			
Image Output	No		No	Output JRC/JDC at NG			

- 2. Press <ENTER>
- 3. Select the judgement type JRC or JDC
Select whether to use the result of a external output register (JDC) or an internal register (JRC) as the condition.
- 4. Move the cursor to the column "Checker No." and press <ENTER>

5. Select the number of the judgement formula that should be used for the total judgement and press <ENTER>

The "Result" column displays the status of the function. "No" indicates that no image is saved (output) because the condition is not fulfilled.

OPERATE	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETUP	STOP
Checker	Slice Level	Preprocess	Num. Calcu.	Judgment			

Condition	Checker No.	Result	Description
Total Judg.	JDC	004	OK
Save Img Memory	No	No	Save JRC/JDC at NG
Image Output	No	No	Output JRC/JDC at NG

JDC002	PAC000_JUDGE+SMC000_JUDGE	OK	
JDC003	Unset		
JDC004	6EC000_JUDGE	OK	4444
JDC005	Unset		
JDC006	Unset		
JDC007	Unset		

Condition	Setting
Image / Tool / User	Setting

Condition	Checker No.	Result	Description
Total Judg.	JDC	004	OK
Save Img Memory	No	No	Save JRC/JDC at NG
Image Output	No	No	Output JRC/JDC at NG

6. Press <CANCEL> to return to the list of formulas

10.3.4.2 Execution Modes "Automatic Switch" and "User-Defined"

To set up the total judgement for a type using execution mode "Automatic Switch" or "User-Defined" (see page 357), please proceed as follows:



◆ Procedure

1. In the judgement formula window, select [Setting] next to "System Settings" and press <ENTER>

The condition window is opened at the top of the screen.

OPERATE	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETUP	STOP
Checker	Slice Level	Preprocess	Num. Calcu.	Judgment			

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

2. Select the table and press <ENTER>

	Condition	Checker No.	Result
Block0	No		
Block1	No		
Block2	No		
Block3	JRC		
Block4	JDC		

3. Select the judgement type JRC or JDC

Select whether to use the result of a external output register (JDC) or an internal register (JRC) as the condition.

4. Move the cursor to the column "Checker No." and press <ENTER>

5. Select the number of the judgement formula that should be used for the total judgement and press <ENTER>

The "Result" column displays the status of the function. "No" indicates that no image is saved (output) because the condition is not fulfilled.

	Condition	Checker No.	Result
Block0	JRC	004	--
Block1	No		
Block2	No		
Block3	No		
Block4	No		

Judge	Comment
OK	
OK	
OK	
OK	

Condition	Setting
Setting	Setting

	Condition	Checker No.	Result	Description
Total Judg.	JRC	004	--	
Save Img Memory	No		No	Save JRC/JDC at NG
Image Output	No		No	Output JRC/JDC at NG

6. Repeat for the other blocks

7. Press <CANCEL> to return to the list of formulas

10.3.5 Using a Judgement Formula to Save or Output NG Images

It is possible to save and/or output NG images by setting up a judgement formula. When this formula is judged to be NG, the current inspection image is saved and/or output.



◆ NOTE

Saving (outputting) NG images only works if you have set the option "Saving Condition" to "NG Judgement". You find this option when you select "Input/Output" in the ENVIRONMENT menu and then "Save Image Memory".

Before you can use a judgement formula to save and/or output NG images, you need to set up the judgement formula (see page 348).

10.3.5.1 Execution Mode "Execute All"

To save (output) NG images with a judgement formula for a type using execution mode "Execute All" (see page 57), please proceed as follows:



◆ Procedure

1. In the judgement formula window, select [Setting] next to "System Settings" and press <ENTER>

The condition window is opened at the top of the screen.

OPERATE	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETUP	STOP
Checker	Slice Level	Preprocess	Num. Calcu.	Judgment			
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				

2. Select "No" in the row labeled "Save Img Memory" or "Image Output" and press <ENTER>
3. Select the judgement type JRC or JDC
Select whether to use the result of a external output register (JDC) or an internal register (JRC) as the condition. When you select "No Condition", all NG images will be saved (output).
4. Move the cursor to the column "Checker No." and press <ENTER>
5. Select the number of the judgement formula that should be used for saving (outputting) the NG images and press <ENTER>

The "Result" column displays the status of the function. "No" indicates that no image is saved (output) because the condition is not fulfilled.

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETUP MENU	STOP
Checker	Slice Level	Preprocess	Num. Calcu.	Judgment			
Condition	Checker No.	Result	Description				
Total Judge.	No						
Save Img Memory	JRC	004	No	Save JRC/JDC at NG			
Image Output	No		No	Output JRC/JDC at NG			

6. Press <CANCEL> to return to the list of formulas

10.3.5.2 Execution Modes "Automatic Switch" and "User-Defined"

To save (output) NG images with a judgement formula for a type using execution mode "Automatic Switch" (see page 57) or "User-Defined" (see page 58), please proceed as follows:



◆ Procedure

- 1. In the judgement formula window, select [Setting] next to "System Settings" and press <ENTER>

The condition window is opened at the top of the screen.

OPERATE	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL
Preprocess		Num. Calcu.	Judgment	Check	
Total Judg. ▾					
	Condition	Checker No.	Result		
Block0	No				
Block1	No				
Block2	No				
Block3	No				
Block4	No				

- 2. Select "Save Image Memory" or "Image Output" and press <ENTER>
- 3. Select the table and press <ENTER>

OPERATE	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL
Preprocess		Num. Calcu.	Judgment	Check	
Total Judg. ▾					
	Condition	Checker No.	Result		
Block0	No				
Block1	No				
Block2	No				
Block3	JRC				
Block4	JDC				

- 4. Select the judgement type JRC or JDC
Select whether to use the result of a external output register (JDC) or an internal register (JRC) as the condition. When you select "No Condition", all NG images will be saved (output).
- 5. Move the cursor to the column "Checker No." and press <ENTER>
- 6. Select the number of the judgement formula that should be used for saving (outputting) NG images and press <ENTER>

The "Result" column displays the status of the function. "No" indicates that no image is saved (output) because the condition is not fulfilled.

The screenshot shows the 'Judgment' tab in the PV500 software. The main window displays a table for block conditions and a 'Judge' table.

Block	Condition	Checker No.	Result
Block0	JRC	004	--
Block1	No		
Block2	No		
Block3	No		
Block4	No		

Judge	Comment
OK	
OK	
OK	
OK	

Condition Setting

Condition	Setting
Total Judg.	JRC
Save Img Memory	No
Image Output	No

Condition	Checker No.	Result	Description
Total Judg.	004	--	
Save Img Memory		No	Save JRC/JDC at NG
Image Output		No	Output JRC/JDC at NG

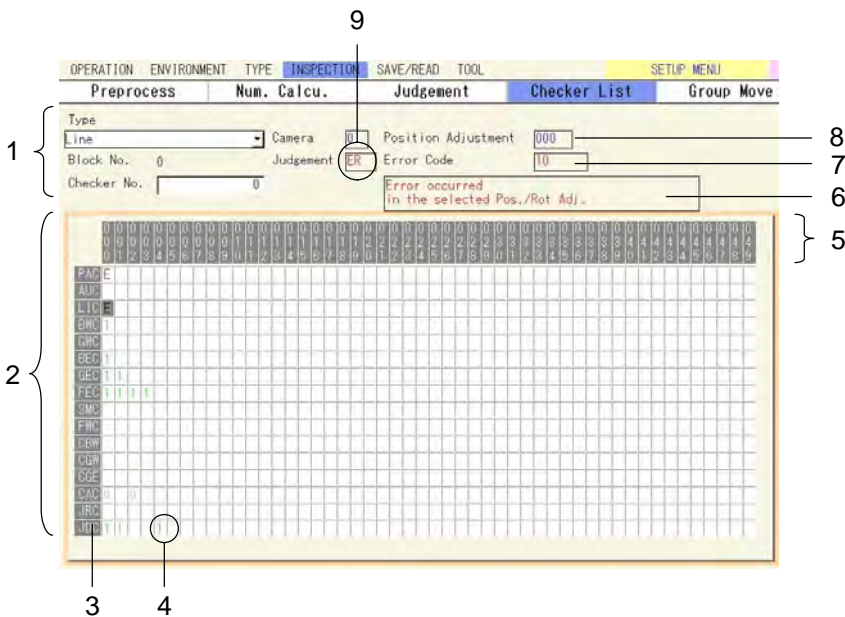
7. Repeat for the other blocks
8. Press <CANCEL> to return to the list of formulas

10.4 Checker List

This function shows which element has been set and what the current execution result is. The elements displayed are

- inspection checkers,
- position/rotation adjustment checkers,
- area size adjustments,
- numerical calculation formulas, and
- judgements formulas.

The displayed information is color-coded. The colors can be changed (see page 360). When you select a cell with an entry, you can directly jump to the setting window of that element pressing <ENTER>.



1	Information on the currently selected element: <ul style="list-style-type: none">• Checker or formula type• Block number• Number of the currently selected element
2	Checker list. Select a row to see the full element name in the "Type" box at the top left of the checker list.
3	Type of element
4	Status or execution result <ul style="list-style-type: none">• Blank: Element not set• 1 (green): Element has been set and is judged OK• 0 (pink): Element has been set and is judged NG• E (red): Element has been set and there has been an error during execution

	<ul style="list-style-type: none"> Yellow cell color: When you select a position adjustment checkers, all dependent inspection checker cells will be highlighted in yellow.
5	Checker or formula number
6	Error information field
7	Error code
8	Number of adjustment checker when the currently selected checker is adjusted by position/rotation adjustment checker. For position/rotation adjustment checkers the entry is "****".
9	Judgement of the currently selected element

10.4.1 Changing the Display Colors

You can change the colors of the characters and cells in the checker list. please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"INSPECTION"** from the menu bar and press **<ENTER>**
2. Select **"Checker List"** from the submenu and press **<ENTER>**

The checker list is displayed.

3. Press **<FUNC>**

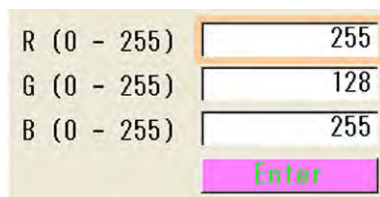
A pop-up menu appears in the top left corner.

4. Press <ENTER> on "Colors"

The Imagechecker displays the color setting window.

**5. Select the item of which you want to change the color and press <ENTER>**

A subwindow is displayed with the current RGB values (red, green, blue).

**6. Change the values with the keypad**

Higher values yield brighter colors, lower values yield darker colors. Watch the [Enter] button to see the effect of the changes in RGB values.

**7. To confirm the new color select the [Enter] button and press <ENTER>**

If you press <CANCEL> at any time, the RGB values will be reset to that of the original color.

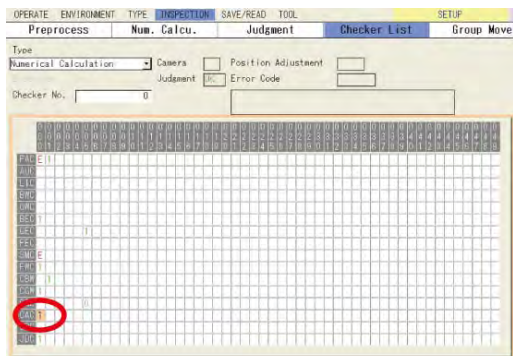
10.4.2 Jumping to the Setting Window of an Element

When you select a cell with an entry, you can directly jump to the setting window of that element pressing <ENTER>. This is useful when you have executed a test by pressing <TRIG> and need to adjust some checker settings. please proceed as follows:



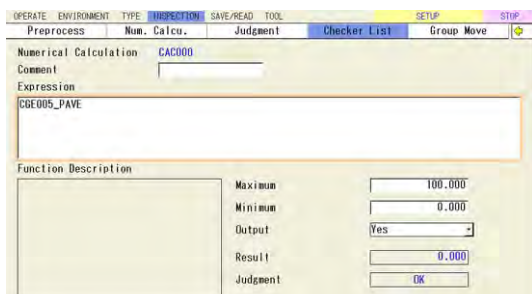
◆ Procedure

1. In the checker list, select the element you want to change



2. Press <ENTER>

The setting window of the selected checker or formula opens.



3. Change the settings as required and press <CANCEL>

You are returned to the checker list window.

10.4.3 Changing the Display of Checker Shapes

By default, all checker shapes are displayed when you open the checker list. Depending on the transparency setting of your screen (see page 77), you can see them displayed in red behind the checker list. The checker shape currently selected in the list is displayed in orange. You can limit the display so that only the shape of the currently selected checker is visible. please proceed as follows:



◆ Procedure

1. In the checker list, press <FUNC>

A pop-up menu appears in the top left corner.



2. **Select "Display Patterns", then "Selected Checker" and press <ENTER>**

Now only the shape of the selected checker is visible.

10.5 Data Output to External Devices

The following data can be output to external devices in this order:

1. Scan count
2. Judgement data (JDC formulas, as JRC formulas are only used internally)
3. Numerical inspection results via numerical calculations
4. Camera images

Depending on the type of data to be output, the data can be output to one or more destinations. All output settings are made in the **ENVIRONMENT** menu in the submenu "Input/Output".

Type of data	Output destinations
Numerical data	<ul style="list-style-type: none"> • Parallel I/O (up to 16 results) • I/O terminal block (up to 8 results) • Serial I/O (Com 0) • Ethernet • SD memory card
Judgement data (JDC formulas)	<ul style="list-style-type: none"> • Parallel I/O (up to 16 results) • I/O terminal block (up to 8 results) • Serial I/O (Com 0) • Ethernet • SD memory card
Camera images	<ul style="list-style-type: none"> • Ethernet • SD memory card

Configuration workflow

For all outputs, you need to configure two things:

1. Activate the output for the specific type of data
2. Make the correct communication settings

10.5.1 Output to the Parallel I/O

Note that depending on whether you use the I/O connector or the I/O terminal block you have 16 resp. 8 outputs available (see page 26).

10.5.1.1 Output of Numerical Data

To activate the output of numerical data such as scan counts and inspection data, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"ENVIRONMENT"** from the menu bar and press **<ENTER>**

If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.

2. Select **"Input/Output"** from the submenu and press **<ENTER>**

3. Select **"Parallel I/O Output"**

4. Set **"Output Data"** to **"All selectable"**

Otherwise only the judgement data will be output.

5. Select **whether or not to use the handshake**

When you set this option to **"Yes"**, the Strobe signal is used to indicate the completion of data output and the Acknowledge signal is used by the external devices to indicate the completion of data reception. When you set this option to **"No"**, the Strobe signal is used to indicate the completion of data output. However, The Imagechecker does not wait for a signal to indicate data reception, but outputs the next data after a certain period of time (see page 422).

6. Set **"Scan Count"** to **"Output"**

7. Set **"Numerical Calculation"** to **"Output"**

8. Set the correct bit width

You can select a bit width of 8 or 16 bit.

9. Set the maximum value to be output in **"Data Bit (bit)"**

You can select a data bit width of 8, 16 or 32 bit. Note that you need to select 32 bit if you want to output negative values (see page 402).

10. Set the **"Output Signal Guarantee Time (ms)"**

You can set a time between 1 and- 1000ms (default: 10ms). After setting the Out and the Tact signal, the Imagechecker holds the output data for the time specified here (twice the time if no handshake is used!). After the guarantee time has passed, the Tact signal turns off. Whether the Out signal is held or reset depends on the setting of **"Parallel I/O Output Reset Condition"** in the **"Operation"** option in the **"System Settings"** submenu in the **ENVIRONMENT** menu (see page 422).

11. If you use handshake, set the timeout

You can set a time between 4 and 20000ms (default: 5000ms) to specify the maximum time from data output to the input of the Acknowledge signal (data receipt completion signal) from the external device. If the Acknowledge signal is

not input within this period, a timeout occurs and signal Error0 is output.

With these settings, the scan count and all numerical calculation results with the entry "Yes" in the "Output" column will be output to the external devices.



◆ NOTE

- When "Data Bit (bit)" is 8 or 16, you cannot output negative values. If a value to be output is negative, it will be output as 0.
- When the data to be output exceeds the output range, it will be output as 0.

10.5.1.2 Output of Judgement Data

There are two settings available under "Parallel I/O Output" in the "input/Output" submenu in the **ENVIRONMENT** menu:

1. Output one set of judgements (option "Output Data" = "Once, Judgement (16 bit)")
2. Output all judgements (option "Output Data" = "All selectable" and option "Judgement" = "Output")

Output	Execution mode	I/O connector	I/O terminal block	Functionality
One set of judgements	Execute ALL	Out0-Out15	Out0-Out7	Data is output in ascending order beginning with smallest judgement formula number.
	User-Defined	Out0-Out15	Out0-Out7	Data is output in ascending order beginning with smallest judgement formula number of the executed block.
	Automatic Switch	Out0-Out15	Out0-Out7	Data is output in ascending order beginning with smallest judgement formula number of the block executed last.
All judgements	Execute ALL	Out0-Out15	Out0-Out7	Data is divided in chunks of 16/8 bits and is output in ascending order beginning with smallest judgement formula number.
	User-Defined	Out0-Out15	Out0-Out7	Data is divided in chunks of 16/8 bits and is output in ascending order beginning with smallest judgement formula number of the executed block.
	Automatic Switch	Out0-Out15	Out0-Out7	Data is divided in chunks of 16/8 bits and is output in ascending order beginning with smallest judgement formula number of the block executed last.



◆ NOTE

The data communication is timed with the Strobe and the Acknowledge signal of the I/O connector when handshake is used or just by the Strobe signal alone (see page 422).

To activate the output of judgement data, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"ENVIRONMENT"** from the menu bar and press **<ENTER>**

If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.

2. Select **"Input/Output"** from the submenu and press **<ENTER>**

3. Select **"Parallel I/O Output"**

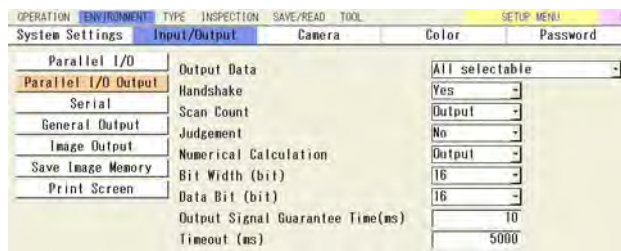
4. Set **"Output Data"** to **"All selectable"**

5. Select whether or not to use the handshake

When you set this option to **"Yes"**, the Strobe signal is used to indicate the completion of data output and the Acknowledge signal is used by the external devices to indicate the completion of data reception. When you set this option to **"No"**, the Strobe signal is used to indicate the completion of data output. However, The Imagechecker does not wait for a signal to indicate data reception, but outputs the next data after a certain period of time (see page 422).

6. Set **"Judgement"** to **"Output"**

7. Set **"Numerical Calculation"** to **"Output"**



8. Set the correct bit width

You can select a bit width of 8 or 16 bit.

9. Set the maximum value to be output in **"Data Bit (bit)"**

10. Set the **"Output Signal Guarantee Time (ms)"**

This is the minimum duration the result data will be output.

11. If you use handshake, set the timeout

10.5.1.3 Output Examples

Example 1

Output of all judgement data to the I/O terminal block when 1000 formulas have been created and "Execution Mode" = "Execute All":

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
-------	--------	--------	--------	--------	--------	--------	--------	--------

Output of all judgement data to the I/O connector when 1000 formulas have been created and "Execution Mode" = "Execute All":

Out15	Out14	Out13	Out12	Out11	Out10	Out9	Out8	Out7	Out6	Out5	Out4	Out3	Out2	Out1	Out0
-------	-------	-------	-------	-------	-------	------	------	------	------	------	------	------	------	------	------

1st	JDC015	JDC014	JDC013	JDC012	JDC011	JDC010	JDC009	JDC008	JDC007	JDC006	JDC005	JDC004	JDC003	JDC002	JDC001	JDC000
-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

2nd	JDC031	JDC030	JDC029	JDC028	JDC027	JDC026	JDC025	JDC024	JDC023	JDC022	JDC021	JDC020	JDC019	JDC018	JDC017	JDC016
-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

...

63rd	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	JDC999	JDC998	JDC997	JDC996	JDC995	JDC994	JDC993	JDC992
------	-----	-----	-----	-----	-----	-----	-----	-----	--------	--------	--------	--------	--------	--------	--------	--------



◆ NOTE

When you have activated judgement output ("Output Data" = "All selectable" and "Judgement" = "Output"), the Imagechecker outputs all judgement results up to the last formula number which has been set. Results of unset formulas are output as OFF. For example, when judgement formulas No. 0 to 5 and NO. 30 are set, No. 0 to 30 are all output. Nothing will be output after No. 30. No. 6 to 29 are output as OFF.

Example 2

Output of judgement data to the I/O terminal block when "Execution Mode" = "Automatic Switch" (last executed block: block number 3):

Out7	Out6	Out5	Out4	Out3	Out2	Out1	Out0
------	------	------	------	------	------	------	------

1st: Judgement result of block number 3

JDC307	JDC306	JDC305	JDC304	JDC303	JDC302	JDC301	JDC300
--------	--------	--------	--------	--------	--------	--------	--------

... continued until the last judgement formula number created in block number 3.

Example 3

Output of numerical data when "Data Bit (bit)" = 32 and "Bit Width (bit)" = 8:

	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 4

Output of numerical data when "Data Bit (bit)" = 32 and "Bit Width (bit)" = 16:

	Out15	Out14	Out13	Out12	Out11	Out10	Out9	Out8	Out7	Out6	Out5	Out4	Out3	Out2	Out1	Out0
1st (lower 16 bits)	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
2nd (higher 16 bits)	Bit31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24	Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16

Example 5

Output of the following results for scan count, judgement and numerical calculation data when "Data Bit (bit)" = 32 and "Bit Width (bit)" = 16:

- Scan count = 100
- Judgement = JDC000 to JDC015

- Numerical calculation CAC000 = 70000

Out15	Out14	Out13	Out12	Out11	Out10	Out9	Out8	Out7	Out6	Out5	Out4	Out3	Out2	Out1	Out0
-------	-------	-------	-------	-------	-------	------	------	------	------	------	------	------	------	------	------

1st (lower 16 bits of scan count)

0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

2nd (higher 16 bits of scan count)

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

3rd (judgement JDC000 to JDC014)

0	JDC 014	JDC 013	JDC 012	JDC 011	JDC 010	JDC 009	JDC 008	JDC 007	JDC 006	JDC 005	JDC 004	JDC 003	JDC 002	JDC 001	JDC 000
---	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

4th (lower 16 bits of CAC000)

0	0	0	1	0	0	0	1	0	1	1	1	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

5th (higher 16 bits of CAC000)

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

10.5.2 Output to COM.0, Ethernet, SD Card

Apart from parallel output, the following output destinations are available from "Destination" in the "General Output" option, "Input/Output" submenu in the **ENVIRONMENT** menu.

Destination	Description	Further settings
Serial (COM 0)	Outputs inspection results to the COM. 0 port. With certain PLCs you can write data to a PLC register directly. (see page 405)	Protocol Type of output data No. of digits Decimal digit Unused digit Option "Serial"
Ethernet	Outputs inspection results via the Ethernet port. To receive the data, use a PC with software which supports telnet such as Hyper Terminal. The Imagechecker adds date and time to the header of data.	The port number of the Imagechecker is 8601. Type of output data No. of digits Decimal digit Unused digit Option "Serial"
SD memory card	Writes data in a text file on the SD inserted into the memory card slot of the Imagechecker. The Imagechecker adds the output time to the header of data. The name of the text file and the saving path are as follows.	Type of output data No. of digits Decimal digit

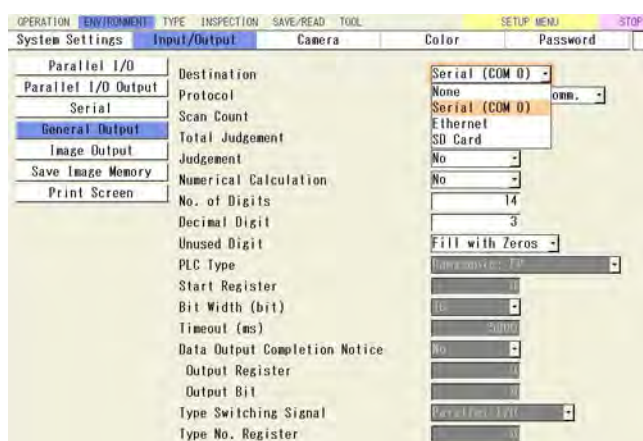
Destination	Description	Further settings
	<ul style="list-style-type: none"> File name: yymmdd.txt (yymmdd is read from the built-in calendar (see page 472) of the Imagechecker) Path: \Panasonic MEW Vision\PV500\Result\ 	Unused digit Option "Serial"

To make the output settings, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"ENVIRONMENT"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Input/Output"** from the submenu and press **<ENTER>**
3. Select **"General Output"**
4. Select the output destination under **"Destination"**



5. When you have selected **"Serial (COM 0)"**, set **"Protocol"** to **"PLC Communication"**

Select the PLC type and make the appropriate settings (see page 407).

6. Select which results you wish to output by selecting **"Output"**
7. Set **"No. of Digits"**

With the default settings, 14 digits are output, which means an 11-digit integer and 3 decimal numbers. When the inspection result to be output exceeds the value that can be output, the output is "0" and the error signal goes ON.

8. Set **"Decimal Digits"**

When you select "2" or "1", the data output will be rounded.

9. Set **"Unused Digit"**

Decide how unused digits should be handled. You can either ignore them (setting

"Comma separated" or use zeros ("Fill with Zeros", default).

10.5.2.1 Output Examples

The following data should be output with the following settings:

Settings	Output data	Indicated as
No. of digits: 6	Scan count: 1234	A
Decimal digit: 1	Total judgement: OK	B
Unused digit: Fill with zero	Judgement: JDC000 = OK	C
	Judgement JDC001 = not set	D
	Judgement JDC002 = NG	E
	Numerical calculation CAC000 = 215.8	F
	Numerical calculation CAC001 = not set	G
	Numerical calculation CAC002 = -368.0	H
	Date: 2008/01/15	J
	Time: 09:25:48	K

Output destination "Serial (COM. 0)"

0	0	1	2	3	4	1	1	0	0	0	2	1	5	8
A						B	C	E	F					

-	0	3	6	8	0	BCC	CR
H						-	-

Output destination "SD memory card"

0	9	:	2	5	:	4	8	0	0	1	2	3	4	1	1	0
K								A						B	C	E

0	0	2	1	5	8	-	0	3	6	8	0	BCC	CR
F						H						-	-

Output destination "Ethernet"

0	8	/	0	1	/	1	5	0	9	:	2	5	:	4	8	0	0	1	2	3	4
J								K								A					

1	1	0	0	0	2	1	5	8	-	0	3	6	8	0	BCC	CR
B	C	E	F						H						-	-



◆ NOTE

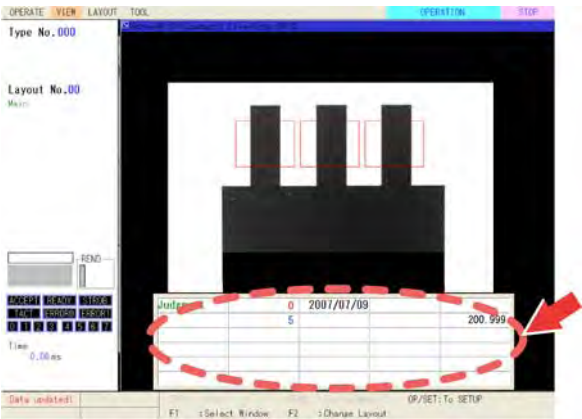
Judgement formula JCD001 (D) and numerical calculation formula CAC001 (G) are not output because they have not been set.

10.6 Data Output to the Screen with Data R/W

The following data can be displayed when the RUN menu is active.

- Checkers
- System values
- Text (green print)
- Slice levels
- Preprocessing groups
- Numerical calculations
- Judgement results
- Statistics

You can create up to 4 data R/W sheets per type. Each sheet can show up to 80 items in 5 columns x 16 rows.



The display is color-coded:

Color	Meaning	Used for
Black	Usually data that can be modified	Checker parameters, slice levels. By default, modifiable content can be overwritten (see page 377).
Blue	Read-only data	Results from checkers, numerical calculations and judgement formulas
Green	Read-only data	Text

10.6.1 Activate Screen Display for Data R/W

To activate the screen display for the data monitor, please proceed as follows:



◆ Procedure

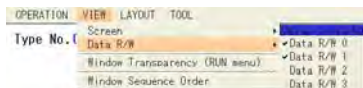
1. In the RUN menu, select "VIEW" from the menu bar and press <ENTER>

If the SETUP menu is active, press <OPE/SET> to activate the RUN menu.

2. Select "Data R/W"

3. Select the sheet number

The Data R/W sheet is displayed at the bottom of the screen. You can display more than one Data R/W sheet. They will display overlapping. The transparency of the windows can be changed (see page 77).



To deactivate the display of a Data R/W sheet, repeat the procedure.

10.6.2 Configuring the Size of the Data R/W Sheet

You can create up to 4 data R/W sheets per type. Each sheet can show up to 80 items in 5 columns x 16 rows. To change the default sheet with 5 columns and 6 rows, please proceed as follows:



◆ Procedure

1. In the SETUP menu, select "TYPE" from the menu bar and press <ENTER>

If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

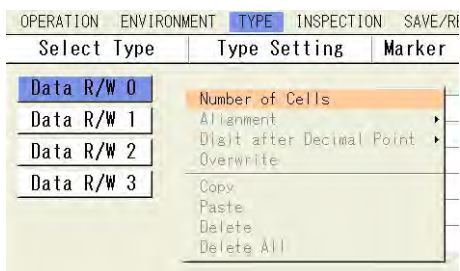
2. Select "Data R/W" from the submenu and press <ENTER>

3. Select a data sheet number and press <ENTER>

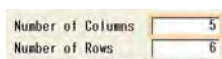
The cursor is now inside the data R/W sheet.

4. Press <FUNC>

The Imagechecker displays a pop-up window.



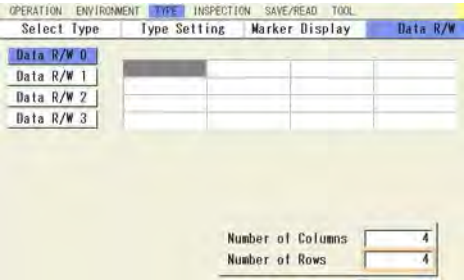
5. Select "Number of Cells" and press <ENTER>



6. Set the number of columns and press <ENTER>

7. Set the number of rows and press <ENTER>

The data sheet is modified accordingly.



8. Press <CANCEL> to return to the data R/W sheet



◆ NOTE

If you decrease the number of columns and rows after inserting data, columns and rows will be removed regardless of whether they contain data or not.

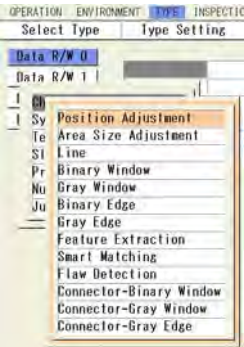
10.6.3 Entering Data in the Data R/W Sheet

To enter data into the data R/W sheet, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select "TYPE" from the menu bar and press <ENTER>
If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.
2. Select "Data R/W" from the submenu and press <ENTER>
3. Select a data sheet number and press <ENTER>
The cursor is now inside the data R/W sheet.
4. Select a cell and press <ENTER> twice
A pop-up menu appears.

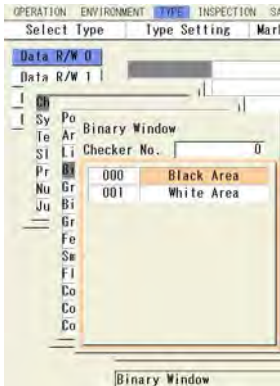


5. Select the item you want to display

In this example, the result of a binary window checker should be displayed (see page 378).

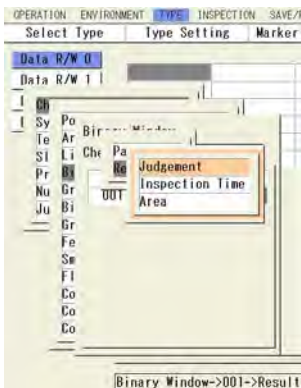
6. Select "Checker" and press <ENTER>

7. Select "Binary Window" and press <ENTER>



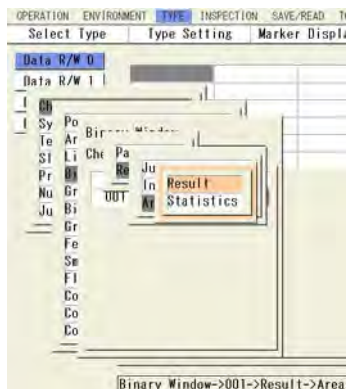
8. Select the checker number and press <ENTER>

9. Select "Result" and press <ENTER>



10. Select "Area" and press <ENTER>

Next, you need to choose whether you want to display the current result or a statistic value.



11. Select "Result" and press <ENTER>

The selected item is displayed in the cell. The cell only displays "checker", but in the information area at the bottom of the screen you can see the details.



10.6.3.1 Function Key Options for Data R/W Sheets in the SETUP Menu

The following functions are available via the <FUNC> key in the SETUP menu:

Option	Description
Number of cells	Select the number of cells and rows of the sheet.
Alignment	Select the alignment of the cell contents: <ul style="list-style-type: none"> • Center • Left • Right
Overwrite	By default, all data can be overwritten when the sheets are displayed in the RUN menu.
Copy	Copies the contents of a cell
Paste	Pastes copied content into cell
Delete	Deletes the contents of the currently selected cell

Option	Description
Delete all	Deletes the contents of the currently selected data R/W sheet

10.6.3.2 Function Key Options for Data R/W Sheets in the RUN Menu

The following functions are available via the <FUNC> key in the RUN menu when the cursor is in side the data R/W sheet (press <F1> and select the data R/W sheet number):

Option	Description
Move	Allows you to move the data R/W sheet to a different location on the screen.
Size	Allows you to change the size of the data R/W sheet
Cell Width	Allows you to change the width of the selected column
Translucent	By default, the data R/W sheet is translucent so you can see the camera image(s) behind it. Deactivate this option to make the data R/W sheet opaque.
Hide Frame	Hides the tabular lines marking the columns and rows.
Optimize Size	Adapts the surrounding area to fit snugly around the current table width. Use this after you have changed the cell width.
Close	Closes the currently selected data R/W sheet.

10.6.4 Symbols for Data R/W

The following data can be used in the Data R/W screens. All items can be displayed on the screen, but not all can be changed.

10.6.4.1 Position Adjustment (PAC)

Item		Modifiable	Statistics data
Base Position Setting	Base Position X	No	No
	Base Position Y	No	No
	Base Position Theta	No	No
Parameter	Inspection Condition: <ul style="list-style-type: none"> • Preprocess • Slice Level • Filter • Target • Sorting • Sorting Order 	Yes	No
Parameter	Search Method: <ul style="list-style-type: none"> • Labeling • Boundary • Perimeter • Principal Axis Angle • Proj. Width, Height • Plugging 	Yes	No

Item		Modifiable	Statistics data
Parameter	Extraction Condition: <ul style="list-style-type: none"> • Max. Area Limit • Min. Area Limit • Max. Proj. Height • Min. Proj. Height • Max. Proj. Width • Min. Proj. Width 	Yes	No
Result	Judgement	No	1
	Inspection time	No	2
	X Adjustment Amount	No	2
	Y Adjustment Amount	No	2
	Adjustment Amount Theta	No	2
	Detect Position X	No	2
	Detect Position Y	No	2
	Detect Position Theta	No	2
	Base Judgement	No	1
	Base Inspection time	No	2
	Base X-Coordinate	No	2
	Base Y-Coordinate	No	2
	Base Proj. X-Axis	No	2
	Base Proj. X-Axis	No	2

10.6.4.2 Area Size Adjustment (AUC)

Item		Modifiable	Statistics data
Parameter	Area Setting: <ul style="list-style-type: none"> • Start Point X • Start Point Y • End Point X • End Point Y 	Yes	No
	Inspection Condition: <ul style="list-style-type: none"> • Preprocess • Slice Level • Edge Condition • Filter 	Yes	No
	Search Method: <ul style="list-style-type: none"> • Filter • Width 	Yes	No
Result	Judgement	No	1
	Inspection time	No	2
	X-coordinate	No	2
	Y-coordinate	No	2

Item		Modifiable	Statistics data
	Proj. X	No	2
	Proj. Y	No	2

10.6.4.3 Line (LIC)

Item		Modifiable	Statistics data
Area Setting	Area Setting: <ul style="list-style-type: none"> Start Point X Start Point Y End Point X End Point Y Vertex X (if the checker shape is a broken line) Vertex Y (if the checker shape is a broken line) 	Yes	No
	Area Size Adjustment Offset (Start)	Yes	No
	Area Size Adjustment Offset (End)	Yes	No
Inspection Condition	Preprocess	Yes	No
	Slice Level	Yes	No
	Filter	Yes	No
	Count pixel color	Yes	No
	Count object color	Yes	No
	Min. Object Size	Yes	No
	Min. Gap Size	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	1
	Inspection time	No	2
	Pixel Judgement	No	1
	Object Judgement	No	1
	No. of Pixels	No	2
	No. of Objects	No	2

10.6.4.4 Binary Window (BWC)

Item		Modifiable	Statistics data
Area Setting	Area Setting: • Start Point X • Start Point Y • End Point X • End Point Y	Yes	No
	Mask • Start Point X • Start Point Y • End Point X • End Point Y	Yes	No
	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
Inspection Condition	Preprocess	Yes	No
	Slice Level	Yes	No
	Target	Yes	No
	Filter	Yes	No
Judgement Limits	OK Judg. Max.	Yes	No
	OK Judge. Min.	Yes	No
Result	Judgement	No	1
	Inspection time	No	2
	Area	No	2

10.6.4.5 Gray Window (GWC)

Item		Modifiable	Statistics data
Area Setting	Area Setting: • Start Point X • Start Point Y • End Point X • End Point Y	Yes	No
	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
Inspection Condition	Preprocess	Yes	No
Judgement Limits	OK Judg. Max.	Yes	No
	OK Judge. Min.	Yes	No

Item		Modifiable	Statistics data
Result	Judgement	No	1
	Inspection time	No	2
	Gray Average	No	2

10.6.4.6 Binary Edge (BEC)

Item		Modifiable	Statistics data
Area Setting	Area Setting: <ul style="list-style-type: none"> Start Point X Start Point Y End Point X End Point Y 	Yes	No
	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
Inspection Condition	Preprocess	Yes	No
	Slice Level	Yes	No
	Edge Condition	Yes	No
	Detection Position	Yes	No
	Filter	Yes	No
Judgement Limits	OK Judg. Max.	Yes	No
	OK Judge. Min.	Yes	No
Search Method	Filter	Yes	No
	Width	Yes	No
Result	Judgement	No	1
	Inspection time	No	2
	No. of Objects	No	2
	X-coordinate	No	2
	Y-coordinate	No	2
	Detected Color	No	2
	Proj. X	No	2
	Proj. Y	No	2

10.6.4.7 Gray Edge (GEC)

Item		Modifiable	Statistics data
Area Setting	Area Setting: • Start Point X • Start Point Y • End Point X • End Point Y	Yes	No
	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
Inspection Condition	Preprocess	Yes	No
	Scan method	Yes	No
	Edge condition	Yes	No
	Edge Threshold	Yes	No
	Detect Position	Yes	No
Judgement Limits	OK Judg. Max.	Yes	No
	OK Judge. Min.	Yes	No
Search Method	Scan Pitch:	Yes	No
	Filter	Yes	No
	Width	Yes	No
	Average Range:	Yes	No
Result	Judgement	No	1
	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

10.6.4.8 Feature Extraction (FEC)

Item		Modifiable	Statistics data
Area Setting	Area Setting: <ul style="list-style-type: none"> Start Point X Start Point Y End Point X End Point Y Vertex X (if the checker shape is a polygon) Vertex Y (if the checker shape is a polygon) 	Yes	No
	Mask <ul style="list-style-type: none"> Start Point X Start Point Y End Point X End Point Y 	Yes	No
	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
Inspection Condition	Preprocess	Yes	No
	Slice Level	Yes	No
	Filter	Yes	No
	Target	Yes	No
	Sorting	Yes	No
	Sorting Order	Yes	No
Judgement Limits	OK Judg. Max.	Yes	No
	OK Judge. Min.	Yes	No
Search Method	Labeling	Yes	No
	Boundary	Yes	No
	Perimeter	Yes	No
	Principal axis angle	Yes	No
	Projection Width, Height	Yes	No
	Plugging	Yes	No
Extraction Condition	Max. Area Limit	Yes	No
	Min. Area Limit	Yes	No
	Max. Proj. Width	Yes	No
	Min. Proj. Width	Yes	No
	Max. Proj. Height	Yes	No
	Min. Proj. Height	Yes	No
Result	Judgement	No	1
	Inspection time	No	2
	No. of Objects	No	2
	Area	No	2

Item		Modifiable	Statistics data
	Gravity X	No	2
	Gravity Y	No	2
	Projection Width	No	2
	Projection Height	No	2
	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
	Perimeter	No	2
	Principal axis angle	No	2
	Proj. X	No	2
	Proj. Y	No	2

10.6.4.9 Matching (SMC)

Item			Modifiable	Statistics data
Area Setting	Search Area: <ul style="list-style-type: none">Start Point XStart Point YEnd Point XEnd Point Y		Yes	No
Inspection Condition	Preprocess		Yes	No
	Detect B/W Reversed Template		Yes	No
	Angle - Accuracy		Yes	No
	Sorting		Yes	No
	Sorting Order		Yes	No
	Template Rotated by 180d		Yes	No
	Ignore Dark Image		Yes	No
	Threshold to Ignore Dark Image		Yes	No
Sequence	1st	Min. Correlation	Yes	No
		Max. Count	Yes	No
	2nd	Min. Correlation	Yes	No
		Max. Count	Yes	No
	3 rd	Min. Correlation	Yes	No
		Max. Count	Yes	No
	4th	Min. Correlation	Yes	No
		Max. Count	Yes	No

Item			Modifiable	Statistics data
	5th	Min. Correlation	Yes	No
		Max. Count	Yes	No
	6th	Min. Correlation	Yes	No
		Max. Count	Yes	No
	Square Correlation		Yes	No
Subtraction Setting	Min. Subtracted Size		Yes	No
	Subtraction Threshold		Yes	No
	Filter		Yes	No
	Max. OK No. of Subtracted Objects		Yes	No
Result	Judgement		No	1
	Inspection time		No	2
	No. of Objects		No	2
	Detected Template No.		No	2
	Correlation Value		No	2
	X-coordinate		No	2
	Y-coordinate		No	2
	Angle		No	2
	Pixels of Max. 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

10.6.4.10 Flaw Detection (FWC)

Item		Modifiable	Statistics data
Area Setting	Area Setting: <ul style="list-style-type: none"> Start Point X Start Point Y End Point X End Point Y 	Yes	No
	Area Size Adjustment Offset (Start)	Yes	No
	Area Size Adjustment Offset (End)	Yes	No
Inspection Condition	Preprocess	Yes	No
	Scan direction	Yes	No
Judgement Limits	OK Judg. Max.	Yes	No
	OK Judge. Min.	Yes	No
Search Method	Number of cells for Calculation Range	Yes	No
	Number of cells per shift	Yes	No
	Threshold	Yes	No

Item		Modifiable	Statistics data
Result	Min. Flaw Size in Cells	Yes	No
	Detect Mode	Yes	No
	Judgement	No	1
	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

10.6.4.11 Connector - Binary Window (CBW)

Item		Modifiable	Statistics data
Area Setting	Area Setting: • Start Point X • Start Point Y • End Point X • End Point Y	Yes	No
	Area Size Adjustment Offset (Start)	Yes	No
	Area Size Adjustment Offset (End)	Yes	No
Inspection Condition	Preprocess	Yes	No
	Slice Level	Yes	No
	Filter	Yes	No
	Target	Yes	No
	Independent Setting	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	1
	Inspection time	No	2
	No. of Objects	No	2
	Area	No	2
	Individual Judgement	No	1

10.6.4.12 Connector - Gray Window (CGW)

Item		Modifiable	Statistics data
Area Setting	Area Setting: <ul style="list-style-type: none"> Start Point X Start Point Y End Point X End Point Y 	Yes	No
	Area Size Adjustment Offset (Start)	Yes	No
	Area Size Adjustment Offset (End)	Yes	No
Inspection Condition	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	1
	Inspection time	No	2
	Detected Count	No	2
	Gray Average	No	2
	Individual Judgement	No	1

10.6.4.13 Connector - Gray Edge (CGE)

Item		Modifiable	Statistics data
Area Setting	Area Setting: <ul style="list-style-type: none"> Start Point X0 Start Point Y0 End Point X0 End Point Y0 Start Point X1 Start Point Y1 End Point X1 End Point Y1 	Yes	No
Inspection Condition	Preprocess	Yes	No
	Detect Direction	Yes	No
	Scan Method	Yes	No
	Edge Condition 0	Yes	No
	Edge Condition 1	Yes	No
	Detected Position	Yes	No
Search Method	Scan Pitch	Yes	No
	Filter	Yes	No

Item		Modifiable	Statistics data
	Width	Yes	No
	Average Range	Yes	No
Threshold Adjustment	Set Individually	Yes	No
	Common Threshold 0	Yes	No
	Common Threshold 1	Yes	No
	Independent Threshold 0	Yes	No
	Independent Threshold 1	Yes	No
Judgement Limits	Max. Judge. Pitch	Yes	No
	Min. Judge. Pitch	Yes	No
	Max. Distance Difference Judge	Yes	No
	Min. Distance Difference Judge	Yes	No
Result	Judgement	No	1
	Inspection time	No	2
	No. of Objects	No	2
	Pitch Total Judgement	No	1
	Distance difference Total Judgement	No	1
	Max. Pitch	No	2
	Min. Pitch	No	2
	Average Pitch	No	2
	Area 0 X-Coordinate Edge	No	2
	Area 1 X-Coordinate Edge	No	2
	Area 0 Y-Coordinate Edge	No	2
	Area 1 Y-Coordinate Edge	No	2
	Area 0 Edge Differential	No	2
	Area 1 Edge Differential	No	2
	Pitch	No	2
	Distance Difference	No	2
	Pitch Individual Judgement	No	1
	Individual Judgement for Distance Difference	No	1

10.6.4.14 System Value

Item	Modifiable	Statistics data
Inspection time	No	No
Inspection Frequency	No	No
Total Judgement	No	No
Scan Count	No	No

Item	Modifiable	Statistics data
SYS:REG0	Yes	No
SYS:REG1	Yes	No
SYS:REG2	Yes	No
SYS:REG3	Yes	No
SYS:REG4	Yes	No
SYS:REG5	Yes	No
SYS:REG6	Yes	No
SYS:REG7	Yes	No
Run type No.	No	No
Date (Y-M-D)	No	No
Date (H-M-S)	No	No

10.6.4.15 Numerical Calculations, Judgements, and Other Data

Item		Modifiable	Statistics data
Text	User-definable text of up to 16 characters (up to 12 can be displayed)	No	No
Slice Level A - H	Maximum	Yes	No
	Minimum	Yes	No
Preprocessing Group A - E	Preprocess type (1st to 5th step)	Yes	No
	Filter size (1st to 5th step)	Yes	No
	Max. Gray Value for Gray Cut (1st to 5th step)	Yes	No
	Min. Gray Value for Gray Cut (1st to 5th step)	Yes	No
Numerical Calculation (CAC)	Max. Judgement	Yes	No
	Min. Judgement	Yes	No
	Numerical Result	No	2
	Judgement	No	
Previous Result (OCA)	Numerical Result	No	2
	Judgement	No	
Judgement (JRC)	Judgement	No	1
Judgement (JDC)	Judgement	No	1

10.6.4.16 **Statistic Data**

Depending on the item you have selected, different statistics data can be selected for display

Statistics data 1	Statistics data 2
<div>Scan Count</div> <div>OK Count</div> <div>NG Count</div>	<div>Minimum Value</div> <div>Maximum Value</div> <div>Average</div> <div>Range</div> <div>Variance</div> <div>OK Judge. Min.</div> <div>OK Judge. Max.</div> <div>OK Average</div> <div>OK Range</div> <div>OK Variance</div> <div>NG Judge. Min.</div> <div>NG Judge. Max.</div> <div>NG Average</div> <div>NG Range</div> <div>NG Variance</div>

10.6.5 **Modifying Entries in the Data R/W Sheets in the RUN Menu**

Some of the data displayed in the data R/W sheets can be modified (see page 378).
Modifiable entries are written in black. To modify the entries, please proceed as follows:

- 1. **In the RUN menu, press <F1>**

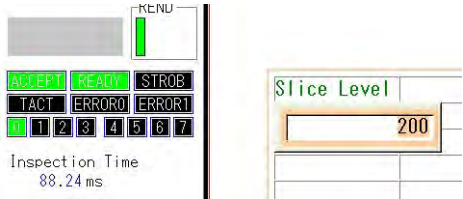
If the SETUP menu is active, press <OPE/SET> to activate the RUN menu.



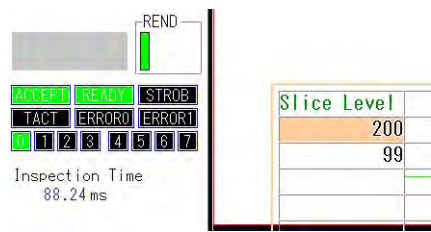
- 2. **Select the data R/W screen number with the entry you wish to change and press <ENTER>**

The cursor moves to the top left cell of the data sheet

- 3. **Select the entry you wish to modify and press <ENTER>**



4. Change the value with the keypad and press <ENTER>



◆ NOTE

You can only modify entries that can be overwritten (see page 377).

Chapter 11

Environment Settings

11.1 Overview

This menu contains some basic settings for the Imagechecker operation.



◆ NOTE

The settings in the Environment menu are valid for all types. It is not possible to make different settings for each type.

11.2 System Settings

The submenus contain the startup and operation settings as well as the values for system registers.

11.2.1 Startup Setting

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETUP MENU
System Settings	Input/Output	Camera	Color	Password		
Startup Setting	Layout No.	Selected Layout No. ▾				
Operation	Select Layout No.	0				
System Register	Type No.	Last Type No. ▾				
	Select Type No.	0				

Option name	Description
Layout No.	Select the screen layout (see page 72) when you start the Imagechecker.
Select layout No.	Only available when "Layout No." is set to "Selected Layout No.". Set the number of layout to be used.
Type No.	Select the type to be loaded when you start the Imagechecker. <ul style="list-style-type: none"> Last type No.: Opens the last type that was loaded before you switched off the Imagechecker. Selected type No.: Opens the type number specified below. Note: The available type data depends on which set of type data is loaded into the execution memory after start, see the option "Start with Memory Area No." in the "Startup Setting", submenu "General" in the TOOL menu (see page 471).
Select type No.	Only available when "Type No." is set to "Selected Type No.". Set the number of the type to be used.

11.2.2 Operation

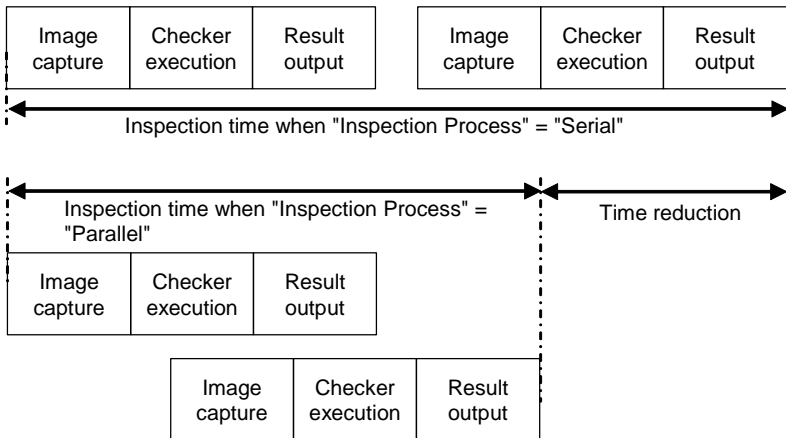
OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETUP MENU	STO
System Settings	Input/Output	Camera	Color	Password			
Startup Setting	Run Mode in SETUP Menu	Not Available ▾					
Operation	When Switching to SETUP...	Not save image in 'Test' ▾					
System Register	Inspection Process	Serial ▾					
	Output Results	Synchronous ▾					
	Image Output	Synchronous ▾					
	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	Common ▾					
	Smart Matching Performance	Type Switch First ▾					

Option name	Description
Run mode in SETUP menu	Select whether to continue in run mode when you switch from the run menu to the setup menu or not (default: Not available). Use the menu command OPERATE → Stop Operation or OPERATE → Restart Operation to switch modes manually.
When switching to SETUP ...	Select whether or not to save the last inspection images of the camera(s) in the test-image memory. The default setting is "Save image in 'Test'".
Inspection process	Select whether or not to perform image capture and checker execution at the same time (see page 419). <ul style="list-style-type: none"> Serial Parallel
Output results (see page 397)	Determines the timing of the output. <ul style="list-style-type: none"> Synchronous Asynchronous
Image output (see page 397)	Determines the timing of the output. <ul style="list-style-type: none"> Synchronous Async. (image output first) Async (inspection first)
Parallel I/O output reset condition	Select whether to hold or reset numerical inspection results at the outputs (see page 365).
Continuous inspection	Select how you want to carry out inspection, once or repeatedly with start signal or automatically. <ul style="list-style-type: none"> No (Once): Executes one inspection when you give the start signal. Automatic: After trigger: After the first start signal, the inspection is executed repeatedly. Automatic: After power on: After you have switched on the Imagechecker, the inspection is executed repeatedly. To stop the continuous inspection, input a start signal.
Template setting	Select which image you want to use for re-registering the template: <ul style="list-style-type: none"> Use the last image: Capture new image:
Position	There are two possibilities where you can execute the template re-registration: <ul style="list-style-type: none"> Set position: Re-registers the template at the position where you have created the checker. Use this option when the object will be in the same position during re-registration as it has been when you created the checker. Adjusted position: Re-registers the template at the position of the checker after position or rotation adjustment has been executed. Use this option when the object will be in a different position from where it was when you created the checker.
Area display	Use this option to determine whether you wish to see the region to be re-registered on the screen before the Imagechecker performs the re-registration or not. By default, this option is set to "No".
Template registration	Select how to handle templates: <ul style="list-style-type: none"> Per checker: Every checker uses its own templates. Checkers cannot share. Common: All templates are organized in a dictionary. Checkers can share templates.
Smart matching performance	For high-speed inspections select how to handle the type switch when smart matching is used. <ul style="list-style-type: none"> Type switch first: Gives priority to the type switch Smart matching first: Executes smart matching first, then switches the type

Option name	Description
SYS:Reg0 - Reg7 default	Registers for storing numerical values in the range from -9,999,999.999 to +9,999,999.999. To read or change a value use the keypad an external device and the serial or Ethernet interface.

11.2.2.1 Inspection Process

By default, the inspection process is serial. To reduce inspection time when the tact cycle is short, change to parallel processing.



The inspection time is displayed in the bottom left corner of the screen:



11.2.2.2 Synchronous and Asynchronous Output

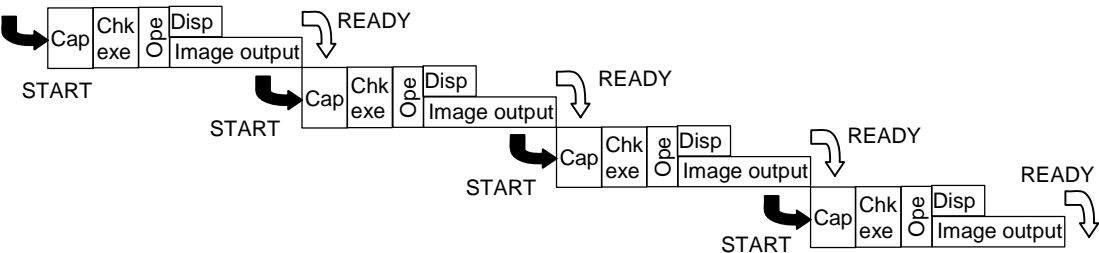
Use this option to set the output timing of inspection results and images to the external devices.

Option	Setting	Description
Output results	Synchronous	Outputs all inspection results which have been set up for output. Note: The inspection time tends to be longer than for "Asynchronous".
	Asynchronous	Output of all inspection results which have been set up for output is not guaranteed. Note: The inspection time tends to be shorter than for "Synchronous"
Image output	Synchronous	The Imagechecker has to complete result and image output before the next inspection can be started.
	Asynchronous (image output first)	The Imagechecker always waits until image output is completed before turning on the Ready signal and accepting the next start signal for the next inspection.

Option	Setting	Description
	Asynchronous (inspection output first)	The Imagechecker turns on the Ready signal as soon as the inspection process is completed, even if the image output has not finished.

Synchronous image output

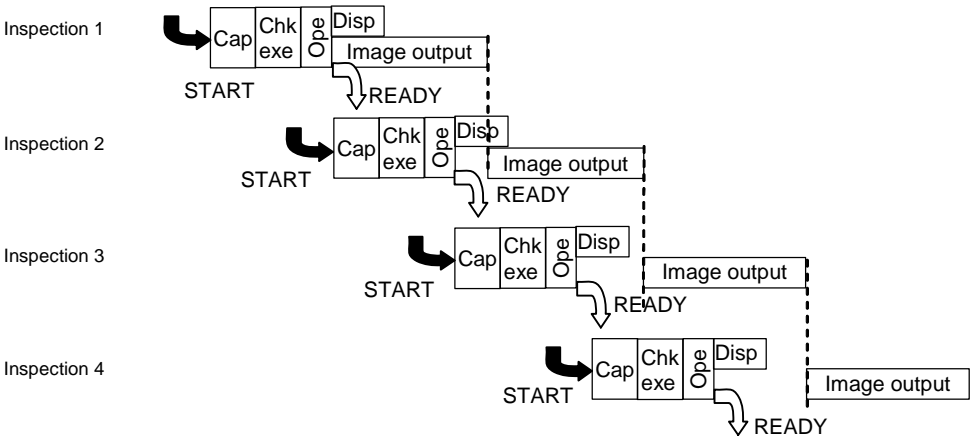
Every step of the process has to be completed before the next step can be taken. This means result and image output has to be completed before the next inspection can be started. All inspection images will be output.



Synchronous output

Asynchronous output (image first)

The inspection process and the image output take place at the same time, but image output has priority. Images will be stored temporarily in the image buffer until they are output. When the image buffer is full, the Imagechecker waits with the next inspection until the buffer has free space available. All inspection images will be output.

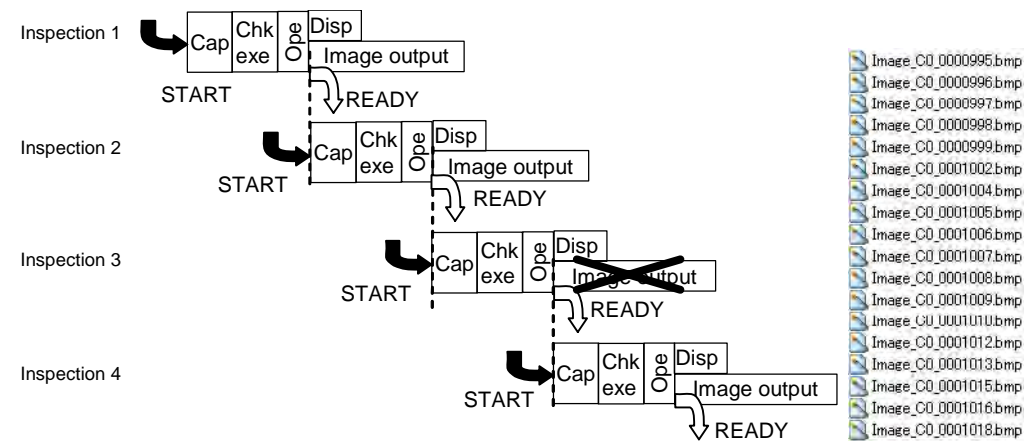


Asynchronous output - image first

Asynchronous output (inspection first)

The inspection process and the image output take place at the same time, but the inspection has priority. Images will be stored temporarily in the image buffer until they are output. Even when the image buffer is full, the Imagechecker still accepts new start signals. In this case, inspection images will be discarded because there is no space in the image buffer. **There is no guarantee that all images selected for output will be output.** In the example, the image from inspection 3 will be discarded because image output for inspection 2 has not finished.

Check the image numbers in the list of output files to see how many images have been skipped.



Asynchronous output - inspection first

11.2.3 System Registers

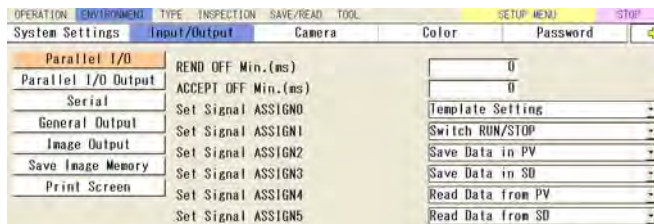
These are registers for storing numerical values in the range from -9,999,999.999 to +9,999,999.999. To read or change a value use the keypad an external device and the serial or Ethernet interface.

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETUP	ME
System Settings	Input/Output	Camera	Color	P			
Startup Setting							
Operation							
System Register							
	SYS:REG0	Default				0.000	
	SYS:REG1	Default				0.000	
	SYS:REG2	Default				0.000	
	SYS:REG3	Default				0.000	
	SYS:REG4	Default				0.000	
	SYS:REG5	Default				0.000	
	SYS:REG6	Default				0.000	
	SYS:REG7	Default				0.000	

11.3 Input/Output

Use this submenu for all data output settings.

11.3.1 Parallel I/O



Option	Setting	Description
REND Off Min. (ms)	0 to 1000 (default: 0)	Use this option when an external device such as a PLC cannot detect the signal turning ON because the OFF time is too short.
ACCEPT OFF Min. (ms)	0 to 1000 (default: 0)	Use this option when an external device such as a PLC cannot detect the signal turning ON because the OFF time is too short.
Set Signal ASSIGN0 - ASSIGN5	Default setting: <ul style="list-style-type: none"> • ASSIGN0: Template setting • ASSIGN1: Switch RUN/STOP • ASSIGN2: Save data in PV • ASSIGN3: Save data in SD • ASSIGN4: Read data from PV • ASSIGN5: Read data from SD 	Use this option to define the function of the inputs ASSIGN0 to ASSIGN5 on the I/O connector or ASSIGN0 to ASSIGN2 on the I/O terminal block.

11.3.2 Set Signal ASSIGN0 to ASSIGN5

Use this option to define the function of the inputs ASSIGN0 to ASSIGN5 on the I/O connector or ASSIGN0 to ASSIGN2 on the I/O terminal block. The following functions are available:

Setting	Description
Template setting	Updates the template image for smart matching checkers. Specify the checker number 000 to 999 at IN0 to IN9 and the template number 00 to 63 with IN10 to IN15, then input the Assign signal.
Switch RUN/STOP	Switches from RUN to STOP mode and vice versa. Note: This function is not available when you are in the submenu "Update" in the TOOL menu.
Save data in PV	All type data currently registered in the execution memory will be saved in the storage memory of the Imagechecker. Specify a storing area number 00 to 99 with IN0 to IN6.

Setting	Description
Save data in SD	All type data currently registered in the execution memory will be saved on the SD memory card. Specify a storing area number 00 to 99 with IN0 to IN6.
Read data from PV	The type data currently registered in the main memory will be loaded in the execution memory of the Imagechecker. Specify a reading area number 00 to 99 with IN0 to IN6.
Read data from SD	The type data currently registered on the SD memory card will be loaded in the execution memory of the Imagechecker. Specify a reading area number 00 to 99 with IN0 to IN6.
Reinspect	Performs inspection without capturing a new image. Enter the block number 00 to 09 to execute with IN0 to IN3.
Reset statistics	Resets the statistics data and scan count to zero.
Reset error	Turns off the error signals ERROR0 and ERROR1.
Save image memory in SD	Saves the image data in the main memory to the SD memory card.
Output latest image	Saves the last inspection image on the SD memory card or via Ethernet on a PC. Note: <ul style="list-style-type: none"> The option "Output Conditions" must be set to "Command Reception" in ENVIRONMENT → Input/Output → Image Output. The PC must be running the Image Receiver software.
Clear image memory	Deletes all image data from the main memory.
Print screen	Captures the entire monitor contents (camera image, menus, checkers, etc.) and saves in on the SD memory card or via Ethernet on a PC
Abort inspection/process	Cancels the following processes and returns to the status before the process was started: <ul style="list-style-type: none"> Execution of a serial command that has been received. Waiting for individual trigger input. Reset of output data waiting for result output after an inspection. Saving images from the image memory to the SD memory card. Template re-registration
Abort save/read setting data	Cancels the process of reading setting data from or saving setting data to the Imagechecker.



◆ NOTE

For usage of the signals ASSIGN0 to ASSIGN5 together with the other inputs, refer to Input Signals (see page 416).

11.3.3 Parallel I/O Output

The following options are available:

Option name	Settings	Description
Output data	Once, Judgement (16bit)	Only judgement data will be output for the time set in "Output Signal Guarantee time (ms)"
	All selectable	Select which data to output
Handshake (see page 424)	Yes	<ul style="list-style-type: none"> The Strobe signal is used to indicate the completion of data output. The Acknowledge signal is used by the external devices to indicate the completion of data reception.
	No	The Strobe signal is used to indicate the completion of data output. The Imagechecker does not wait for a signal to indicate data reception, but outputs the next data after a certain period of time.
Scan Count	No or Output	Select whether or not to output this type of data to the parallel interface.
Judgement		
Numerical calculation		
Bit width (bit)	8	Outputs data to Out0 to Out7 in chunks of 8 bit. When "Data Bit (bit)" = 32, the Imagechecker divides the data into 4 chunks and starts output with the lowest bit.
	16	Outputs data to Out0 to Out15 in chunks of 8 bit. When "Data Bit (bit)" = 32, the Imagechecker divides the data into 2 chunks and starts output with the lower bit.
Data bit (bit)	8	For numerical output values from 0 to 255 (no output of negative values)
	16	For numerical output values from 0 to 65535 (no output of negative values)
	32	For numerical output values from -2147483648 to 2147483647. Negative values are represented by the two's complement.
Output signal guarantee time (ms)	1 - 1000 (default: 10)	Duration of inspection data output
Timeout (ms)	4 - 20000 (default: 5000)	Sets the timeout for the response after output of data to an external device.

11.4 Serial

Use this option to make setting for serial communication when "Destination" is set to "Serial (COM 0)" in **ENVIRONMENT** → **Input/Output** → **General Output**. The following settings for serial communication are available:

Option name	Available settings	Functionality
Baud rate (bps)	1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200	Selects the transmission speed for communications (bps). There are 8 transmission speeds available. The default setting is 9600. Make sure to use the same setting as the external device to be communicated with.
Bit length	7 or 8	Sets the number of data bits in each byte. Make sure to use the same setting as the external device to be communicated with. The default setting is 8.
Stop bit	1 or 2	Selects the number of stop bits in each byte. Make sure to use the same setting as the external device to be communicated with. The default setting is 1.
Parity	None, Odd, or Even	Selects the type of parity checking to use to check the data. Make sure to use the same setting as the external device to be communicated with. The default setting is "Odd".
Flow control	None, Soft Flow or Hard Flow	Sets the method of handshake flow control. The selection options are "None" or "Software". The default setting is "None".



◆ NOTE

When you use a FP2 or FP2SH from Matsushita Electric Works, Ltd., set a baud rate of 57600 bit/s or lower.

11.5 General Output

This option determines the output to all the interfaces except the parallel I/O. The following options are available:

Option name	Settings	Description
Destination	None (default), Serial (COM 0), Ethernet, SD card	Set the output destination.
Protocol	General Purpose Communication or PLC Communication (see page 405)	Set the output protocol. Depending on the setting different options become available below.
Scan Count	No or Output	Defines whether or not to output this result type.
Total Judgement		
Judgement		
Numerical Calculation		
No. of digits	4 - 14 (default: 14)	Only available when "Protocol" = "General Purpose Comm." Set the number of digits to output.
Decimal digit	0 - 3 (default: 3)	Only available when "Protocol" = "General Purpose Comm." Set the number of decimal digits to output.
Unused digit	Fill with Zeros (default) or Comma Separated	Only available when "Protocol" = "General Purpose Comm." Specify how the Imagechecker should handle unused digits, i.e. when the result has 10 digits, put "No. of Digits" = 14.
PLC type	<ul style="list-style-type: none"> • Panasonic: FP (default) • Mitsubishi: MELSEC-A • Mitsubishi: MELSEC-Q • Mitsubishi: MELSEC-FX • Mitsubishi: MELSEC-FX-2 • OMRON: C+CV+CS1 • Allen-Bradley: SLC • Fuji: MICREX-SX 	Set the PLC type for the communication. Some further settings may be required depending on the PLC type selected.
Start Register	0 - 99999 (default: 0)	The Imagechecker begins to write inspection results to this register. Note: Depending on the PLC type, not all registers may be used for writing data. Please refer to the PLC's instruction manual.
Bit width (bit)	16 or 32	Set the format for the data output.
Timeout (ms)	20 - 20000 (default: 5000)	Set the maximum time to wait for an acknowledgement signal from the external device.
Data Output Completion Notice	No (default) or Yes	Set whether or not to use a signal to notify the external device that the data output is complete.
Output Register	0 - 99999 (default: 0)	Specify the register for the data output completion signal. Note: Make sure that this register is not used for writing the data output.

Option name	Settings	Description
Output Bit	0 - 15 (default: 0)	Specify which bit should be used as the marker for data output completion. 0 = lowest bit, 15 = highest bit.
Type Switching Signal	Parallel I/O or PLC Communication	Defines the source for the type number to switch to (see page 411).
Type No. Register	0 - 99999 (default: 0)	Only available when "Type Switching Signal" is set to "PLC Communication" Set the register number where the type number to switch to will be stored

11.5.1 PLC Communication

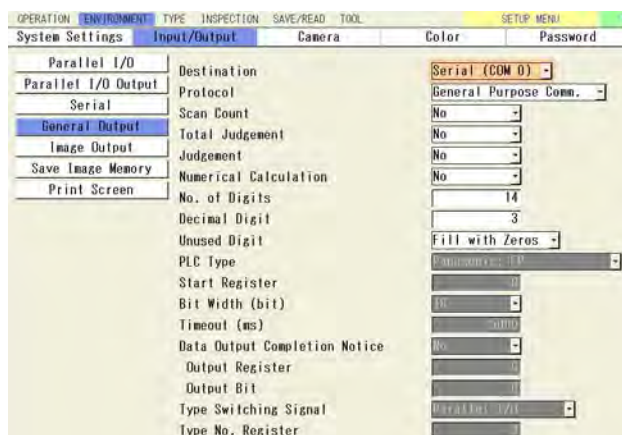
This is the communication mode used for communication between the Imagechecker and a programmable controller (PLC) or a PC. This mode allows the Imagechecker to write results automatically into PLC registers. Therefore, it is not necessary to write a PLC program for receiving data.

To enable communication between the Imagechecker and a PLC, connect a PLC and activate "PLC Communication" as follows:



◆ Procedure

1. In the **SETUP** menu, select **"ENVIRONMENT"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Input/Output"** from the submenu and press **<ENTER>**
3. Select **"General Output"**
4. Set **"Destination"** to **"Serial (COM 0)"**



5. Set **"Protocol"** to **"PLC communication"**

The PLC communication parameters become available at the bottom of the

screen.

System Settings	Input/Output	Camera	Color	Password
Parallel I/O	Destination	Serial (COM 0)		
Parallel I/O Output	Protocol	PLC Communication		
Serial	Scan Count	No		
General Output	Total Judgement	No		
Image Output	Judgement	No		
Save Image Memory	Numerical Calculation	No		
Print Screen	No. of Digits	14		
	Decimal Digit	.		
	Unused Digit	Bit with 20000		
	PLC Type	Panasonic: FP		
	Start Register	0		
	Bit Width (bit)	16		
	Timeout (ms)	5000		
	Data Output Completion Notice	No		
	Output Register	0		
	Output Bit	0		
	Type Switching Signal	Parallel I/O		
	Type No. Register	0		

6. Set "Scan Count", "Total Judgement", "Judgement", and "Numerical Calculation" according to your output requirements

Only results set to "Output" will be output.

7. Set "PLC Type"

8. Specify the "Start Register"

9. Set "Bit Width (bit)"

10. Set "Timeout (ms)"

Set the maximum time to wait for an acknowledgement signal from the external device.

11. Set "Data Output Completion Notice"

By default, the external device is not notified when data output is complete. If you are using a Mitsubishi PLC, enter the interface number. The setting in "Output Bit" will be ignored.

12. Set "Output Register" and "Output Bit", if necessary

13. Set "Type Switching Signal"

Specify whether the parallel or the serial I/O are used to transfer the type number to switch to.

14. Set "Type No. Register, if necessary"

This is the PLC register used for storing the type number to switch to.

11.5.1.1 PLC Types Available for Communication

The following PLCs are available:

Manufacturer	Series and model name	Data output / Type switch	Data output completion notice	
		Register	Register	Bit
Matsushita Electric Works, Ltd.	FP series	DT	WR	0 - 15 (0-F)
Mitsubishi Electric Corporation (MELSEC)	A series (supports "Format 4", 1C frame compatible for A.)	D	M	Invalid
	Q series (supports "Format 4", IC frame compatible for QnA.)	D	M	Invalid
	FX series (FX1N)	D	M	Invalid
	FX-2N series (FX2N, FX3U, FX3UC)	D	M	Invalid
OMRON Corporation	C series, CV series, CS1 series	D / DM	CIO IR	0 - 15(0-F)
Allen-Bradley	SLC500	N7	N7	0 - 15 (0-F)
Fuji Electric FA Components & Systems Co., Ltd.	MICREX-SX SPH series	%MW3	%MW3	0 - 15 (0-F)



◆ NOTE

- When you use a FP2 or FP2SH from Matsushita Electric Works, Ltd., set a baud rate of 57600 bit/s or lower.
- Make sure to connect cables to the I/O terminals Error 0, Error 1, Read End, and Accept signal.

PLC-specific settings

If you are using a non-Matsushita PLC, please observe the following notes:

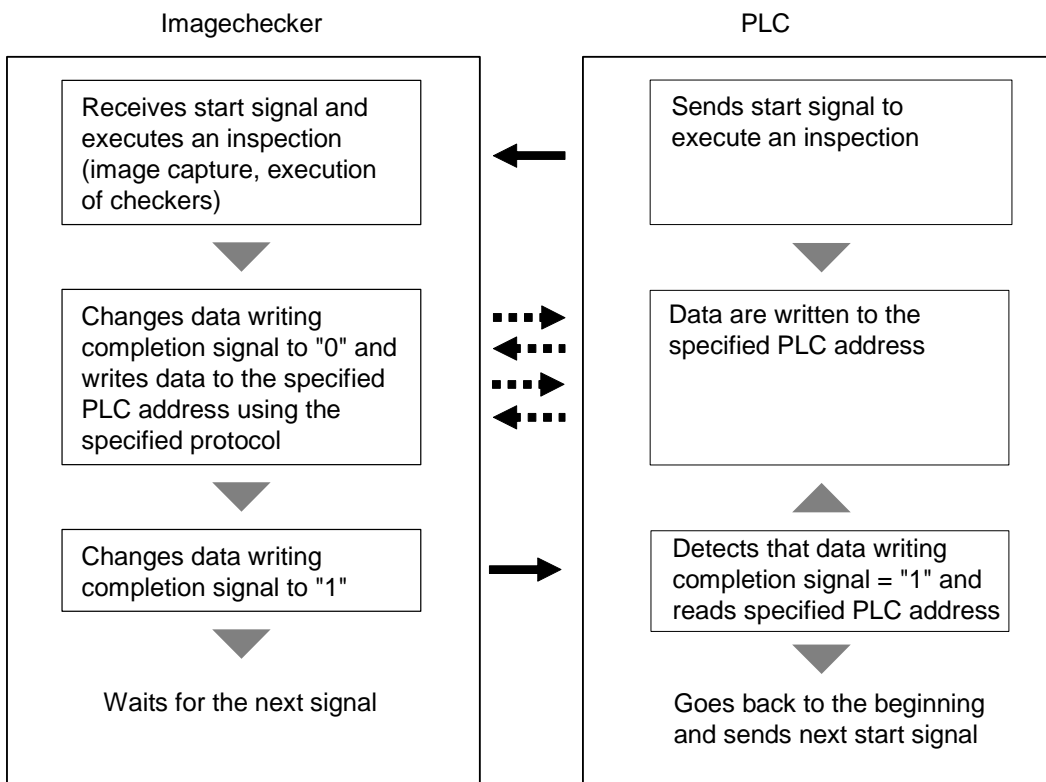


◆ NOTE

- If the PLC does not allow data writing in RUN mode, the Imagechecker cannot write data, which will lead to a communication error. Make sure to choose the right type of PLC or set it to allow the writing of data.

- **For Mitsubishi A- and Q- series PLC:**
You can use only the designated protocol "Format 4" of 1C frame compatible with A for A-series, and "Format 4" of 4C frame compatible with QnA for Q-series to communicate with the Imagechecker. Make sure that the protocols are set in the PLC and the settings are valid.
- **For Mitsubishi FX series and FX2N series PLC:**
Set the register for the communication format (D8120 or D8420) to "0".
- **If you want to use the data output completion notice for any of the Mitsubishi PLCs, set "Output Register" to the interface number. The setting in "Output Bit" will be ignored.**
- **For Allen-Bradley SLC500, make the following settings:**
 - Duplicate Detect: OFF
 - ACK Timeout (*20 ms): 20
 - Control Line: NO HANDSHAKING
 - Error Detect: BCC
 - NAK Retries: 3
 - ENQ Retries: 0
 - Embedded Responses: AUTO DETECT (only integer registers are available)

11.5.1.2 Data Output Flow



Communication between Imagechecker and PLC

11.5.1.3 Data Output Format

The following data can be output to in this order:

1. Scan count will be stored in the start register you have specified.
2. Total judgement will be output as a word
3. Judgement data will be output as 4 judgement results per word. "E" will be output for not set judgement formulas between set formulas.
4. Numerical calculation results are only output for set formulas



◆ NOTE

There is no data output to the PLC if:

- There is no data that can be output.
- Inspection results exist, but the output has not been activated in ENVIRONMENT → Input/Output → General Output.

Judgement data

Output data	One judgement is output in a 4-bit (digit) unit. Four judgement data are stored in a word on the PLC. The output always starts with the lowest byte.
Number of data	Up to 1000 (together with numerical calculation data)
Values to be output	<ul style="list-style-type: none"> • 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) • Not set: No data is output. But if the judgement formulas before and after the unset formula number are set to output, E is output in 16-digit form (1110 in binary form).

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	<ul style="list-style-type: none"> • 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) • Not set: E in hexadecimal form (1110 in binary form)

Scan count and numerical calculation

Only integer values can be output. Decimal values are rounded to the whole number and output.

Output data	Differs depending on the setting of "Bit width (bit)": <ul style="list-style-type: none"> • 16 bit: -32768 to 32767 • 32 bit: -2147483648 to 2147483647
-------------	---

Number of data	Numerical Calculation: Up to 1000
Values to be output	<ul style="list-style-type: none"> • Normal: Calculation results from -2147483648 to +2147483647 • When results exceed the range of values or an overflow occurs: 0 • Error: 0 • Not set: Data are not output.



◆ NOTE

- The Imagechecker always stores 4 judgement data per word independent of the setting of "Bit Width (bit)".
- For numerical calculation results and scan count, there is a difference when "Bit Width (bit)" = 32. In this case the data will be stored in two words. The lower bytes will be stored in the registers with the smaller number.

11.5.1.4 Output Example

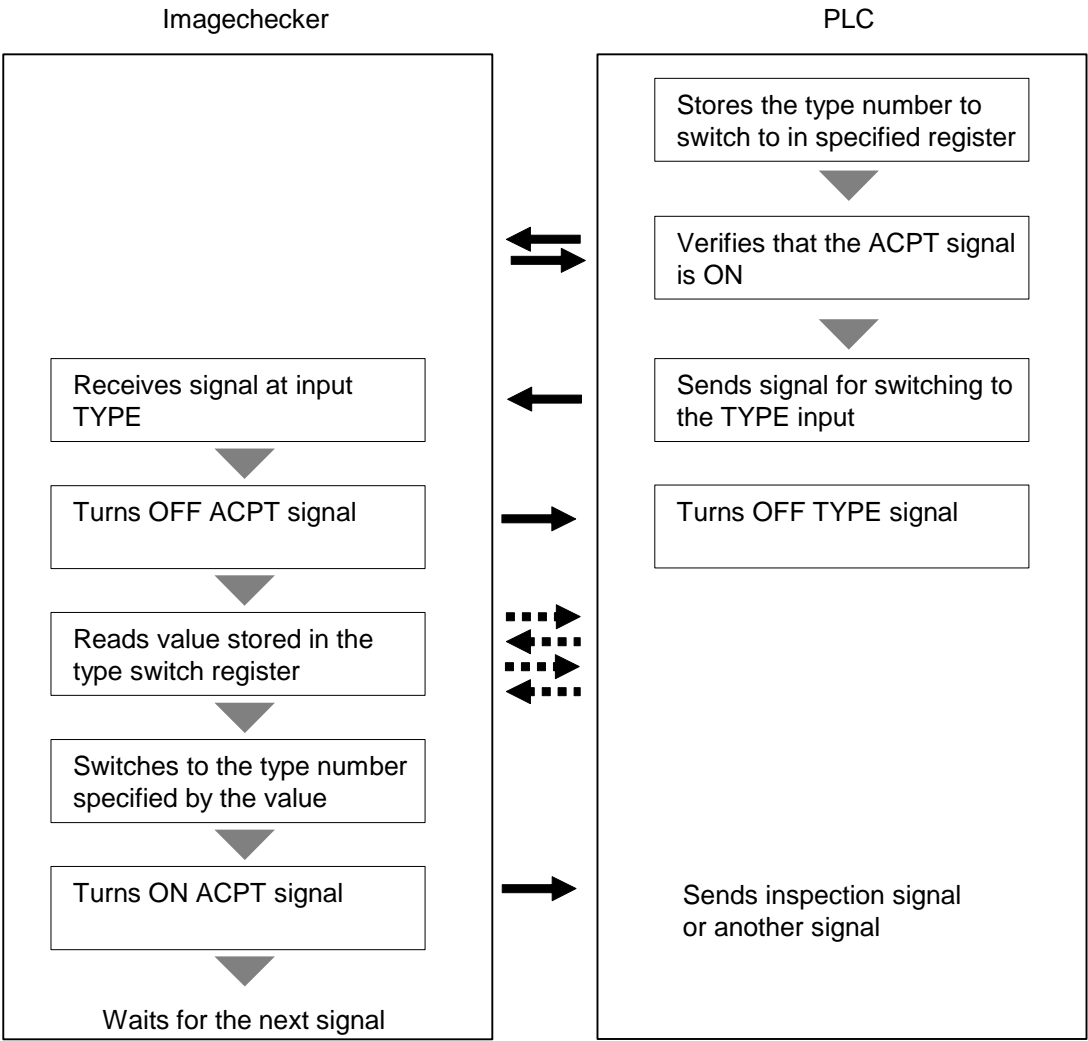
Output of the following results for scan count, total judgement, judgement and numerical calculation data:

- Settings: Start register = 500, Bit width = 16 bit
- Output data: Scan count = 1234, Total judgement = OK, Judgement = JDC000 = OK, JDC001 = not set, JDC002 = NG, Numerical calculation result of CAC000 = 215.3. CAC001 = not set, CAC002 = 2184.0

Output data	Register No.	Value (Hex.)	Description	Details
Scan count	500	04D2	1234	1234
Total judgement	501	0001	Bit 15 ← Bit 0 	OK output as one word
Judgement results	502	E0E1	Bit 15 ← Bit 0 	JDC000 to JDC002
Numerical calculation results	503	00D7	215	CAC000
	504	0888	2184	CAC002

11.5.2 Type Switching via PLC

You can either input the type number to switch to at the parallel inputs ("Type Switch Setting" = "Parallel I/O" or store the type number in a PLC register and read it from there:



◆ NOTE

Make sure not to write output data to the register you want to use for the type number to switch to.

When you input the type number to switch to at the parallel inputs, specify the type number in binary format:

Type No.	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

11.6 Password

You can set a password for switching from run mode to setup mode. This way, you can prevent unwanted changes to the setting data. By default there is no password. You can set a password with up to 15 characters.



◆ NOTE

In order to use this function, you need to set a password in the ENVIRONMENT menu and activate the password request,

To protect the SETUP menu against modifications, please proceed as follows:



◆ Procedure

1. In the SETUP menu, select "ENVIRONMENT" from the menu bar and press <ENTER>

If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

2. Select "Password" from the submenu and press <ENTER>

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ
System Settings	Input/Output	Camera		
Password Setting	Invalid			
Password				
Save Changes in RUN Menu	Yes			

3. Set "Password Setting" to "Valid"
4. Select "Password" and press <ENTER>
The Imagechecker displays the password entry window with the virtual keyboard.
5. Enter the password and confirm with <ENTER>
6. Select whether or not to allow the user to save changes in the OPERATION menu
Some data can be modified in the OPERATION menu, where a password is not required. With "Yes", changes will be saved automatically. With "No", no changes can be saved.
7. Press <CANCEL>

11.7 Initialize

To reset all environment settings to the default factory settings, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"ENVIRONMENT"** from the menu bar and press **<ENTER>**

If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.

2. Select **"Initialize"** from the submenu and press **<ENTER>**

A confirmation message appears.

3. Select **"Yes"** and press **<ENTER>**

All settings return to the factory default.



◆ NOTE

- Initializing does not affect the type data.
- Initializing the environment data does not affect the language setting. After initialization, the menus and options appear in the same language as before.

Chapter 12

Parallel Communication and Timing

12.1 Overview

This chapter deals with the parallel communication and its input and output timing.

12.1.1 Input Signals

The following input signals are available at the I/O connector. Signal names in brackets refer to the names of the inputs of the I/O terminal block.

Signal name	Pin No.	Usage
Acknowledge	8	<p>Use this signal together with the output signal Strobe (data output completion signal during handshake) when outputting result data from Out1 to Out15 to the external device in handshake mode.</p> <p>During handshake, the Imagechecker turns on the Strobe signal after outputting the result data. The external device receives data at the rising edge of the Strobe signal. Turn on the reception completion signal after reception is complete. The Imagechecker receives the reception completion signal with the Acknowledge input.</p>
Assign 0 - Assign 5	11 - 15	<p>You can assign a function to these inputs. Default setting:</p> <ul style="list-style-type: none"> • ASSIGN0: Template setting • ASSIGN1: Switch RUN/STOP • ASSIGN2: Save data in PV • ASSIGN3: Save data in SD • ASSIGN4: Read data from PV • ASSIGN5: Read data from SD
Display	6	<p>Use this signal to switch layouts with a signal from the external device. Input the layout number you want to switch to at IN0 to IN4 and turn on the Display signal to execute the layout switch</p>
Input 0 - Input 15	21 - 36	<p>Use these signals to input data in binary format like type numbers, memory areas for reading or saving data.</p>
Reentry	7	<p>Use this signal to update (re-register) a template image for the smart matching checker. Specify a checker number (0 - 999) with IN0 to IN9 and a template number (0 - 63) at IN10 to IN15 and turn on the Reentry signal.</p> <p>Note: When the option "Area Display" is set to "Yes" in ENVIRONMENT → System Settings → Operation, ; you need to input the Reentry signal twice - once for specifying the checker and template number, once by itself to confirm the area.</p>
Run/Stop	9	<p>Use this signal to switch the Imagechecker from RUN to STOP mode and vice versa. The status change of signal from OFF to ON (or rising edge of the signal) switches between RUN and STOP.</p> <p>Note: The signal will not be accepted when you are in the submenu TOOL → Update.</p>
Start 0 - Start 3 (STA0 - STA3)	1 - 4	<p>This is the start signal for inspection. It triggers the image capture. Start 0 to Start 3 correspond to camera0 to camera 3. Use Start 0 when "Camera Trigger" is set to "Common" in , that means when all cameras are triggered at the same time.</p>
Type (TYPE)	5	<p>Use this signal to switch types with a signal from the external device. Input the type number you want to switch to at IN0 to IN7 and turn on the Type signal to execute the type switch.</p>



◆ EXAMPLE

This is how you specify type numbers etc. in binary format. This is how you input type number 6:

IN7	IN6	IN5	IN4	IN3	IN2	IN1	IN0
0	0	0	0	0	1	1	0

This is how you input type number 237:

IN7	IN6	IN5	IN4	IN3	IN2	IN1	IN0
1	1	1	0	1	1	0	1

12.1.2 Output Signals

The following output signals are available at the I/O connector. Signal names in brackets refer to the names of the inputs of the I/O terminal block.

Signal name	Pin No.	Usage
Flash 0 - Flash 3	2, 4, 6, 8	Use this signal to synchronize the flash. When the Start signal is input, the Imagechecker waits for the specified flash delay and then turns on the Flash signal(s) for the specified time (TYPE → Type Setting → Camera). Note that you can change the polarity of the flash signal for every camera in ENVIRONMENT → Camera → Flash Polarity .
Read end 0 - Read end 3 (REN0 - REN3)	9 - 12	Read end 0 to Read end 3 correspond to camera0 to camera 3. When "Inspection Process" is set to "Parallel", the Read end signal goes off during image capture and goes ON when image capturing is complete. When you use more than one camera and "Camera Trigger" is set to "Individual", all Read end signals turn ON after each camera has finished the image capture. Note: When "Inspection Process" is set to "Serial", use the Ready signal as the Read End signal.
Ready (REDY)	13	This signal indicates when the Imagechecker is ready to receive the next start signal. The Ready signal turns off when the Start signal has been received and image capture begins. Note: When "Inspection Process" is set to "Parallel", use the Read End signal as an indication when the Imagechecker is ready for the next start signal.
Accept (ACPT)	15	This signal indicates when the Imagechecker is ready to receive the Type, Display, Reentry or Assign signal. When the Imagechecker receives any of these signals, the Accept signal turns OFF. After the action triggered by the signal has been executed, the Accept signal turns back ON.
Error 0 (ERR0)	14	This signal turns on when (see page 144): <ul style="list-style-type: none"> an error occurred during result output (when the Result signal is output) an error occurred during template re-registration (after input of the Reentry signal)

Signal name	Pin No.	Usage
Error 1 (ERR1)	16	<p>This signal turns on when an error occurred after one of the following parallel signals have been input via the parallel or serial interface or via Ethernet:</p> <ul style="list-style-type: none"> • Type • Display • Save data in PV/SD (Assign0 to Assign5) • Read data from PV/SD (Assign0 to Assign5) • Save image memory to SD (Assign0 to Assign5) • Clear image memory (Assign0 to Assign5)
Result (RSLT)	17	<p>This signal outputs the total judgement. The signal turns on if the total judgement is OK and turns off if the total judgement is NG or an error has occurred. The signal is output automatically when you have set a total judgement (see page 353).</p>
Tact (TACT)	18	<p>This signal turns ON when:</p> <ul style="list-style-type: none"> • the Imagechecker starts to output results to Out 1 to Out 15 • the Imagechecker outputs the Result signal or the Error 0 signal <p>The Tact signal turns OFF when the time set in "Output Signal Guarantee Time (ms)" in ENVIRONMENT → Input/Output → Parallel I/O Output has passed. External devices can be triggered to read the results by the rising edge of the Tact signal.</p> <p>Note: When result data is output to more than one destination, perform handshake with the Strobe signal (see Strobe signal).</p>
Strobe	19	<p>This signal is used as a handshake when data is output via Out 1 to Out 15 to more than one destination.</p> <p>Result output with handshake</p> <p>Use the Strobe signal together with the Acknowledge signal. The Imagechecker turns ON the Strobe signal after outputting the results. The external device receives data at the rising edge of the Strobe signal. After data reception is complete, the external device should input a reception completion signal at the Acknowledge input within the period specified in "Timeout (ms)".</p> <p>Result output without handshake</p> <p>Results are output at the interval set in "Output Signal Guarantee Time (ms)". The Imagechecker turns ON the Strobe signal after each result output. The external device receives data at the rising edge of the Strobe signal within the time period in "Output Signal Guarantee Time (ms)".</p>
Run	20	<p>This signal is ON when the Imagechecker is in RUN mode.</p>



◆ NOTE

The signals Error 0 and Error 1 can be reset forcibly with the serial command %E**CR (see page 443)

12.2 Typical Inspection Operations

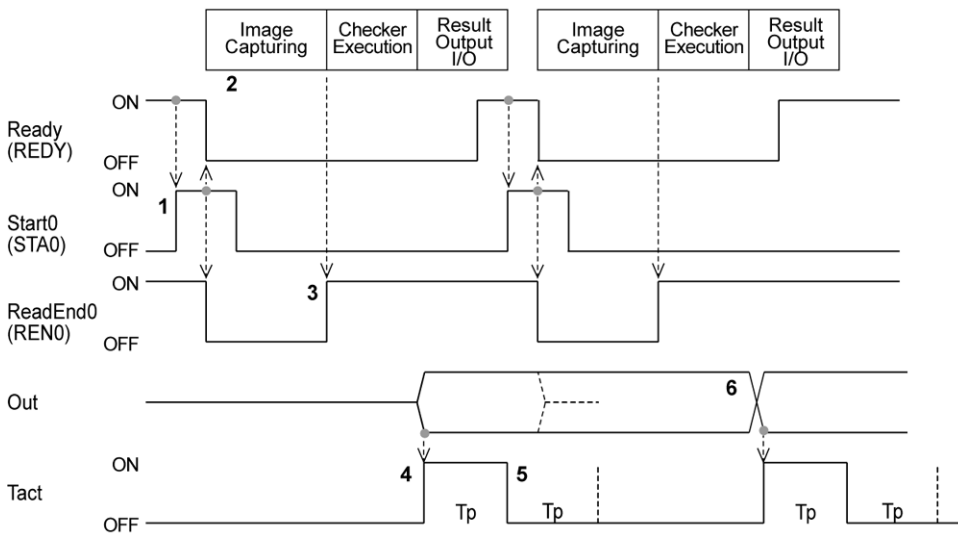
The chapter provides time diagrams for typical inspection operations.

12.2.1 Common Trigger

The time diagram for the common trigger differs depending on the setting of the option "Inspection Process".

12.2.1.1 Serial Inspection Process

This is the time diagram when "Inspection Process" is set to "Serial" (**ENVIRONMENT** → **System Settings** → **Operation**).



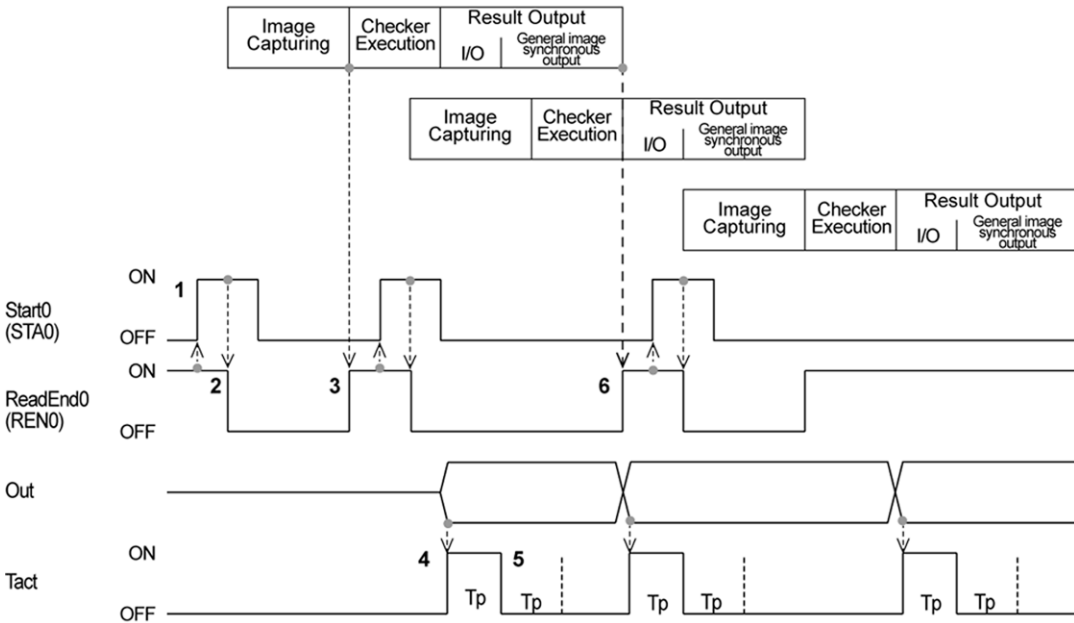
T_p (1 to 1000ms): Data output guarantee time (default: 10ms)

1. Make sure that the Ready signal is ON and then turn on Start0 signal for more than 1ms.
2. The Imagechecker turns OFF the Ready signal and the ReadEnd0 signal, and starts capturing an image.
3. After image capturing is completed, the Imagechecker turns ON the ReadEnd0 signal and executes checkers.
4. When the inspection ends, a result is output through the I/O interface and the Tact signal and the Ready signal are turned ON. The inspection result data is obtainable when the Tact signal turns ON.
5. The Tact signal is turned ON for the time of " T_p ", and then turned OFF for the same length of time. **You cannot output the next result while the signal is OFF.**
6. The Out signal keep its status till the next output (Hold), or turns off before the next image capturing (Reset) depending on the setting of the option "Parallel Reset

Condition" (**ENVIRONMENT** → **System Settings** → **Operation**).

12.2.1.2 Parallel Inspection Process

This is the time diagram when "Inspection Process" is set to "Parallel" (**ENVIRONMENT** → **System Settings** → **Operation**).



T_p (1 to 1000ms): Data output guarantee time (default: 10ms)

1. Make sure that the ReadEnd signal is ON and then turn on the Start0 signal for more than 1ms.
2. The Imagechecker turns off the ReadEnd0 signal and starts capturing an image.
3. After image capturing is completed, the Imagechecker turns ON the ReadEnd0 signal and executes checkers. When the ReadEnd0 signal has turned back ON, the Imagechecker is ready for the next Start0 signal / the next image capture.
4. When inspection is complete, the result is output through the I/O interface and the Tact signal is turned ON. The inspection result data is obtainable when the Tact signal turns ON.
5. The Tact signal turns ON for the time of " T_p ", and then turns OFF the same length of time. **You cannot output the next result while the signal is OFF.**

- After the second image capture has been completed, the Imagechecker executes the checkers. If the results from the first inspection have been output at the time, the ReadEnd0 signal is turned ON. If the first result output has not completed, the Imagechecker waits until all data has been output and then turns ON the ReadEnd0 signal. When the ReadEnd0 signal has turned back ON, the Imagechecker is ready for the next Start0 signal / the next image capture

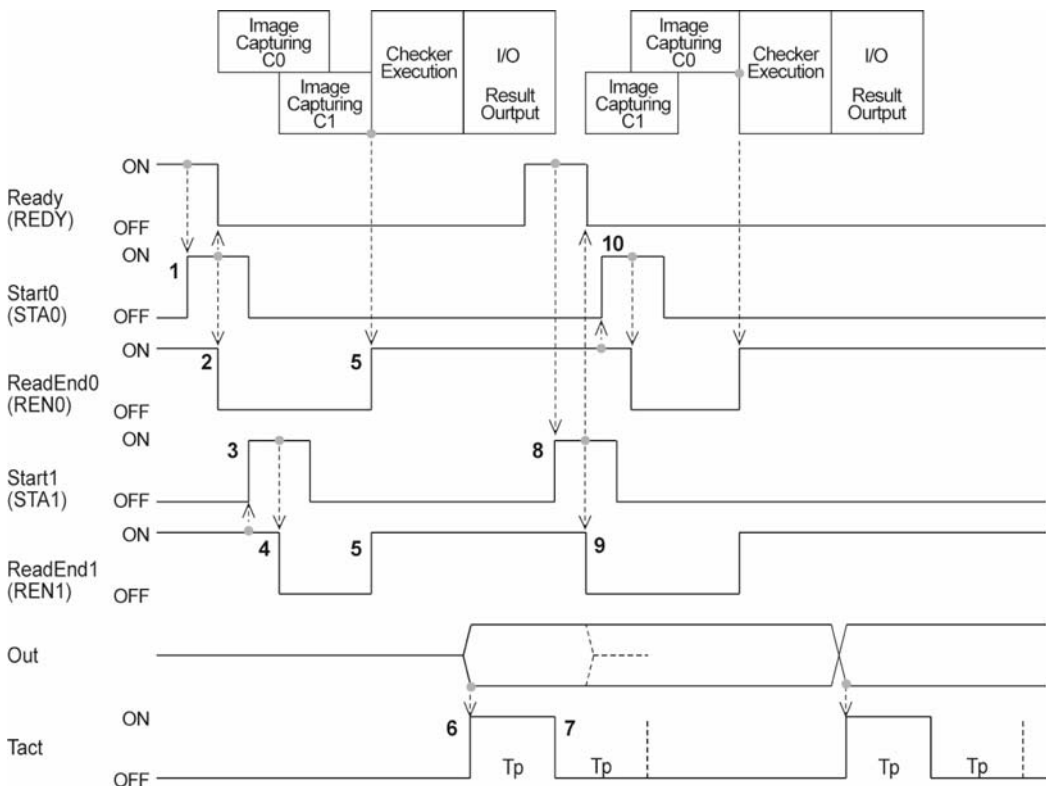


◆ NOTE

If you set “Image Output” to “Async. (inspection first)”, the ReadEnd0 signal turns ON after the second image capture has been completed without waiting for the output of the result and the image of the first inspection. Note that this means that not all data of all inspection results can be output.

12.2.1.3 Serial Inspection Process with Two Cameras

This is the time diagram when “Inspection Process” is set to “Serial” (**ENVIRONMENT** → **System Settings** → **Operation**) and there are two cameras connected to the Imagechecker.



Tp (1 to 1000ms): Data output guarantee time (default: 10ms)

- To start capturing an image of the first camera, make sure that the Ready signal is ON and then turn ON the Start signal (Start0 for the example above) for more than 1ms.
- The Imagechecker turns OFF the Ready and the ReadEnd0 signal and starts

capturing an image.

3. To start capturing an image of the second camera, make sure that the ReadEnd signal for the second camera (ReadEnd1 for the example above) is ON and then turn ON the Start signal for more than 1ms. When "Individual Trigger Timeout" is set to "Yes" (**TYPE** → **Type Setting** → **Camera**), a timeout error occurs when the time from the input of the Start signal for the first camera to the input of the Start signal for the last camera exceeds the time set in "Timeout (ms)". In this case, inspection is terminated and the Error0 signal is output.
4. The Imagechecker turns OFF the ReadEnd1 signal and starts capturing an image.
5. After all connecting cameras complete capturing their image, turn ON the corresponding ReadEnd signals (ReadEnd0 to 1 for the example above) and execute the checkers.
6. When inspection is complete, the result is output through the I/O interface and the Tact signal is turned ON. The inspection result data is obtainable when the Tact signal turns ON.
7. The Tact signal turns ON for the time of "Tp", and then turns OFF the same length of time. **You cannot output the next result while the signal is OFF.**
8. To start capturing an image of the first camera (C1 for the example) in the second inspection, make sure that the Ready signal is ON and then turn ON the Start signal for more than 1ms.
9. The Imagechecker turns OFF the Ready and ReadEnd1 signal and starts capturing an image.
10. To start capturing an image of the second camera (C0 for the example), make sure that the ReadEnd signal for the second camera is ON and then turn ON the Start signal for more than 1ms.

12.2.2 Result Output

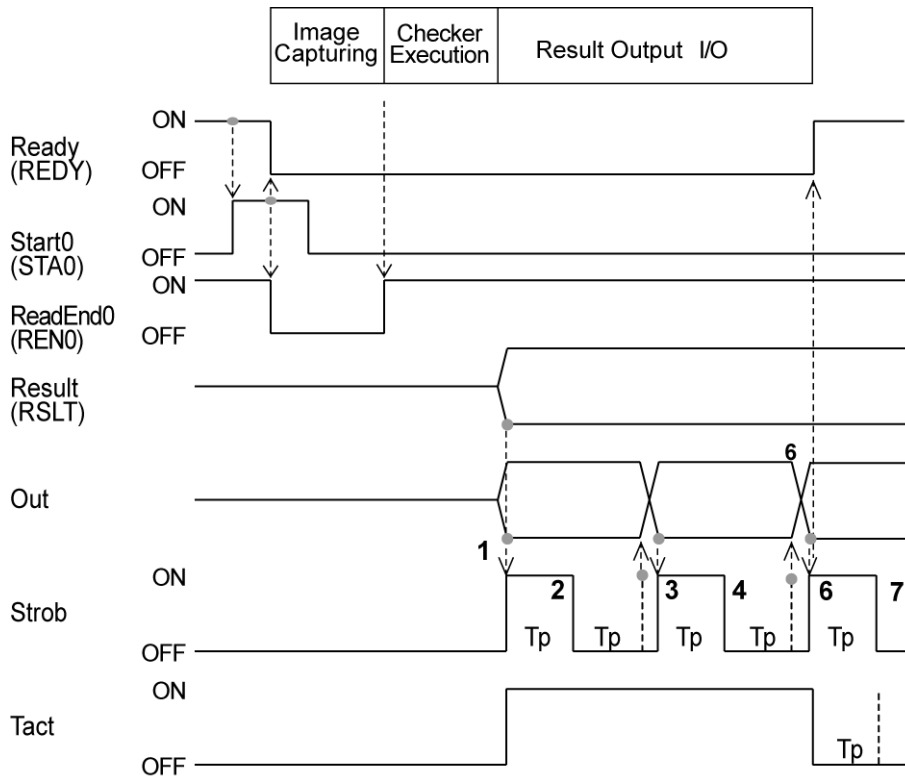
Inspection results can be output with or without handshake. Set the handshake function in **ENVIRONMENT** → **Input/Output** → **Parallel I/O Output**.



12.2.2.1 Result Output without Handshake

When "Handshake" is set to "No", results are output at the interval set in "Output Signal Guarantee Time (ms)". The Imagechecker turns ON the Strobe signal after each result output. The external device receives data at the rising edge of the Strobe signal within the time period in "Output Signal Guarantee Time (ms)".

The time diagram shows a three-time data output when "Inspection Process" = "Serial".



T_p (1 to 1000ms): Data output guarantee time (default: 10ms)

1. As the inspection ends, the first result is output via the parallel I/O interface. The Strobe and the Tact signal are turned ON after about 100 μ sec. The first inspection result data is obtainable when the Strobe signal turns ON.
2. The Strobe signal turns OFF after the time of T_p has passed.
3. The Strobe signal remains OFF for the same length of time as T_p . After that, the second inspection result data is output and the Strobe signal turns ON after about 100 μ sec. The second inspection result data is obtainable when the Strobe signal turns ON.
4. The Strobe signal turns OFF after the time of T_p has passed.
5. The Strobe signal remains OFF for the same length of time as T_p . After that, the third result inspection data is output.
6. About 100 μ sec after the third inspection result data output, the Strobe and the Ready signal turn ON and the Tact signal turns OFF. The third inspection result data is obtainable when the Strobe signal turns ON.



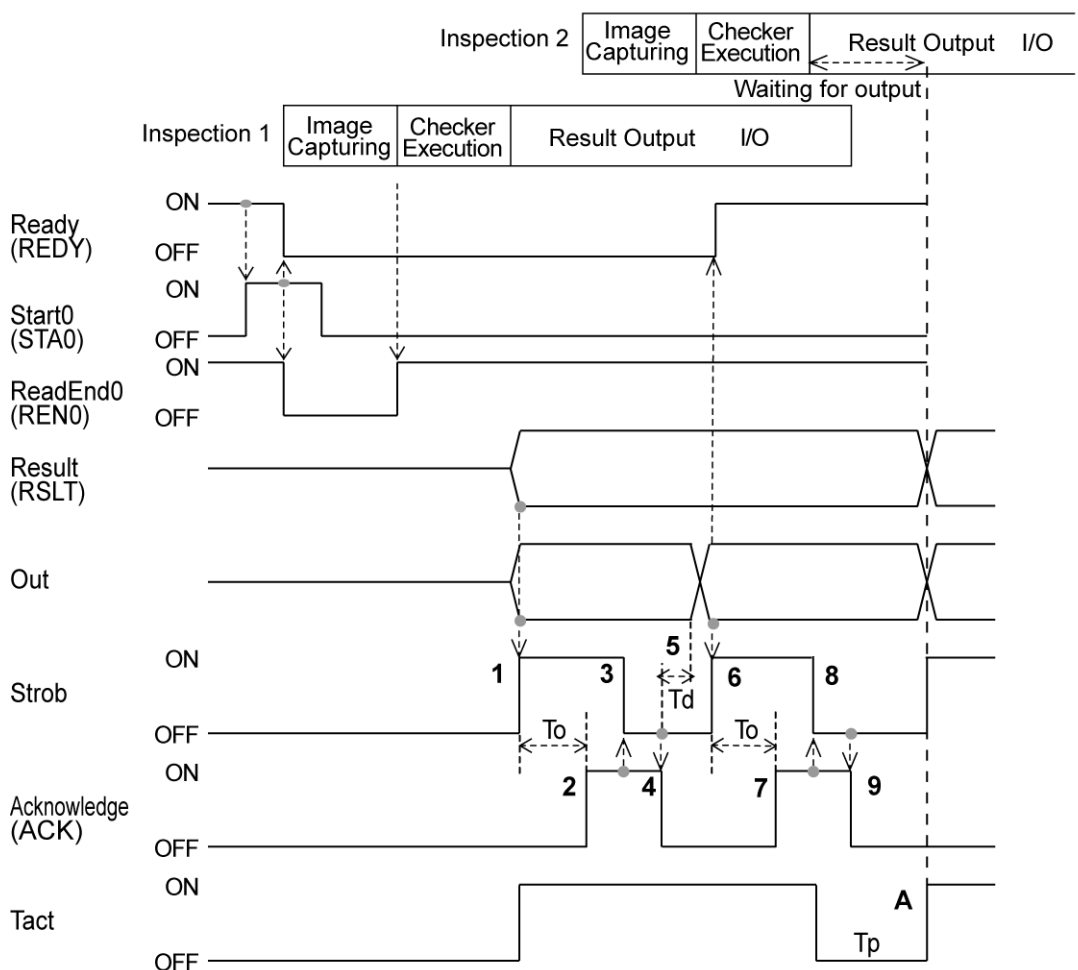
◆ NOTE

When "Inspection Mode" is set to "Parallel", there is no result data output while T_p time is passing after the Tact signal turns OFF.

12.2.2.2 Result Output with Handshake

When "Handshake" is set to "Yes", use the Strobe signal together with the Acknowledge signal. The Imagechecker turns ON the Strobe signal after outputting the results. The external device receives data at the rising edge of the Strobe signal. After data reception is complete, the external device should input a reception completion signal at the Acknowledge input within the period specified in "Timeout (ms)"

The time diagram shows a two-time data output when "Inspection Process" = "Serial".



$T_d = 100\mu\text{sec}$

$T_o = \text{Timeout period, } 4 - 20000\text{ms (default: } 5000\text{ms)}$

$T_p (1 \text{ to } 1000\text{ms}): \text{Data output guarantee time (default: } 10\text{ms)}$

1. When the first inspection is completed, the first inspection result data is output through the parallel I/O. The Strobe and Tact signal are turned ON after about $100\mu\text{sec}$. The first inspection result data as well as the Result signal (total judgement result) are obtainable when the Strobe signal turns ON.
2. Turn ON the Acknowledge signal with the external device after the external device has finished receiving the first inspection result data. A timeout error occurs if the time from

the Strobe signal output to the Acknowledge signal turning ON exceeds the time specified in "Timeout (ms)" (**ENVIRONMENT** → **Input/Output** → **Parallel I/O Output**). And then, output is terminated and Error 0 signal is output.

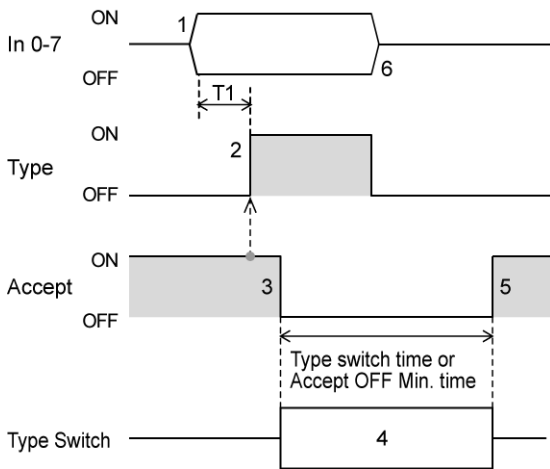
3. The Imagechecker checks that the Acknowledge signal is ON and turns OFF the Strobe signal.
4. The external device checks whether the Strobe signal is OFF and then turns OFF the Acknowledge signal.
5. The Imagechecker outputs the second inspection result data 100μsec (Td) after the Acknowledge signal has been turned OFF.
6. Within 100μsec from the second inspection result data output, the Strobe and the Ready signal turn ON and the Tact signal turns OFF.
7. Turn ON the Acknowledge signal with the external device after the external device has finished receiving the second inspection result data.
8. The Imagechecker checks that the Acknowledge signal is ON and turns OFF the Strobe and the Tact signal.
9. The external device checks whether the Strobe signal is OFF and then turns OFF the Acknowledge signal.

A: You cannot output the next inspection result data while Tp time is passing after the Strobe signal turns OFF in parallel inspection mode and the device is waiting for the data output of inspection 2.

12.2.3 Type Switch

You can switch to a different type with the help of inputs IN1 to IN7 and the Type signal. Use IN1 to IN7 to specify the type number in binary format:

Type No.	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



$T1 > 1\text{ms}$

1. Specify the type number you want to switch to at IN0 to IN7 more than 1ms before turning the Type signal ON. When "Type Switching Signal" is set to "PLC Communication" in **ENVIRONMENT** → **Input/Output** → **General Output**, write the type number to switch to in the PLC register specified in "Type No. Register".
2. Check whether the Accept signal is ON and then input the Type signal to execute the type switch.
3. The Imagechecker checks that the Acknowledge signal is ON and turns OFF the Strobe signal.
4. The Imagechecker executes the type switch.
5. When the type switch has been completed, the Accept signal is turned ON. However, when you have specified a time in "ACCEPT OFF Min. (ms)" in **ENVIRONMENT** → **Input/Output** → **Parallel I/O**, the Accept signal is turned on after the longer time of the two (either the type switch time or the time set in "Accept OFF Min. (ms)").
6. Turn OFF the Type signal and the IN0 to IN7 signals before inputting the next signal, such as Start.

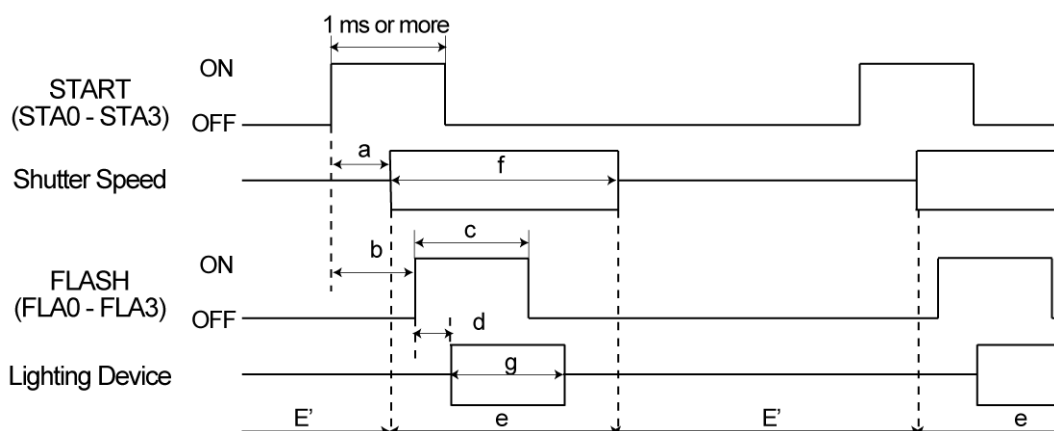
12.2.4 Flash Output

There are 4 start and 4 flash signals available, one for each camera.



◆ NOTE

When you display a live image and send the Flash signal, the light will flash continuously as the Flash signal output is synchronized with the display of the live image. Display the memory image, when you trigger a flash with the Flash signal (see page 75).



a	Image capture response time	Time between the Start signal and the start of image capturing. Start signal response time (1ms or less) + Capture delay (0 to 999.9ms, see note 1) = 1000.9ms (maximum)
b	Flash signal response time	Time between the Start signal and the start of the Flash signal output (see note 2 and note 3). Start signal response time (1ms or less) + Flash signal delay (0 to 999.9ms, see note 1) = 1000.9ms (maximum)
c	Flash span	Set the value in the range from 0.2 to 999.9ms corresponding to the connected lighting. See note 1 and note 3.
d	Lighting response time	Response time of the lighting to the Flash signal. Depends on the lighting connected and whether you have set a delay time for the lighting.
e	Valid lighting range	Time the lighting can be ON plus tolerance time. If the lighting is ON outside the valid lighting range (indicated as E'), the brightness of captured images may vary for every inspection and may lead to unreliable results.
f	Shutter speed	Set the value with the Imagechecker in the range from 30μs to 1000ms. See note 1.
g	Lighting time	Set the value with the lighting. The time from when the light goes ON until the light goes OFF. Must be less than the lighting range (e).



◆ NOTE

1. The option can be set for each camera in TYPE → Type Setting → Camera.

Depending on the internal circuit of the connected device, the response time could be longer than the maximum time (1000.9 ms). Test this with the system you are using.

For Imagecheckers with PNP outputs, the Flash signal span changes depending on the setting of "Flash Polarity" (ENVIRONMENT → Camera → FLASH Polarity). Refer to the table below for examples.

Setting of FLASH Span (ms)	Flash output duration when "Flash polarity" = "ON at High"	Flash output duration when "Flash polarity" = "ON at Low"
0.2ms (200μs)	0.08ms (80μs)	0.24ms (240μs)
10ms	9.88ms	10.04ms

Chapter 13

Serial Communication

13.1 Introduction to Serial Communication

Use serial communication to send commands from and transfer result data to an external device via the COM.0 or the Ethernet port.



◆ NOTE

The Ethernet port uses the following port numbers for communication: General output: 8601, image output: 8602, sending/receiving commands: 8604

The following specifications apply for communication via the COM.0 port:

Item		Specification
Connector		9-pin Sub-D
Communication method		Full duplex
Synchronization method		A
Communication speed (baud rate)		1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 bit/second (default: 9600)
Transmission code		ASCII
Transmission format	Bit length	7 bit, 8 bit (default: 8 bit)
	Stop bit	1 bit, 2 bit (default: 1 bit)
	Parity	None, odd, even (default: odd)
	Flow control	None or software (default: none)
	Delimiter	CR (Carriage Return)



◆ NOTE

When you use a FP2 or FP2SH from Matsushita Electric Works, Ltd., set a baud rate of 57600 bit/s or lower.

13.2 Overview of Serial Commands

You can use a serial command to trigger the following operations. The following serial commands are available:

Functionality	Command	RUN menu		SETUP menu	
		RUN mode	STOP mode	RUN mode	STOP mode
Starts an inspection via common trigger	%S	Yes		Yes	
Starts an inspection via individual trigger	%S	Yes		Yes	
Stop repeated inspection	%S	Yes		Yes	
Stop inspection using "Detect Trigger (common)"	%S	Yes		Yes	
Start reinspection	%R	Yes		Yes	
Switches to another type	%X	Yes		Yes	
Saves the Imagechecker settings to the main memory	%MW	Yes		Yes	
Saves the Imagechecker settings to the SD memory card	%CW	Yes		Yes	
Reads the Imagechecker settings from the main memory	%MR	Yes		Yes	
Reads the Imagechecker settings from the SD memory card	%CR	Yes		Yes	
Save image memory	%SS	Yes		Yes	
Delete image memory	%SR	Yes		Yes	
Print screen	%PS	Yes		Yes	
Resets the statistic data	%Q	Yes		Yes	
Switch between RUN and STOP mode	%RM	Yes	Yes	Yes	Yes (see note)
Reset error signal	%E	Yes	Yes	Yes	Yes
Emulates the keypad	%K	Yes	Yes	Yes	Yes
Cancel inspection/process	%CC	Yes	Yes	Yes	Yes
Switch layout	%I	Yes			
Re-registers template images for the smart matching checkers	%A	Yes			
Read parameter	%PR	Yes		Yes	
Read parameter pairs (upper/lower values)	%PRP	Yes		Yes	
Change parameter	%PW	Yes			
Change parameter pairs (upper/lower values)	%PWP	Yes			



◆ NOTE

This function is not available when you are in the submenu "Update" or "Setting Help" in the TOOL menu.

When you send a serial command to the Imagechecker from an external device and an error occurs, an error message is returned. The error message contents depends on the command that was sent.

13.2.1 Block Check Code

All command messages use a block check code (also called block check character , BCC). The block check code improves the reliability of data transmission by checking for errors using horizontal parity.

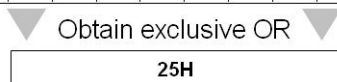
If you do not use the block check code, add "***" (2AH2AH) to the command instead of the block check code.



◆ EXAMPLE

Using exclusive OR to create a block check code for the command to read the execution time:

%	P	R		S	Y	S	_	T	I	M	E	1
25H	50H	52H	20H	53H	59H	53H	5FH	54H	49H	4DH	45H	31H



Command message including BCC:

%	P	R		S	Y	S	_	T	I	M	E	1	2	5	CR

BCC

Error response message

%	!	1	0	0	BCC	CR
---	---	---	---	---	-----	----

The Imagechecker sends this error message in the following cases and turns ON the signal Error 1:

- A BCC error has occurred
- The Imagechecker has received an undefined command.

13.3 Command Details

The serial commands are explained in this order:

1. Inspection Start (see page 433)
2. Stop Continuous Inspection (see page 437)
3. Reinspect the Last Image (see page 437)
4. Type Switch (see page 438)
5. Save Setting Data (see page 438)
6. Read Setting Data (see page 440)
7. Save Images from the Image Memory to the SD Memory Card (see page 441)
8. Delete All Images from Image Memory (see page 441)
9. Print Screen (see page 441)
10. Reset Statistics (see page 442)
11. Switch from RUN to STOP Mode and Vice Versa (see page 442)
12. Reset the Error Signal (see page 443)
13. Keypad Emulation (see page 443)
14. Cancel a Specific Operation (see page 443)
15. Layout Switch (see page 444)
16. Template Registration (see page 444)
17. Read Values (see page 447)
18. Write Values (see page 449)

13.3.1 Inspection Start

The serial start command differs depending on the setting of "Camera Trigger" and "Execution Mode". Commands shown next to "Send" are sent to the Imagechecker, the responses from the Imagechecker to the sender are shown next to "Receive".

13.3.1.1 When "Camera Trigger" is Set to "Common"

Execution modes "Execute All" and "Automatic Switch"

Send	% S BCC CR	BCC = 76 or **
Receive	% S \$ BCC (52) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 0:

%	S	!	Error code (3-digit)	BCC	CR
---	---	---	----------------------	-----	----

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
201	The option "Camera Trigger" is set to "Independent".
202	The option "Execution Mode" is "User-Defined".
203	<ul style="list-style-type: none"> An image capturing error has occurred. There is no camera connected.

Execution mode "User-Defined"

Send	% S ? BCC CR	? = 0 - 9 (Block number that should be executed)
Receive	% S \$ BCC (52) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 0:

%	S	!	Error code (3-digit)	BCC	CR
---	---	---	----------------------	-----	----

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
201	The option "Camera Trigger" is set to "Independent".
202	<ul style="list-style-type: none"> The specified block number does not exist. An inspection start command was sent without block number.
203	<ul style="list-style-type: none"> An image capturing error has occurred. There is no camera connected.



◆ EXAMPLE

This is how start you start inspection with block number 2 via the serial interface:

Send	% S 2 * * CR
Receive	% S \$ 5 2 CR

13.3.1.2 When "Camera Trigger" is Set to "Independent"

Execution modes "Execute All" and "Automatic Switch"

Send	<table><tr><td>%</td><td>S</td><td>,</td><td>a</td><td>a</td><td>BCC</td><td>CR</td></tr></table>	%	S	,	a	a	BCC	CR	<p>aa = 0 - 15 (camera number)</p> <p>To specify the camera number, enter 4-bit data as a decimal:</p> <ul style="list-style-type: none">• Bit 0 = camera 0• Bit 1 = camera 1• Bit 2 = camera 2• Bit 3 = camera 3
%	S	,	a	a	BCC	CR			
Receive	<table><tr><td>%</td><td>S</td><td>\$</td><td>BCC (52)</td><td>CR</td></tr></table>	%	S	\$	BCC (52)	CR			
%	S	\$	BCC (52)	CR					

Error response message

The Imagechecker sends this error message and turns ON the signal Error 0:

%	S	!	Error code (3-digit)	BCC	CR
---	---	---	----------------------	-----	----

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
201	The option "Camera Trigger" is set to "Common".
202	<ul style="list-style-type: none">• The option "Execution Mode" is "User-Defined".• The 2nd to 4th command specified a different block than the 1st to 3rd command.
203	<ul style="list-style-type: none">• An image capturing error has occurred.• There is no camera connected.• The option "Camera Type" is set to "Unused" in ENVIRONMENT → Camera → Camera for the camera number specified.



◆ EXAMPLE

This is how you start an inspection with camera 0 and camera 2 via the serial interface:

Send	<table><tr><td>%</td><td>S</td><td>,</td><td>0</td><td>5</td><td>*</td><td>*</td><td>CR</td></tr></table>	%	S	,	0	5	*	*	CR
%	S	,	0	5	*	*	CR		
Receive	<table><tr><td>%</td><td>S</td><td>\$</td><td>5</td><td>2</td><td>CR</td></tr></table>	%	S	\$	5	2	CR		
%	S	\$	5	2	CR				

Execution mode "User-Defined"

Send	% S ? , a a BCC CR	<p>? = 0 - 9 (Block number that should be executed)</p> <p>aa = 0 - 15 (camera number)</p> <p>To specify the camera number, enter 4-bit data as a decimal:</p> <ul style="list-style-type: none"> • Bit 0 = camera 0 • Bit 1 = camera 1 • Bit 2 = camera 2 • Bit 3 = camera 3
Receive	% S \$ BCC (52) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 0:

%	S	!	Error code (3-digit)	BCC	CR
---	---	---	----------------------	-----	----

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
201	<ul style="list-style-type: none"> • The option "Camera Trigger" is set to "Common".
202	<ul style="list-style-type: none"> • The specified block number does not exist. • An inspection start command was sent without block number. • The 2nd to 4th command specified a different block than the 1st to 3rd command.
203	<ul style="list-style-type: none"> • An image capturing error has occurred. • There is no camera connected. • The option "Camera Type" is set to "Unused" in ENVIRONMENT → Camera → Camera for the camera number specified.



◆ EXAMPLE

This is how you start an inspection with camera 1 and block number 9 via the serial interface:

Send	% S 9 , 0 2 * * CR
Receive	% S \$ 5 2 CR

13.3.2 Stop Continuous Inspection

When "Continuous Inspection" is set to "Automatic: After Trigger" or "Automatic: After Power On", you can stop the inspection with the following command in all execution modes:

Send	% S BCC (76) CR
Receive	No response from Imagechecker

13.3.3 Reinspect the Last Image

To execute the last inspection again without capturing a new camera image, send the following command depending on the execution mode.

Execution modes "Execute All" and "Automatic Switch"

Send	% R BCC CR	BCC = 77 or **
Receive	% R \$ BCC (53) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 0:

% R ! Error code (3-digit) BCC CR

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
201	The option "Execution Mode" is "User-Defined".
203	<ul style="list-style-type: none"> No image has been captured before. Reinspection cannot be executed because "Continuous Inspection" is set to "Automatic: After Trigger" or "Automatic: After Power On"

Execution mode "User-Defined"

Send	% R ? BCC CR	? = 0 - 9 (Block number that should be executed)
Receive	% R \$ BCC (53) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 0:

% R ! Error code (3-digit) BCC CR

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
201	The option "Execution Mode" is not "User-Defined".
202	<ul style="list-style-type: none"> The specified block number does not exist. An inspection start command was sent without block number.
203	<ul style="list-style-type: none"> No image has been captured before. Reinspection cannot be executed because "Continuous Inspection" is set to "Automatic: After Trigger" or "Automatic: After Power On"



◆ EXAMPLE

This is how you start inspection with block number 0 via the serial interface:

Send	% R 0 * * CR
Receive	% R \$ 5 3 CR

13.3.4 Type Switch

To switch to a different type, send the following command in all execution modes.

Send	% X ? ? ? BCC CR	??? = 000 - 255 (type number to switch to)
Receive	% X \$ BCC (59) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

% X ! Error code (3-digit) BCC CR

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
210	<ul style="list-style-type: none"> The specified type number does not exist. A number outside the range 000 to 255 has been specified.

13.3.5 Save Setting Data

To save the setting data, send the following command depending on the destination of the data.

13.3.5.1 Main Memory

Send	% M W ? ? BCC CR	?? = 00 - 99 (number of storage area in the main memory)
Receive	% M W \$ BCC (1B) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

% M W ! Error code (3-digit) BCC CR

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
212	A number outside the range 00 to 99 has been specified.

13.3.5.2 SD Memory Card

Send	% C W ? ? BCC CR	?? = 00 - 99 (number of storage area on the SD memory card)
Receive	% C W \$ BCC (15) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

% C W ! Error code (3-digit) BCC CR

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
212	A number outside the range 00 to 99 has been specified.
216	<ul style="list-style-type: none"> SD memory card not inserted. SD memory card cannot be read. SD memory card capacity is used up. SD memory card is write-protected.

13.3.6 Read Setting Data

To read the setting data, send the following command depending on the source of the data.

13.3.6.1 Main Memory

Send	% M R ? ? BCC CR	?? = 00 - 99 (number of storage area in the main memory)
Receive	% M R \$ BCC (1B) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

% M R ! Error code (3-digit) BCC CR

3-digit error code	Meaning
200	The operation has been stopped.
212	A number outside the range 00 to 99 has been specified.

13.3.6.2 SD Memory Card

Send	% C R ? ? BCC CR	?? = 00 - 99 (number of storage area on the SD memory card)
Receive	% C R \$ BCC (1B) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

% C R ! Error code (3-digit) BCC CR

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
212	A number outside the range 00 to 99 has been specified.
213	<ul style="list-style-type: none"> SD memory card not inserted. SD memory card cannot be read. No data file in the specified area on the SD memory card.
214	<ul style="list-style-type: none"> The data file is not a valid data file for the Imagechecker. The data file is incompatible (e.g. later version, etc.). The number and types of cameras connected to the Imagechecker is different from the settings of the data file.

13.3.7 Save Images from the Image Memory to the SD Memory Card

To save images from the image memory of the Imagechecker to a free folder on the SD memory card, send the following command. You cannot specify the folder where the images will be saved.

Send	% S S BCC CR	BCC = 25 or **
Receive	% S S \$ BCC (01) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

% S S ! Error code (3-digit) BCC CR

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
260	<ul style="list-style-type: none"> SD memory card not inserted. SD memory card cannot be read. SD memory card capacity is used up. SD memory card is write-protected. There is no empty folder on the SD memory card. All 100 folders have been used.

13.3.8 Delete All Images from Image Memory

To delete all images in the image memory of the Imagechecker, send the following command.

Send	% S R BCC CR	BCC = 24 or **
Receive	% S R \$ BCC (00) CR	

13.3.9 Print Screen

To save a screenshot in the destination specified in **ENVIRONMENT** → **Input/Output** → **Print Screen**, send the following command. You cannot specify the destination where the screenshot will be saved.

Send	% P S BCC CR	BCC = 26 or **
Receive	% P S \$ BCC (02) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

%	P	S	!	Error code (3-digit)	BCC	CR
---	---	---	---	----------------------	-----	----

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
265	<ul style="list-style-type: none"> SD memory card not inserted. SD memory card capacity is used up. SD memory card is write-protected.

13.3.10 Reset Statistics

To reset the statistics, send the following command.

Send	% Q BCC CR	BCC = 74 or **
Receive	% Q \$ BCC (53) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

%	Q	!	Error code (3-digit)	BCC	CR
---	---	---	----------------------	-----	----

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.

13.3.11 Switch from RUN to STOP Mode and Vice Versa

To switch from RUN mode to STOP mode or vice versa, send the following command.

Send	% R M ? BCC CR	? = 0 - 1 (0 = switch to RUN mode, 1 = switch to STOP mode)
Receive	% R M \$? BCC CR	? = 0 - 1 (0 = RUN mode, 1 = STOP mode)

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

%	R	M	!	Error code (3-digit)	BCC	CR
---	---	---	---	----------------------	-----	----

The following error codes may appear:

3-digit error code	Meaning
240	A number outside the range 0 to 1 has been specified.



◆ **EXAMPLE**

This is how you switch to RUN mode via the serial interface:

Send	% R M 0 * * CR
Receive	% R M \$ 0 2 E CR

13.3.12 Reset the Error Signal

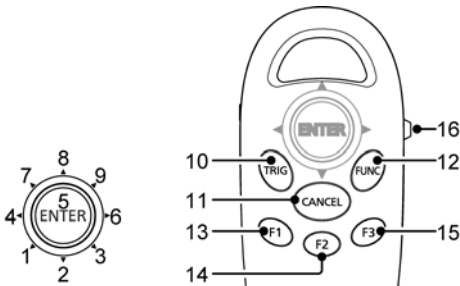
To reset the Error signal, send the following command.

Send	% E BCC CR	BCC = 60 or **
Receive	% E \$ BCC (44) CR	

13.3.13 Keypad Emulation

To emulate the keypad buttons, send the following command.

Send	% K s ? ? BCC CR	s = 0 - 1 (on/off switch of the <SHIFT> key; 0 = off, 1 = on) ?? = 01 - 16 (see figures below)
Receive	No response from Imagechecker	



Decimal codes for keypad emulation

13.3.14 Cancel a Specific Operation

Some operations can be canceled with a serial command:

- The Imagechecker is executing a serial command
- The Imagechecker is waiting for the input of an individual trigger signal
- The Imagechecker is waiting to output data after an inspection is complete
- The Imagechecker is re-registering a template.

Send	% C C BCC CR	BCC = 25 or **
Receive	% C C \$ BCC (01) CR	

13.3.15 Layout Switch

To switch to a different layout, send the following command.

Send	% I ? ? BCC CR	?? = 00 - 31 (layout number)
Receive	% I \$ BCC (48) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

% P S ! Error code (3-digit) BCC CR

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
245	The Imagechecker is in RUN mode, but the SETUP menu is active. You cannot switch the layout.
246	<ul style="list-style-type: none"> • The command contains a layout number outside the range of 00 to 31. • No layout has been registered The specified layout number does not exist.

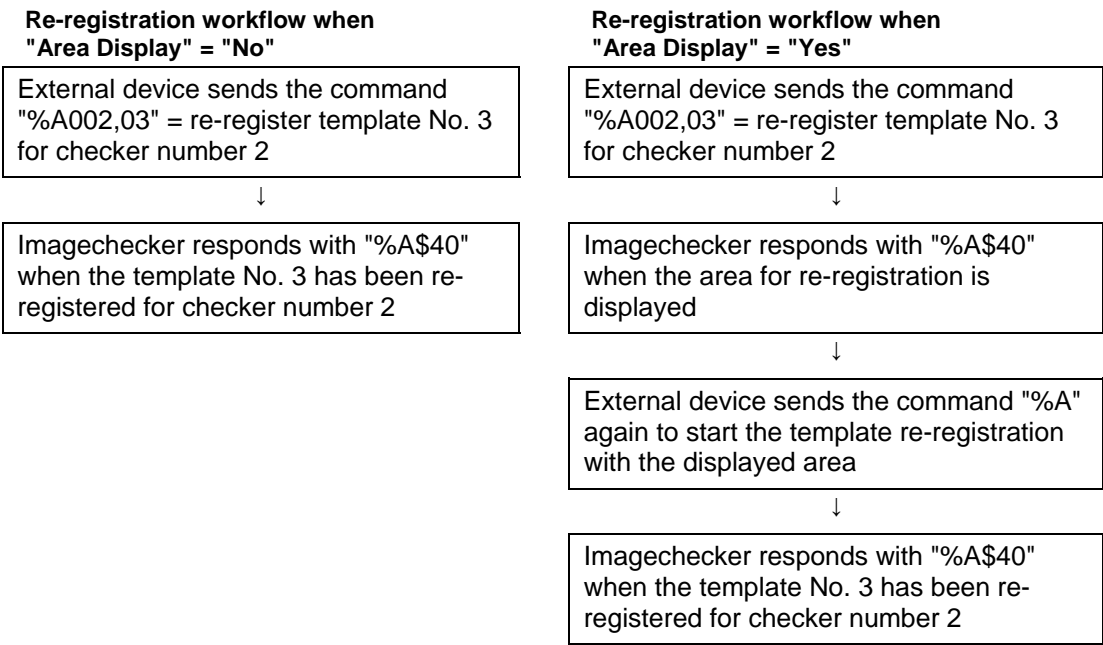
13.3.16 Template Registration

You can re-register the template image for the smart matching or the contour matching inspection checker with a serial command from an external device. Depending on whether you have set the option "Area Display" (**ENVIRONMENT** → **System Settings** → **Operation**) to "Yes" or "No", you need to send an extra command.



◆ NOTE

You can only re-register templates for inspection checkers. For smart matching checkers used in position/rotation adjustment it is not possible to re-register templates via a serial command.



13.3.16.1 When "Area Display" is Set to "No"

To re-register a template, send the following command:

Send	% A c c c , ? ? BCC CR	ccc = 000 - 999 (checker number) ?? = 00 - 63 (template number)
Receive	% A \$ BCC (40) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 0:

%	A	!	Error code (3-digit)	BCC	CR
---	---	---	----------------------	-----	----

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
230	<ul style="list-style-type: none">The Imagechecker received a template setting command when "Camera Trigger" is set to "Detect Trigger (common)".The Imagechecker received a template setting command when "Continuous Inspection" is set to "Automatic" (repeated start).
231	<ul style="list-style-type: none">The specified checker or template number does not exist.The command contains a checker number outside the range of 000 to 999 or a template number outside the range of 00 to 63.
232	The template cannot be registered because "Template Setting" = "Use the Last Image", but no image has been captured since the Imagechecker has been switched on.

3-digit error code	Meaning
233	<ul style="list-style-type: none"> The image to be used for template registration has no features. The checker uses position / rotation adjustment and an error has occurred in the position / rotation adjustment checker.



◆ EXAMPLE

This is how you re-register template number 1 of checker number 5:

Send	% A 0 0 5 , 0 1 * * CR
Receive	% A \$ 4 0 CR

13.3.16.2 When "Area Display" is Set to "Yes"

To re-register a template, send the following commands:

Send 1	% A c c c , ? ? BCC CR	ccc = 000 - 999 (checker number) ?? = 00 - 63 (template number)
Receive 1	% A \$ BCC (40) CR	
Send 2	% A BCC CR	BCC = 64 or **
Receive 2	% A \$ BCC (40) CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 0:

% A ! Error code (3-digit) BCC CR

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
230	<ul style="list-style-type: none"> The Imagechecker received a template setting command when "Camera Trigger" is set to "Detect Trigger (common)". The Imagechecker received a template setting command when "Continuous Inspection" is set to "Automatic" (repeated start).
231	<ul style="list-style-type: none"> The specified checker or template number does not exist. The command contains a checker number outside the range of 000 to 999 or a template number outside the range of 00 to 63.
232	The template cannot be registered because "Template Setting" = "Use the Last Image", but no image has been captured since the Imagechecker has been switched on.
233	<ul style="list-style-type: none"> The image to be used for template registration has no features. The checker uses position / rotation adjustment and an error has occurred in the position / rotation adjustment checker.



◆ EXAMPLE

This is how you re-register template number 1 of checker number 5:

Send 1	% A 0 0 5 , 0 1 * * CR
Receive 1	% A \$ 4 0 CR
Send 2	% A 6 4 CR
Receive 2	% A \$ 4 0 CR

13.3.17 Read Values

You can read settings and inspection results. Depending on whether you read one or two values, the Imagechecker responds differently.

13.3.17.1 One Value (Execution Time, Total Judgement, Upper or Lower Limit)

To read one single value, send the following command.

Send	% P R Parameter BCC CR
Receive	% P R Parameter = Data BCC CR

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

% P R ! Error code (3-digit) BCC CR

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
251	The parameter is undefined.
252	The specified parameter does not exist.

◆ **EXAMPLE**

This is how you read 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

13.3.17.2 Two Values (Upper and Lower Limit, Slice Levels)

To read two values, send the following command.

Send	% P R P Parameter BCC CR
Receive	% P R P \$ Parameter = Data1 , Data2 BCC CR

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

% P R P ! Error code (3-digit) BCC CR

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
251	The parameter is undefined.
252	The specified parameter does not exist.

◆ **EXAMPLE**

This is how you read out the upper and lower value of a slice level:

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 = 1 2 8 , 2 5 5 BCC CR

13.3.18 Write Values

You can change setting values via the serial interface. Depending on whether you write one or two values, the Imagechecker responds differently.

13.3.18.1 One Value (General Register, Maximum or Minimum Value)

To write one single value, send the following command.

Send	%	P	W	Parameter	=	Data	BCC	CR
Receive	%	P	W	\$	Parameter	BCC	CR	

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

%	P	W	!	Error code (3-digit)	BCC	CR
---	---	---	---	----------------------	-----	----

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
251	<ul style="list-style-type: none"> The parameter is undefined. The parameter values are such that the maximum value is smaller than the minimum value.
252	<ul style="list-style-type: none"> The specified parameter does not exist. The specified parameter value is outside the valid range, e.g. upper value for slice level greater than 255).



◆ EXAMPLE

This is how you write the value "3.14" to the 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				

13.3.18.2 Two Values (Upper and Lower Limit, Slice Levels)

To write two values, send the following command.

Send	% P W P	Parameter	=	Data1	,	Data2	BCC	CR
Receive	% P W P	\$	Parameter	BCC	CR			

Error response message

The Imagechecker sends this error message and turns ON the signal Error 1:

% P W P	!	Error code (3-digit)	BCC	CR
---------	---	----------------------	-----	----

The following error codes may appear:

3-digit error code	Meaning
200	The operation has been stopped.
251	<ul style="list-style-type: none"> The parameter is undefined. The parameter values are such that the maximum value is smaller than the minimum value.
252	<ul style="list-style-type: none"> The specified parameter does not exist. The specified parameter value is outside the valid range, e.g. upper value for slice level greater than 255).



◆ EXAMPLE

This is how you set the maximum value to "100" and the minimum value to "50" for numerical calculation number 10:

Send	% P W P	C A C O 1 0	=	1 0 0	,	5 0	BCC	CR
Receive	% P W P	\$	C A C O 1 0	BCC	CR			

13.4 Details for Reading and Writing Values

The tables list the minimum and maximum values for the parameters you can set with a serial command and explain the meaning of the responses.

13.4.1 System Values

Item	Parameter	Read	Write	Minimum value	Maximum value	Details
Inspection time	SYS_TIME1	Yes		0.00	99999.00	
Inspection Frequency	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: OPERATION, 1: SETUP
Operation Status	SYS_RUN	Yes		0	1	0: RUN, 1: STOP
Current Type No.	SYS_TYPE	Yes		0	255	
Date	SYS_DATE	Yes				YYYY/MM/DD (4-digit year/ 2-digit month/ 2-digit day)
Time	SYS_TIME	Yes				HH:MM:SS (2-digit hour: 2-digit minute: 2-digit second)
General Register 0	SYS:REG0	Yes	Yes	0	9999999.999	You can set up to 3 digits after the decimal point.
General Register 1	SYS:REG1	Yes	Yes			
General Register 2	SYS:REG2	Yes	Yes			
General Register 3	SYS:REG3	Yes	Yes			
General Register 4	SYS:REG4	Yes	Yes			
General Register 5	SYS:REG5	Yes	Yes			
General Register 6	SYS:REG6	Yes	Yes			
General Register 7	SYS:REG7	Yes	Yes			

13.4.2 Slice Levels

The character "?" stands for the slice level group A - H.

Item	Parameter	Read	Write	Minimum value	Maximum value	Details
Maximum value	BLV:H?	Yes	Yes	0	255	
Minimum value	BLV:L?	Yes	Yes	0	255	
Maximum and Minimum values	BLV:PAIR?	Yes	Yes	0	255	Data 1 = Min. Data 2 = Max.

13.4.3 Checkers

The string "nnn" stands for the checker number 000 - 999.

	Parameter	R	W	Minimum value	Maximum value	Details
Line						
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	See note
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	See note
Binary Window						
OK Judge. Max.	BWCnnn:MAX	Yes	Yes	0	1920000	
OK Judge. Min.	BWCnnn:MIN	Yes	Yes	0	1920000	
OK Judge. Max and Min.	BWCnnn:LPAIR	Yes	Yes	0	1920000	See note
Gray Window						
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	See note
Binary Edge						
OK Judge. Max.	BECnnn:MAX	Yes	Yes	0	256	
OK Judge. Min.	BECnnn:MIN	Yes	Yes	0	256	

	Parameter	R	W	Minimum value	Maximum value	Details
OK Judge. Max and Min.	BECnnn:LPAIR	Yes	Yes	0	256	See note
Gray Edge						
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	See note
Feature Extraction						
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	See note
Smart Matching						
"Max. Count" 1st step	SMCnnn:CNT.1	Yes	Yes	1	256	
"Max. Count" 2nd step	SMCnnn:CNT.2	Yes	Yes	1	256	
"Max. Count" 3rd step	SMCnnn:CNT.3	Yes	Yes	1	256	
"Max. Count" 4th step	SMCnnn:CNT.4	Yes	Yes	1	256	
"Max. Count" 5th step	SMCnnn:CNT.5	Yes	Yes	1	256	
"Max. Count" 6th step	SMCnnn:CNT.6	Yes	Yes	1	256	
Max. OK No. of Subtracted Objects	SMCnnn:DCNTMAX	Yes	Yes	0	128	
Flaw Detection						
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	See note
Connector (Binary Window)						
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	See note

	Parameter	R	W	Minimum value	Maximum value	Details
Judge. Max.	CBWnnn:MAX.ss	Yes	Yes	0	62500	
Judge. Min.	CBWnnn:MIN.ss	Yes	Yes	0	62500	
Judge. Max. and Min.	CBWnnn:LPAIR.ss	Yes	Yes	0	62500	See note
Connector (Gray Window)						
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	See note
Judge. Max.	CGWnnn:MAX.ss	Yes	Yes	0	255	
Judge. Min.	CGWnnn:MIN.ss	Yes	Yes	0	255	
Judge. Max. and Min.	CGWnnn:LPAIR.ss	Yes	Yes	0	255	See note
Connector (Gray Edge)						
Max. Judge. Pitch	CGEnnn:PMAX	Yes	Yes	0	99999999.999	
Min. Judge. Pitch	CGEnnn:PMIN	Yes	Yes	0	99999999.999	
Max. and Min. Judge. Pitch	CGEnnn:PPAIR	Yes	Yes	0	99999999.999	See note
Max. Distance Difference	CGEnnn:UMAX	Yes	Yes	0	99999999.999	
Min. Distance Difference	CGEnnn:UMIN	Yes	Yes	0	99999999.999	
Max. and Min. Distance Difference	CGEnnn:UPAIR	Yes	Yes	0	99999999.999	See note



◆ NOTE

R = Read, W = Write, data 1 = minimum, data 2 = maximum.

13.4.4 Numerical Calculation Formulas

The string "nnn" stands for the formula number 000 - 999.

	Parameter	Read	Write	Minimum value	Maximum value	Details
Maximum	CACnnn:MAX	Yes	Yes	-2147483648.000 to +2147483647.000, which is - (2^{31}) to $(2^{31}-1)$		
Minimum	CACnnn:MIN	Yes	Yes			
Maximum and Minimum	CACnnn:LPAIR	Yes	Yes			Data 1 = Min. Data 2 = Max.

Chapter 14

Image Saving and Output

14.1 Introduction to Image Saving

Captured inspection images can be saved in different locations:

- the Imagechecker
- the PC via Ethernet output
- the SD memory card

This is useful when you need to change checker settings and run a test.



◆ NOTE

- **Only gray-value images can be saved and/or output.**
- **It is not possible to output preprocessed images.**
- **The maximum number of images to be saved depends on the number of cameras and the camera type or combination of camera types you have connected.**

14.1.1 The Imagechecker's Image Memory

The Imagechecker is equipped with several memory areas, one of which is dedicated to store camera images for inspection.

Destination	Ref. No.	Memory type or path	Description
PV500	1	Inspection image memory	Stores all images captured by the cameras. Inspection is executed on these images.
	2	Test image memory	Contains copies of the last image in the Inspection image memory. This is the image used to make checker setting and the image you see when you display the memory image in the SETUP menu. You can call up the images from the Save image memory (No. 3) and a SD memory card (No.5 and 6) 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 498 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)	7	The folder specified by the Image Receiver software	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.

14.1.2 Maximum Number of Images to Be Saved

The maximum number of images to be saved depends on the number of cameras and the camera type or combination of camera types you have connected.

Images are saved in sets, i.e. 2 images for the 2-camera Imagechecker (images from camera 0 and camera 1) and 4 images for the 4-camera type (images from camera 0 to camera 3).

Quad-speed camera or ultra compact camera only	Number of cameras			
	1	2	3	4
Number of image sets that can be saved	498	299	195	143

2-mega-pixel camera	Number of cameras			
	1	2	3	4
Number of image sets that can be saved	498	299	195	143

Number of quad-speed or ultra-compact camera s	1			2		3
Number of 2-mega-pixel cameras	1	2	3	1	2	1
Number of image sets that can be saved	73	33	18	62	30	54

14.1.3 Image Memory Map

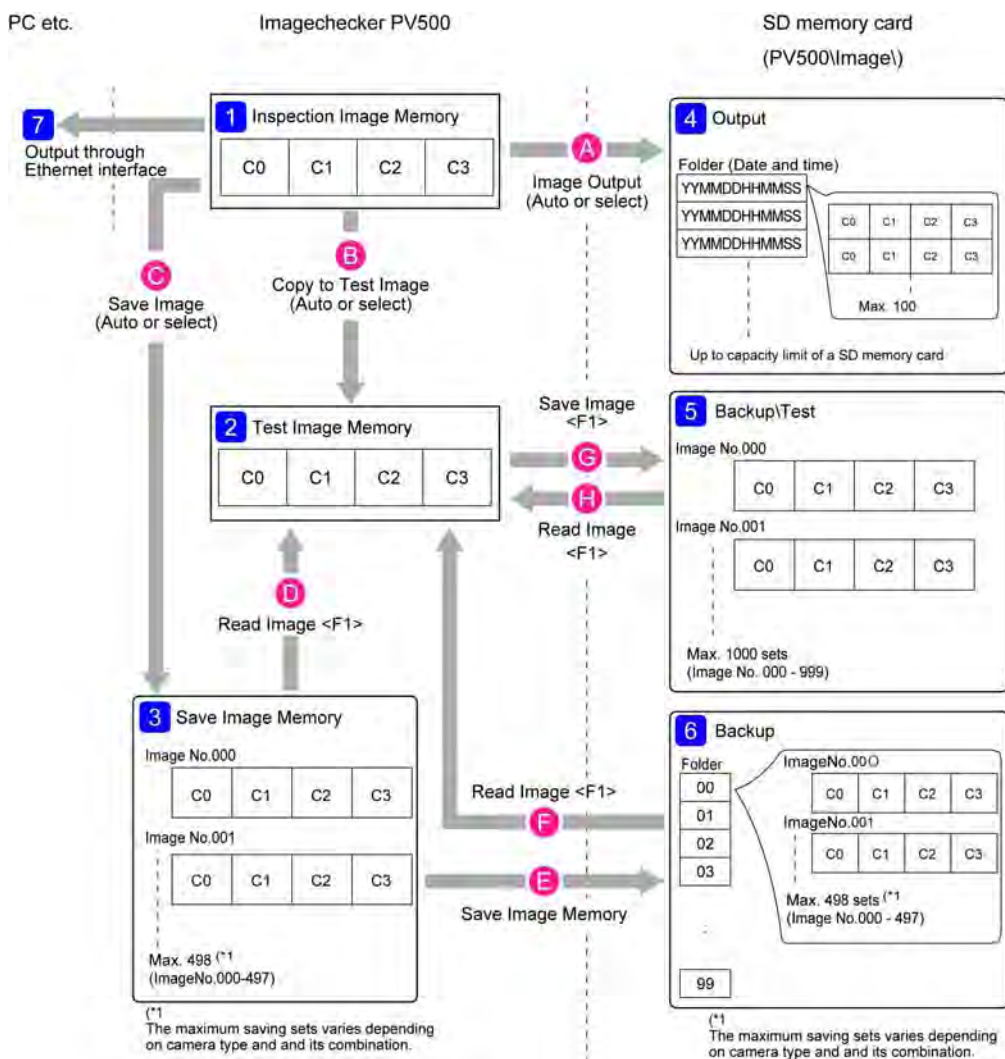


Image handling in the memory areas

Item	Reference
A	Image output to SD memory card (see page 465)
B	Copying image to test image memory (see page 464)
C	Saving image in image memory (see page 461)
D	Reading image from image memory
E	Back up image from image memory to the SD memory card (see page 461)
F	Reading image from the SD memory card
G	Back up test image to the SD memory card (see page 465)
H	Read test image from the SD memory card

14.1.4 Saving Images in the Image Memory

You can save up to 498 sets of images in the Imagechecker's image memory (see page 459). If you need to save more images, back them up on the SD memory card (see page 465).

To save images in the image memory, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"ENVIRONMENT"** from the menu bar and press **<ENTER>**

If the RUN menu is active, press **<OPE/SET>** to activate the SETUP menu.

2. Select **"Input/Output"** from the submenu and press **<ENTER>**
3. Select **"Save Image Memory"**
4. Set the **"Saving Condition"**



With "All" all images are saved, with "NG Judgement" only the images are saved when the judgement formula entered in "Save Img Memory" is judged to be NG (see page 355). If no judgement formula has been set up as the saving trigger, no image will be saved.

5. Set **"Overwrite"** to define what should happen when the maximum number of images has been saved

With "No", image saving is terminated (inspection will continue as normal). With "Yes"; older images will be overwritten.

14.1.4.1 Backing up Images from the Save Image Memory

When the capacity of the image memory is exhausted, but you need to keep the images, back them up to a SD memory card. Please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"SAVE/READ"** from the menu bar and press **<ENTER>**

If the RUN menu is active, press **<OPE/SET>** to activate the SETUP menu.

2. Select "Save Image Memory" from the submenu and press <ENTER>



3. Select a folder number

Folder numbers 00 to 99 are available. If you specify a folder that already contains image data, you will be asked whether you want to overwrite the existing data.

4. Select "Yes" and press <ENTER>

5. Press <CANCEL> to close the window



◆ NOTE

It is possible to back up images by inputting a signal from an external device (see page 441).

14.1.4.2 Deleting Images from the Save Image Memory

To delete all images from the image memory, please proceed as follows:



◆ Procedure

1. In the SETUP menu, select "SAVE/READ" from the menu bar and press <ENTER>

If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

2. Select "Clear Image Memory" from the submenu and press <ENTER>

A message asking for confirmation is displayed.

3. Select "Yes" and press <ENTER>



◆ NOTE

It is possible to clear the save image memory by inputting a signal from an external device (see page 441).

14.2 The Test Image Memory

The test image memory can access images from the save image memory or a SD memory card in the SETUP menu to set checkers and execute a test.

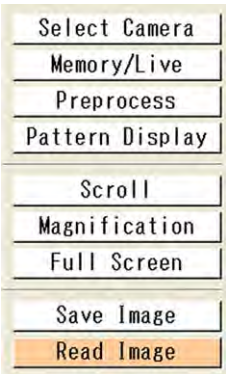
14.2.1 Reading Images from the Test Image Memory

To read images from the test image memory, please proceed as follows:

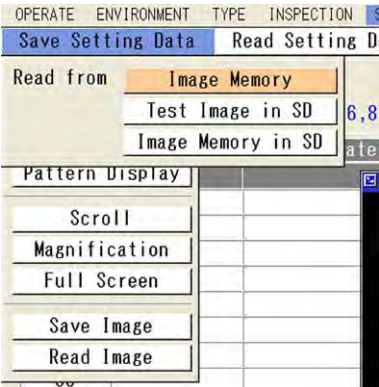


◆ Procedure

1. In the **SETUP** menu, press <F1> to open the image menu bar
If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.
2. Select "Read Image"



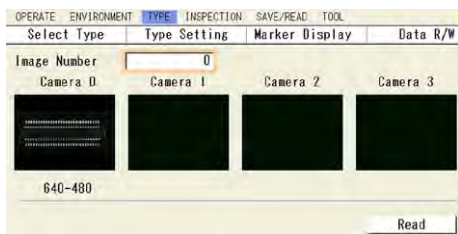
3. Specify the image location



When you select "Image Memory in SD", you need to specify a folder number.

4. Specify the image number

The images are displayed accordingly.



5. Select [Read] and press <ENTER>

The selected image is displayed in the camera window. If it is not displayed, use the image menu to display the memory image. (see page 75)

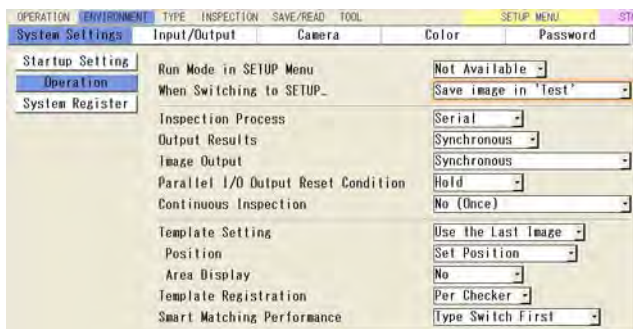
14.2.2 Saving Images to the Test Image Memory

To save images to the test image memory, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **ENVIRONMENT** and press <ENTER>
If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.
2. Select "System Settings" from the submenu and press <ENTER>
3. Select "Operation" and press <ENTER>
4. Set "When Switching to SETUP..." to "Save image in 'Test'" and press <ENTER>



14.3 Image Output to External Devices

You can output images to the SD memory card or via the Ethernet to a PC. Depending on the output destinations, you need to make different settings.

- **Image output to SD Card**
When you select the SD memory card as the output destination, the Imagechecker creates a new folder in \Panasonic MEW Vision\PV500\Image\Output\ and saves the image files in it. The folder name gives time and date information as follows:
YYMMDDHHMMSS = year, month, day, hour, minute, second.
- **Image output to Ethernet**
Use port number 8602 of the Imagechecker to output images to the PC. You will need to install the special software "Image Receiver". You can download the software from <http://www.panasonic-electric-works.com/peweu/en/html/21903.php> when you have filled in the user registration (free of charge).

Setting	Options	Description
Destination	None (default)	No image output
	SD memory card	Images fulfilling the "Output Conditions" will be output to the SD memory card.
	Ethernet	Images fulfilling the "Output Conditions" will be output via the Ethernet.
Output conditions	All images (default)	All inspection images will be output
	NG judgement	Images are output when the judgement formula entered in "Image Output" is judged to be NG (see page 355). If no judgement formula has been set up as the output trigger, no image will be output.
	At interval	Images are output every nth inspection (n = setting of "Interval")
	Command reception	Images are output when the function "Output latest image" has been assigned to one of the Assign inputs (see page 26).
Interval	2 to 2000	Only available when "Output Conditions" = "At Interval". The entry "10" means images will be output at the first inspection and then every tenth inspection: 1, 11, 21, 31 etc. Note: If the option "Image Output" (ENVIRONMENT → System Settings → Operation) is set to "Async. (inspection first)", it is possible that not all images eligible for output can be output (see page 397).
Camera No. 0-4 Output	No (default) / Yes	Activate image output for each camera.
File header	Image_	You can enter text with up to 8 characters.
Additional information 0 - 4	None (default)	No additional information is included in the image file name.
Additional information 0 - 4	Type No.	The type number 000 to 255 is included.
Additional information 0 - 4	Date	The current date as stored in the built-in calendar (see page 472) is included.
Additional information 0 - 4	Time	The current time as stored in the built-in calendar (see page 472) is included.
Additional information 0 - 4	Total judgement	Includes the total judgement of the image into the file name (OK/NG).

Setting	Options	Description
Overwrite	No (default) / Yes	Select whether you want to overwrite older output files or terminate the image output when the saving capacity of the SD memory card is exhausted.
No. of folders	1 to 1000 (default: 10)	You can save up to 100 image files per folder on the SD memory card. Use this option to determine how many image-saving folders may be created on the SD memory card. The value range is 1 to 1000 (default: 10 folders).
ERR signal ON at output error	No (default) / Yes	Only available when "Destination" = "Ethernet". To turn on the signal Error0 when an error occurs, select "Yes".
Forced outage ON at output error	No (default) / Yes	Only available when "Destination" = "Ethernet". To terminate the inspection when an error occurs, select "Yes". In the case of an output error, check the connection between the Imagechecker and the PC. When you have set the option "Image Output" to "Synchronous" (ENVIRONMENT → System Settings → Operation), images can be resent.

The output file name consists of the following items and can be up to 50 digits long:

- File header (default: "Image_") of up to 8 characters
- Scan count (7 digits)
- Number of the camera that captured the image (2 digits)
- Image number (7 digits)
- Optional information as specified in the options "Additional Information 0-3"



◆ EXAMPLE

File Header: Image_
 Additional information 0: Type No. 50)
 Additional information 1: Date 20071215
 Additional information 2: Total Judgement NG
 Additional information 3: None
 Camera No.: Camera 0
 Scan Count: 100

Name of image output file: Image_050_071215_NG_C0_0000100.bmp

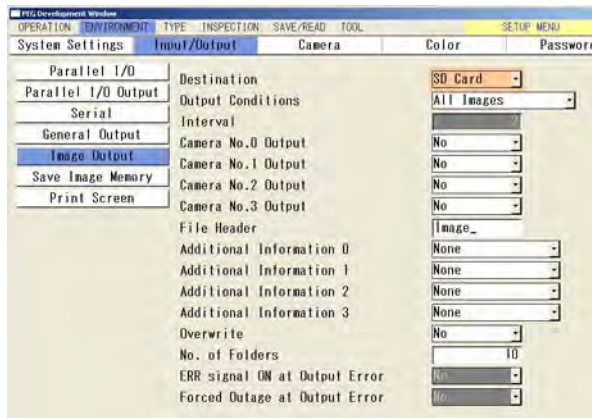
To activate image output, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select "**ENVIRONMENT**" from the menu bar and press **<ENTER>**
 If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select "**Input/Output**" from the submenu and press **<ENTER>**
3. Select "**Image Output**"

4. Select the output destination under "Destination"



5. Specify the "Output Conditions"

Select whether to output all or only NG pictures (triggered by a judgement formula (see page 355)) or whether to output images at a regular interval or only when receiving the command to do so.

6. Set "Output" to "Yes" for the camera images that should be output

7. Change or leave the "File Header"

8. Select whether or not to include additional information in the file name

9. Make destination-specific settings

For the SD memory card, set the number of folders and select whether or not to overwrite old images. For Ethernet, set how to handle output errors.

Chapter 15

Tool Menu

15.1 Overview

The **TOOL** menu offers some additional functions:

Submenu	Contents
PC Communication	Use this option to communicate with a PC. The PC needs to have the software PVWIN installed. For further information refer to the online help of PVWIN.
General	<p>The general configuration covers the following areas:</p> <ul style="list-style-type: none"> • Startup setting (see page 471) • Network (see page 471) • Calendar (see page 472) • Language (see page 473) • Initialize (see page 474)
SD Property	Displays information about the SD memory card and lists the contents saved on the card.
Eject SD Card	Use this option to remove the SD memory card safely from the Imagechecker.
Information	<p>Displays the following information about the Imagechecker:</p> <ul style="list-style-type: none"> • Model (fixed) • Version number you are using • Free space for setting data • Free space for template data (template 0 space is for camera 0 and camera 1, template 1 space is for camera 2 and camera 3) • Free storage space • Total capacity of SD memory card (only when an SD card is inserted) • Free space on the SD memory card (only when an SD card is inserted) • Name of the Imagechecker (user-definable (see page 472))
Setting Help	<p>Use the setting help tools to adjust camera and lighting settings properly before performing inspections.</p> <ul style="list-style-type: none"> • Focus Adjustment (see page 475) • Aperture Adjustment (see page 477) • Gray Data Analysis (see page 477) • Capture Delay Control (see page 479) • I/O Test (see page 479) • Communication Test (see page 480)
Update	<p>Use this option to update the following items:</p> <ul style="list-style-type: none"> • Firmware • Splash screen

15.2 General

This submenu contains some general configuration options.

15.2.1 Startup Setting

Use this option to specify the memory area of the Imagechecker which should be read after switching the power on. To specify which type and layout to use after starting the Imagechecker, use **ENVIRONMENT** → **System Settings** → **Startup Setting**.

15.2.2 Network

When you are using Ethernet communication, you need to enter a device name and IP address.

15.2.2.1 Entering an IP Address

To enter or change an IP address, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"TOOL"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"General"** from the submenu and press **<ENTER>**
3. Select **"Network"** and press **<ENTER>**

The cursor jumps to the first field of the IP address.

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL	SETUP
PC Communi.	General	SD Property	Eject SD Card			
Startup Setting	IP Address	192	168	1	6	
Network	Subnet Mask	255	255	255	0	
Calendar	Default Gateway	192	168	1	1	
Language	Set					
Initialize	Device Name	ImageCheckerPV500				
		00-C0-8F-B0-70-E2				

4. Press **<ENTER>**
The cursor is now inside the first IP address field.
5. Use the cursor key to set a value and press **<ENTER>**
6. Select the next address field and press **<ENTER>**
7. Repeat for all fields of the IP address, subnet mask and the default gateway

8. To save the settings, select [Set] and press <ENTER>

15.2.2.2 Changing the Device Name

By default, the device name is "ImageCheckerPV500". You can change this by selecting the name field and pressing <ENTER>. Use the virtual keyboard to first delete and then enter a new name.

15.2.3 Calendar

Use the built-in calendar to set the time and date. Output data will use the information from the calendar.



◆ NOTE

Before you start the Imagechecker for the first time, you need to connect the battery (see page 3). The built-in clock and calendar are powered by the battery when the Imagechecker is switched off.

To set the date and time, please proceed as follows:



◆ Procedure

1. In the SETUP menu, select "TOOL" from the menu bar and press <ENTER>
If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.
2. Select "General" from the submenu and press <ENTER>
3. Select "Calendar" and press <ENTER>

The cursor jumps to the field "Date Format".

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL
PC Communi.	General	SD Property	Eject SD Card		
Startup Setting	Date	15/12/2008			
Network	Time	18:13			
Calendar	Date Format	DD/MM/YYYY			
Language	Year	2008			
Initialize	Month	12			
	Day	15			
	Hour	18			
	Minute	13			
	Set				

4. Press <ENTER>
5. Select a date format and press <ENTER>

For example, the date of January 30th in 2010 is displayed as follows

[YYYY/MM/DD] (default):	2010/01/30
[MM/DD/YYYY]:	01/30/2010
[DD/MM/YYYY]:	30/01/2010

6. Press <ENTER>
7. Use the cursor key to set a value and press <ENTER>
8. Repeat for the other date and time fields
9. To save the settings, select [Set] and press <ENTER>

15.2.4 Language

This option switches the menu display language (national language or English). The following languages are available:

- Japanese
- English
- German
- French
- Spanish
- Italian
- Simplified Chinese
- Korean

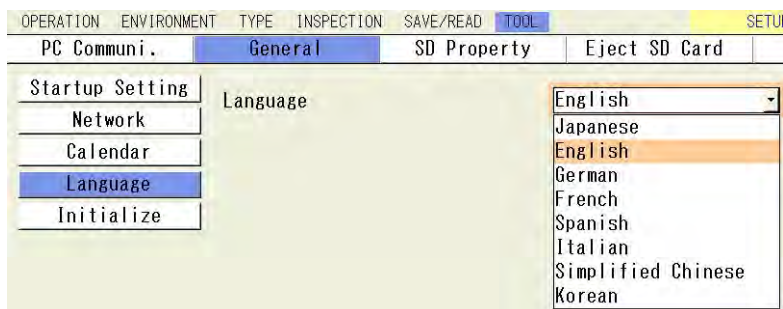
To switch the menu display language, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"TOOL"** from the menu bar and press <ENTER>
If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.
2. Select **"General"** from the submenu and press <ENTER>
3. Select **"Language"** and press <ENTER>

The cursor jumps to the field "Language" and opens the list of available languages.



4. **Select a language and press <ENTER>**

5. **Press <CANCEL>**

A confirmation message appears.

6. **Confirm by pressing <ENTER>**

When you press <CANCEL> to close the menu, another confirmation message appears asking whether you want to save the changes. Select the appropriate option and press <ENTER>.

15.2.5 Initialize

Use this option to reset "Startup Setting" and "Network" to the default values.

Option name	Field name	Default value
Startup setting	Startup Read Area No.	0
Network	IP Address	192.168.1.5
	Subnet Mask	255.255.255.0
	Default Gateway	192.168.1.1
	Device Name	ImageCheckerPV500

15.3 Setting Help

It is important to adjust camera and lighting settings properly before performing inspections. This option helps with adjusting the settings, making it easier to set the focus and the aperture.



◆ **NOTE**

While you are in the submenu "Setting Help", the Imagechecker cannot receive any commands via the serial interface.

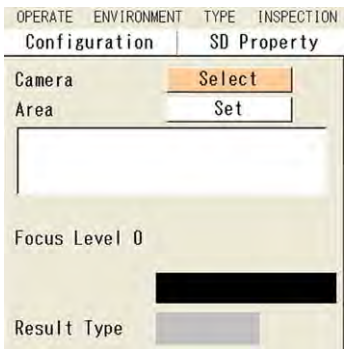
15.3.1 Focus Adjustment

Helps you adjust the focus correctly by watching a bar graph on the screen while turning the focus ring on the camera lens.



◆ **Procedure**

1. In the **SETUP** menu, select **"TOOL"** from the menu bar and press **<ENTER>**
If the RUN menu is active, press **<OPE/SET>** to activate the SETUP menu.
2. Select **"Setting Help"** from the submenu and press **<ENTER>**
3. Select **"Focus Adjustment"** and press **<ENTER>**
4. Press **<ENTER>** on **[Select]** to select the camera

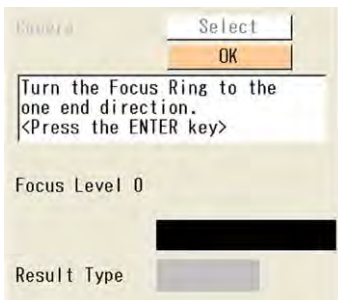


5. Select **[Set]** to set the area
A square shape appears in the middle of the camera image. A table appears at the left of the screen with the coordinates for the rectangle's start (ST) and end point (ED).

6. **Position the shape on a feature of the image and change the size, if necessary**



When you press <ENTER> to confirm the position of the end point, a message asking you to turn the focus ring all the way into one direction is displayed.



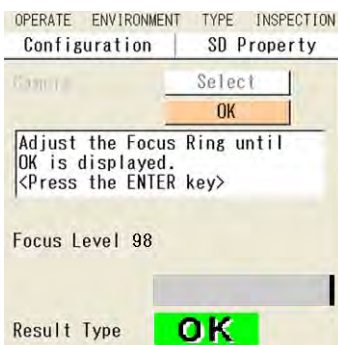
7. **Turn the focus ring in one direction until it has reached the end and press <ENTER>**

A message asking you to turn the focus ring all the way into the other direction is displayed.

8. **Turn the focus ring into the other direction until it has reached the end and press <ENTER>**

A white rectangular bar graph appears in the middle of the status display area. A message asks you to turn the focus ring back until OK is displayed.

9. **Adjust the focus ring slowly until the total judgement in the status display becomes OK**



10. While OK is displayed, press <ENTER> on "YES"

The focus is now adjusted.

15.3.2 Aperture Adjustment

Helps you adjust the aperture correctly by watching a bar graph on the screen while turning the iris ring on the camera lens. Please follow the procedure for "Focus Adjustment" (see page 475).

15.3.3 Gray Data Analysis

Displays gray values along a horizontal or vertical line in a graph. You can use a preprocessed or binarized image.

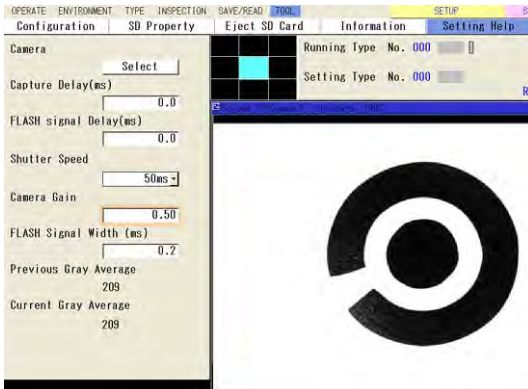
Option	Description
Camera	Selects the camera image
Area direction	Select whether to use a horizontal or vertical line for the gray data analysis.
Area	Sets the line on the camera image for the gray data analysis.
Live/memory	Select the image type
Magnification	Select the zoom factor for the image
Preprocess	Select a preprocessing group
Gray/binary	Select a gray-value or binary image
Scroll	Use this to move the display area when the image has been magnified.



◆ Procedure

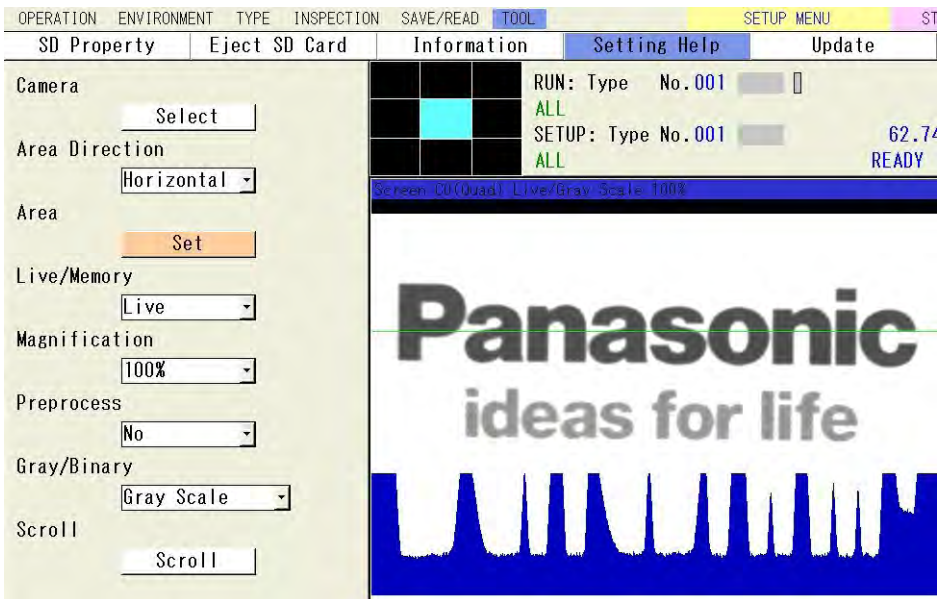
1. In the **SETUP** menu, select **"TOOL"** from the menu bar and press <ENTER>
If the **RUN** menu is active, press <OPE/SET> to activate the **SETUP** menu.
2. Select **"Setting Help"** from the submenu and press <ENTER>
3. Select **"Gray Data Analysis"** and press <ENTER>

4. Press <ENTER> on [Select] to select the camera



5. Use the options on the left to select the image type and display

6. Press <ENTER> on [Set] to set the area



7. Select [Set] to set the area

A line appears in the middle of the camera image. A table appears at the left of the screen with the coordinates for the rectangle's start (ST) and end point (ED). When you have finished setting the area and press <ENTER>, a blue graph appears displaying the gray values along the line. The higher the graph, the brighter the pixel on the line.

15.3.4 Capture Delay Control

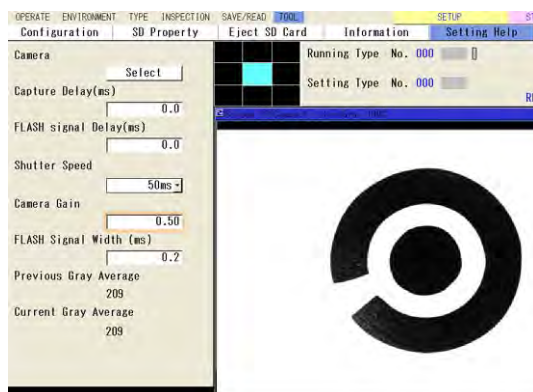
This option allows you to find the optimum image capture settings. When you have found the optimum settings, set the corresponding values in **TYPE** → **Type Setting** → **Camera**.



◆ Procedure

1. In the **SETUP** menu, select **"TOOL"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Setting Help"** from the submenu and press **<ENTER>**
3. Select **"Capture Delay Control"** and press **<ENTER>**
A live image and the current capturing settings are displayed.
4. Press **<ENTER>** on **[Select]** to select the camera
5. Use the options on the left to change the image capturing settings

The next image is captured with the changed settings and the displayed image is updated. The current and the previous average gray value is displayed at the bottom left.



6. When you have found the optimum settings, set the corresponding values in **TYPE** → **Type Setting** → **Camera**

15.3.5 I/O Test

This option allows you to set output signals forcibly and to test input signals from external devices. To test the parallel inputs/outputs, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"TOOL"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.

- 2. Select "Setting Help" from the submenu and press <ENTER>
- 3. Select "I/O Test" and press <ENTER>

The list of outputs and inputs is displayed.

- 4. To force a signal, select it and press <ENTER>

The character "X" appears next to the signal to indicate that it is ON.

OPERATION	ENVIRONMENT	TYPE	INSPECTION	SAVE/READ	TOOL
SD Property		Eject SD Card	Information		
Output					
COM	FLA0	STA0	STA1		
COM	FLA1	STA2	STA3		
COM	FLA2	TYPE	DISP		
COM	FLA3	RENT	ACK		
REN0 X	REN1	R/S	ASN0		
REN2	REN3	ASN1	ASN2		
REDY	ERRO	ASN3	ASN4		
ACPT	ERR1	ASN5	RESV		
RSLT	TACT	COM	COM		
STRB	RUN	N.C	N.C		
OT 0	OT 1	IN 0	IN 1		
OT 2	OT 3	IN 2	IN 3		
OT 4	OT 5	IN 4	IN 5		
OT 6	OT 7	IN 6	IN 7		
OT 8	OT 9	IN 8	IN 9		
OT10	OT11	IN10	IN11		
OT12	OT13	IN12	IN13		
OT14	OT15	IN14	IN15		
COM	COM	COM	COM		
N.C	N.C	N.C	N.C		

- 5. Use the external device to check that the output is working correctly
- 6. Input a signal from the external device to check the inputs



◆ NOTE

When you close the I/O test window, all forced outputs are reset.

15.3.6 Communication Test

Use this option to test the communication with an external device connected via the Com.0 port or via Ethernet.

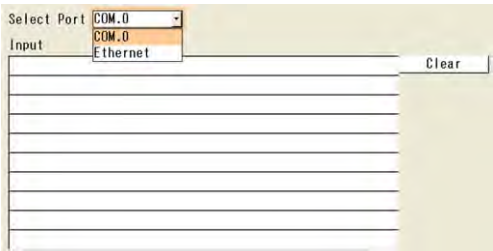
Option	Description
Select port	Select the communication port, Ethernet or Com.0.
Input	Displays the signals received from an external device.
Clear	Deletes the input signals received so far.
Output	Press <ENTER> to display the virtual keyboard to create an output string.

Option	Description
Send	Sends the output you have created

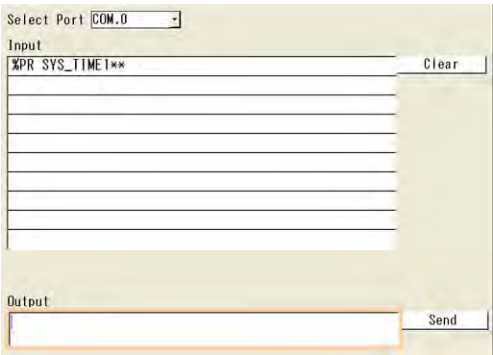


◆ Procedure

1. In the **SETUP** menu, select **"TOOL"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Setting Help"** from the submenu and press **<ENTER>**
3. Select **"Communication Test"** and press **<ENTER>**
4. Select the port



All input signals from an external device are displayed in the "Input" field.



5. To test the output, select the **"Output"** field and press **<ENTER>**
6. Use the virtual keyboard to set an output string
7. Select **[Send]** to send the output to the external device
Check the external device to see whether the sending the output signals has worked correctly.

15.4 Update

Use this option to update your Imagechecker. You will need an SD memory card to perform the update.



◆ Procedure

1. Download the update file from our website

Go to <http://www.panasonic-electric-works.com/peweu/en/html/index.php>, select "Automation products", then "Machine vision", then "PV500". Next, select "Manuals, software, other downloads"

2. Unzip the downloaded ZIP file

3. Copy the unzipped PRG file to the SD memory card

The file must be copied in this folder: \Panasonic MEW Vision\PV500\Update.

4. Insert the SD memory card into the Imagechecker

5. In the SETUP menu, select "TOOL" from the menu bar and press <ENTER>

If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

6. Select "Update" from the submenu and press <ENTER>

7. Select "Firmware" and press <ENTER>

A table is displayed listing all the files in the folder \Panasonic MEW Vision\PV500\Update.

8. Select the update file and press <ENTER>

A confirmation message appears.

9. Select "Yes" and press <ENTER>

This will take a while. While the update is running, do not turn off the power.

10. Reboot the Imagechecker when the update is complete



◆ NOTE

- If the table with the file list is not displayed, check the following:
 - Is the SD memory card inserted correctly?
 - Is the update file located in the correct folder?
- While the update is running, do not turn off the power. Turning off the power during an update may damage the system or stop it from functioning properly.
- While you are in the submenu "Update", the Imagechecker cannot receive any commands via the serial interface.

15.4.1 Splash Screen

Use this option to customize the splash screen displayed when you start the Imagechecker or reset it to the original file.

15.4.1.1 Changing the Splash Screen

You will need an SD memory card to perform the change.



◆ Procedure

1. Prepare the image file you wish to use as a splash screen

The file must be a 24-bit bitmap file named "Logo.bmp" with a maximum size of 1024 x 768 pixels (width x height).

2. Copy the BMP file to the SD memory card

The file must be copied in this folder: \Panasonic MEW Vision\PV500\Logo.

3. Insert the SD memory card into the Imagechecker

4. In the SETUP menu, select "TOOL" from the menu bar and press <ENTER>

If the RUN menu is active, press <OPE/SET> to activate the SETUP menu.

5. Select "Update" from the submenu and press <ENTER>

6. Select "Splash Screen" and press <ENTER>

7. Select "Change" and press <ENTER>

A confirmation message appears.

8. Select "Yes" and press <ENTER>

This will take a while. When the change is complete, a message appears. When you next start the Imagechecker, the new splash screen will be displayed.



◆ NOTE

If you cannot change the splash screen, check the following:

- Is the SD memory card inserted correctly?
- Is the splash screen file located in the correct folder?
- Does the file have the correct name "Logo.bmp"?
- Does the file have the correct format (24 bits, bitmap file)?
- Does it not exceed the size restrictions (1024 x 768 pixels (width x height))?

15.4.1.2 Resetting the Splash Screen

To reset the splash screen to the original file, please proceed as follows:



◆ Procedure

1. In the **SETUP** menu, select **"TOOL"** from the menu bar and press **<ENTER>**
If the **RUN** menu is active, press **<OPE/SET>** to activate the **SETUP** menu.
2. Select **"Update"** from the submenu and press **<ENTER>**
3. Select **"Splash Screen"** and press **<ENTER>**
4. Select **"Delete"** and press **<ENTER>**
A confirmation message appears.
5. Select **"Yes"** and press **<ENTER>**

This will take a while. When the change is complete, a message appears. When you next start the Imagechecker, the default splash screen will be displayed.

Chapter 16

Specifications

16.1 Specification of Parts

16.1.1 PV500

Item		2-Camera type	4-Camera type
CPU		32 bit RISC CPU and DSP	
Maximal number of camera that can be connected		Up to 2	Up to 4
Resolution		<ul style="list-style-type: none"> Quad-speed digital camera, ultra compact digital camera: 640 x 480 pixels (horizontal x vertical) 2-mega-pixel digital camera: 1600 x 1200 pixels (horizontal x vertical) 	
Image processing function		<ul style="list-style-type: none"> Gray: 8 bits, 256 gray values Binary: 8 slice level groups per type Partial imaging: Up to 2 areas can be set. 	
Interface	Serial	RS-232C x 1	
	Parallel input	<ul style="list-style-type: none"> I/O terminal (Phoenix): Input 14 points, I/O connector (MIL connector type): Input 32 points. 24V DC, Bi-directional photo coupler	
	Parallel output	<ul style="list-style-type: none"> I/O terminal (Phoenix): Output 15 points I/O connector (MIL connector type): Output 32 points NPN output type (N at the end of the product number): 5 to 24 V DC, Photo coupler output PNP output type (P at the end of the product number): 5 to 24V DC, PhotoMOS output 	
	Ethernet	Ethernet Port x 1 Media: 10-BASE-T / 100BASE-TX / 1000BASE-T, protocol: TCP/IP	
	Memory card	SD memory card slot x1	
	Monitor output	XGA output (1024 x 768)	
	Setting	Keypad x 1	
Rating	Voltage	24V DC. Operating voltage range: 21.6 to 26.4 V DC (with ripples)	
	Power consumption	1.5A or less	2.0A or less

Item		2-Camera type	4-Camera type
Environmental resistance	Operating temperature range	0°C to +45°C (avoid ice and condensation)	0°C to +40 °C (avoid ice and condensation)
	Operating humidity range	35% to 85% RH (avoid ice and condensation at 25°C)	
	Noise resistance	1000V 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/Z direction	
	Insulation resistance (initial)	100 MΩ or more (500V DC by insulation resistance tester) [*] 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)	500V AC/minute (600V AC/second), cutoff current 10mA [*] 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		About 10 years (at 25°C)	
Weight		Approx. 1600g	

^{*} Tested with the varistor and the condenser at the primary side of the power supply for the internal circuit removed

16.1.2 Keypad

Item		Specification
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 75% RH (avoid ice and condensation at 25°C)
	Operating temperature range	0°C to + 45°C (avoid ice and condensation)
Weight		ANPVP03: 170g, ANPVP10: 425g

16.1.3 Quad-Speed Digital Camera

Item		Specification
Image sensor		Interline transfer method. 1/3-inch CCD, pixel size: 7.4μm x 7.4μm (tetragonal pixel)
Number of effective pixels		659 x 494 pixels (horizontal x vertical)
Scanning method		Non-interlace
Shutter speed		30μs, 100μs, 250μs, 500μs, 1ms, 5ms, 10ms, 50ms, 100ms, 500ms, 1000ms
Lens mount		C-mount
Synchronous method		Internal synchronous
Picture output		Digital output
Rating	Power supply voltage	12V DC +/- 10%
	Power Consumption	235mA or less
Environmental resistance	Operating ambient temperature	0°C to +45°C (avoid ice and condensation)
	Operating ambient humidity	35% to 85% RH (avoid ice and condensation at 25°C)
	Vibration resistance	10 to 55 Hz, 1 sweep per minute, amplitude 1 mm, 30 minutes each in X/Y/Z direction
	Shock resistance	700 m/s ² , 3 times each in X/Y/Z direction
Weight		Approx. 65g (without lens)

16.1.4 2-Mega-Pixel Digital Camera

Item		Specification
Image sensor		Interline transfer method. 1/1.8-inch CCD, pixel size: 4.4 μ m x 4.4 μ m (tetragonal pixel)
Number of effective pixels		1628 x 1236 pixels (horizontal x vertical)
Scanning method		Non-interlace
Shutter speed		30 μ s, 100 μ s, 250 μ s, 500 μ s, 1ms, 5ms, 10ms, 50ms, 100ms, 500ms, 1000ms
Synchronous method		Internal synchronous
Picture output		Digital output
Lens mount		C-mount
Rating	Power supply voltage	12V DC +/- 10%
	Power Consumption	360mA or less
Environmental resistance	Operating ambient temperature	0°C to +40°C (avoid ice and condensation)
	Operating ambient humidity	35% to 85% RH (avoid ice and condensation at 25°C)
	Vibration resistance	10 to 55 Hz, 1 sweep per minute, amplitude 1 mm, 30 minutes each in X/Y/Z direction
	Shock resistance	700 m/s ² , 3 times each in X/Y/Z direction
Weight		Approx. 65 g (without lens)

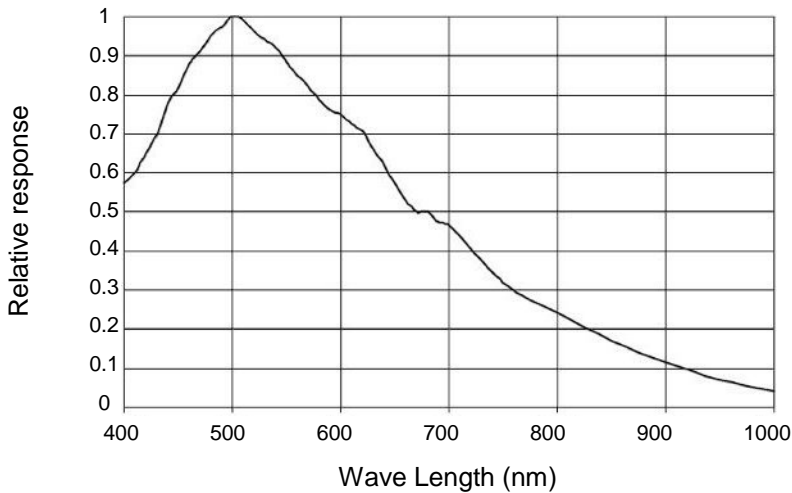
16.1.5 Ultra Compact Double Speed Digital Camera

Item		Specification
Image sensor		Interline transfer method. 1/3-inch CCD, pixel size: 7.4μm x 7.4μm (tetragonal pixel)
Number of effective pixels		659 x 494 pixels (horizontal x vertical)
Scanning method		Non-interlace
Shutter Speed		30μs, 100μs, 250μs, 500μs, 1ms, 5ms, 10ms, 50ms, 100ms, 500ms, 1000ms
Synchronous method		Internal synchronous
Picture output		Digital output
Lens mount		Special mount
Rating	Power supply voltage	12 VDC +/- 10%
	Power Consumption	250mA or less
Environmental resistance	Operating ambient temperature	0°C to +45°C (avoid ice and condensation)
	Operating ambient humidity	35% to 85% RH (avoid ice and condensation at 25°C)
	Vibration resistance	10 to 55 Hz, 1 sweep per minute, half amplitude 1 mm (camera head), 30 minutes each in X/Y/Z direction
	Shock resistance	700 m/s ² , 3 times each in X/Y/Z direction
Weight		Camera head: approx. 185 g (without lens) Camera control unit: approx. 65 g
Cable length		Camera head cable (between camera and camera control unit): Approx. 3m

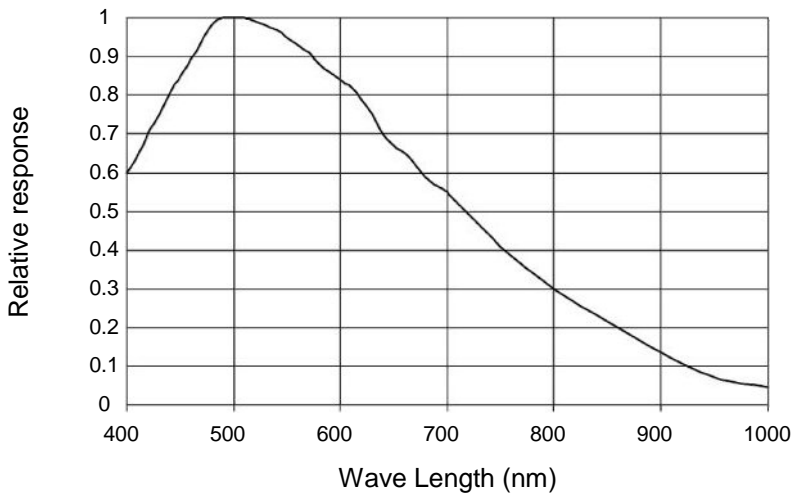
16.2 Spectral Sensitivity

The spectral sensitivity properties are as follows:

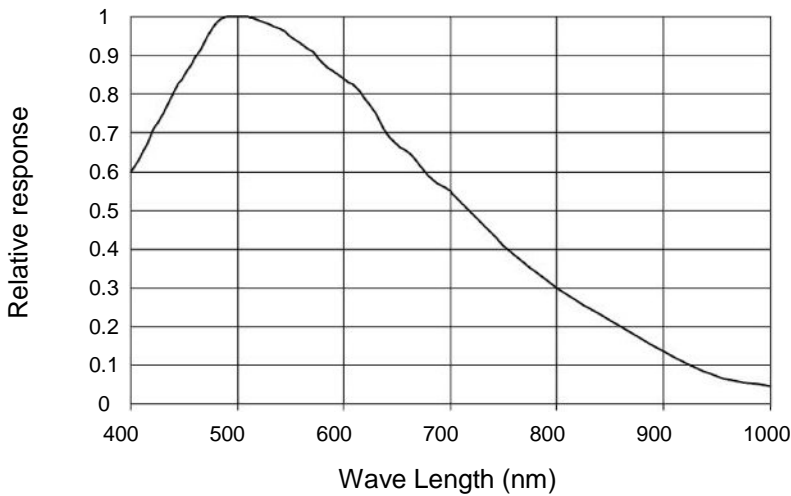
16.2.1 2-Mega-Pixel Digital Camera



16.2.2 Quad-Speed Digital Camera



16.2.3 Ultra Compact Double Speed Digital Camera

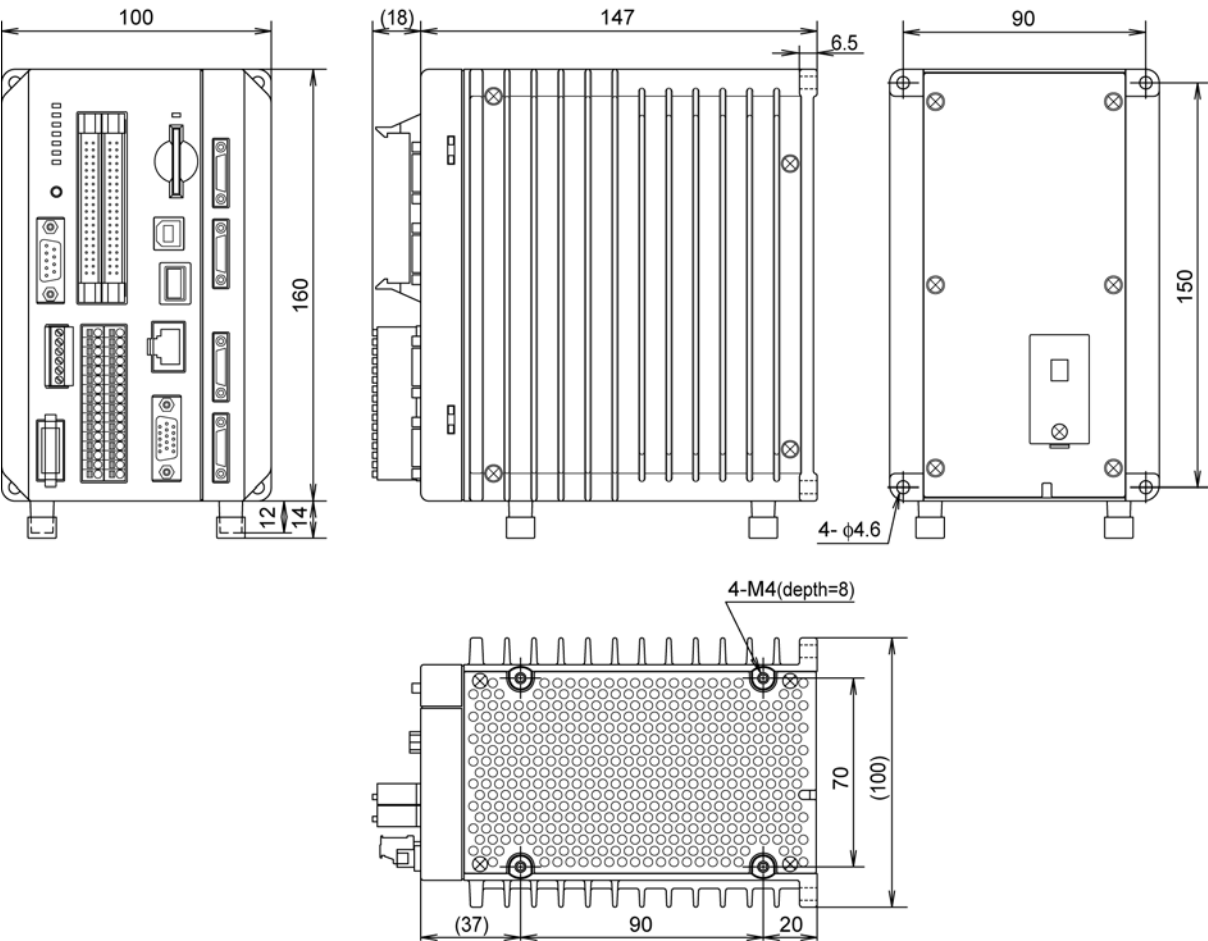


16.3 Product Numbers

Part	Specification	Product number
Imagechecker PV500 with power cable, I/O connector for discrete wires, language support for English, French, German, Italian, Japanese, Korean, Simplified Chinese, and Spanish	2-camera type	ANPV0502ADP
	4-camera type	ANPV0504ADP
Keypad	Cable length: 3m	ANPVP03
	Cable length: 10 m	ANPVP10
Quad-speed digital camera with adapter ring 2.5mm (1mm x 2, 0.5 mm x 1)	Adapted for progressive, C-mount, 120 fps	ANPVC1040
2-Mega-pixel digital camera with adapter ring 2.5mm (1mm x 2, 0.5	Adapted for progressive, C-mount, 30 fps	ANPVC1210
Ultra compact camera	Adapted for progressive, C-mount, 60 fps	ANPVC1021
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: 10m	ANPVC8110R
Serial Cable for COM.0 Port Note: Ferrite cores (equivalent products to ZCAT2035-0930A produced by TDK Corporation) must be attached to both ends of a serial cable	3-line (discrete) cable D-sub 9 pin (male) — 3-line (discrete wire), cable length: 2 m	AIP81842
	Sub-D 9-pin crossing cable Sub-D 9 pin (male) — Sub-D 9 pin (male), cable length: 2 m	AIP81862N
	PC connecting cable Sub-D 9 pin (male) — Sub-D 9 pin (female), cable length: 3m	AFB85853
Backup battery for PV500	Coin-type lithium battery	AFPX-BATT
Power cable for PV500	Cable length: 1m	ANPVH001
Terminal socket	16 pins for I/O port x 2	ANPVH002
	6 pins for COM.1 and COM.2 ports x 1	ANPVH003
I/O connector (MIL connector type)	Connector for discrete wire: 40 pins, x 2	AFP2801
	Connector for flat cable: 40 pins, x2	AFP2802

16.4 Dimensions

16.4.1 Imagechecker PV500



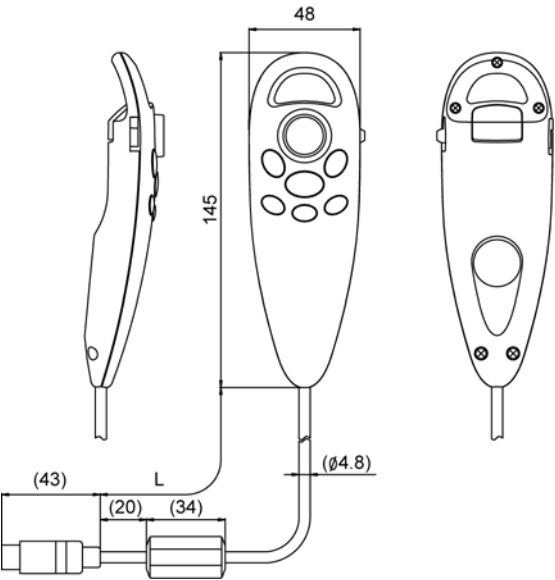
PV500 dimensions

16.4.2 Keypad

L = cable length.

ANPVP03: 3 m

ANPVP10: 10 m

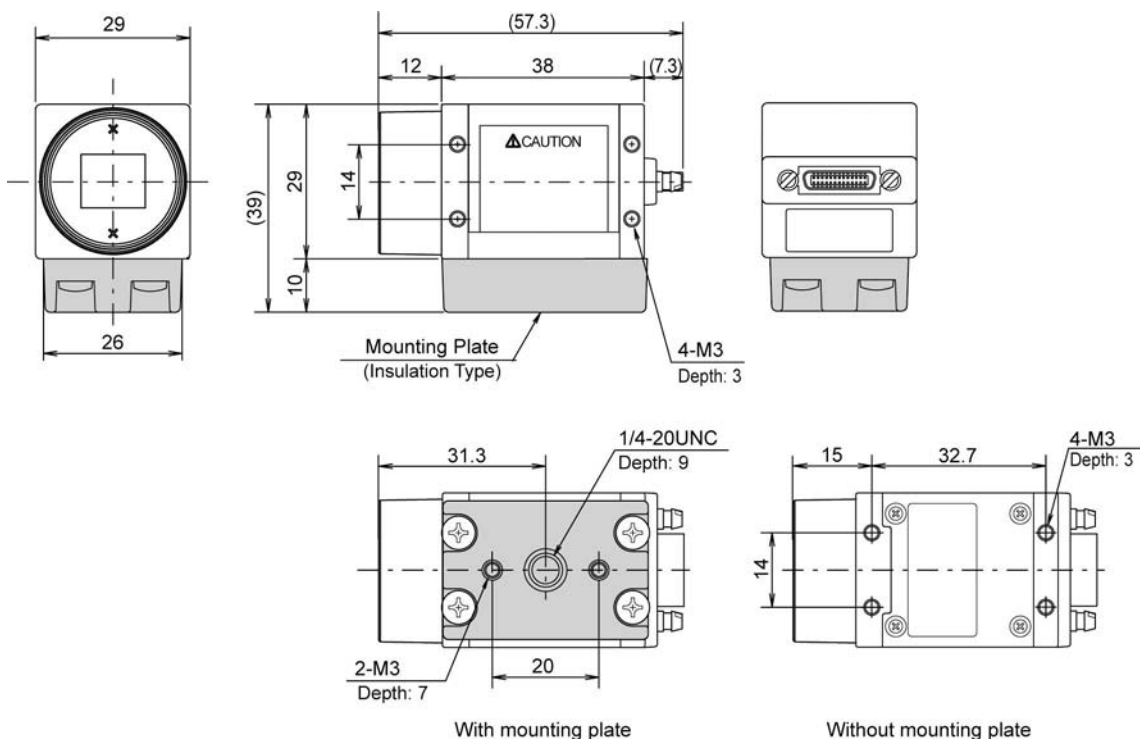


Keypad dimensions

16.4.3 Cameras and Cables

The following dimensions apply.

16.4.3.1 Quad-Speed and 2-Mega Camera



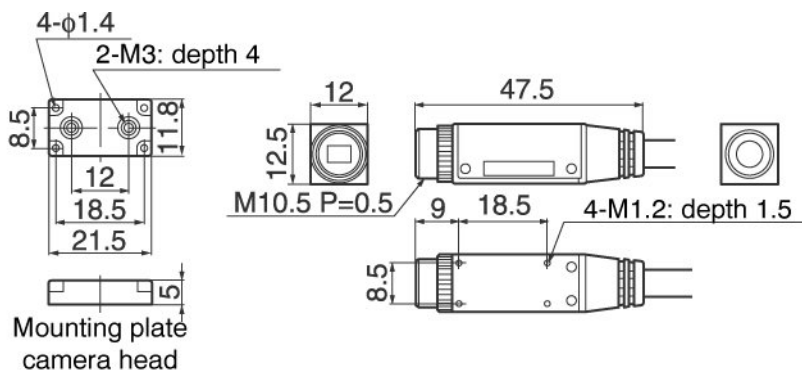
Quad-speed and 2-Mega camera with and without mounting plate



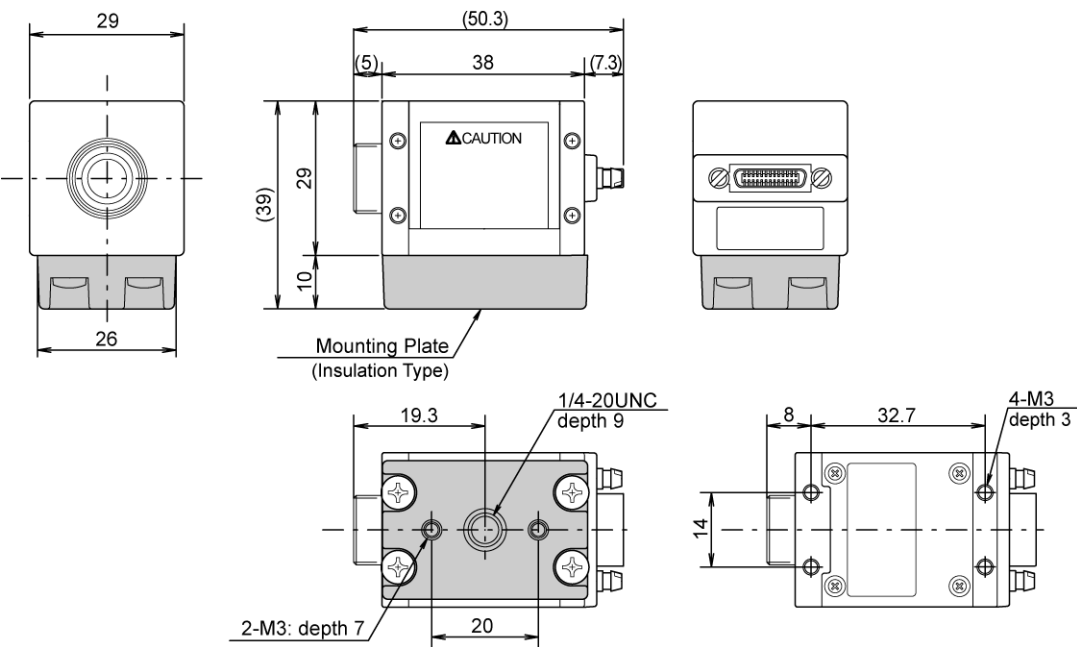
◆ NOTE

The mounting plate can be attached to the four sides of the camera, but not the side with the lens or the cable.

16.4.3.2 Ultra Compact Double Speed Digital Camera



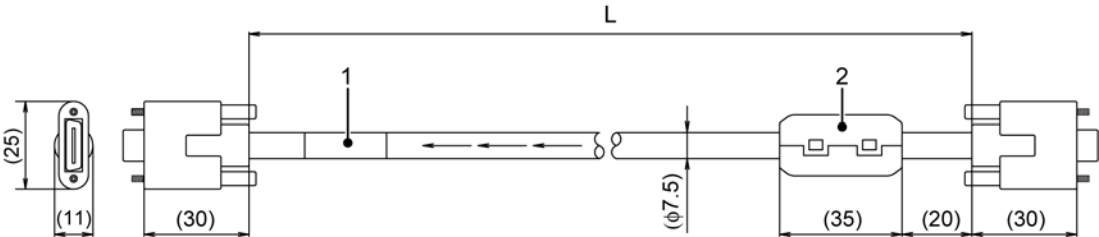
Dimensions of ultra compact camera head



Camera control unit dimensions

16.4.3.3 Camera Cable

1	Product number label
2	Ferrite core
L	Cable length: ANPVC8103: 3 m, ANPVC8105: 5 m, ANPVC8110: 10 m



Camera cable dimensions

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Record of Changes

Manual No.	Date	Description of Changes
ARCT1F443V10END	February 2009	First European edition based on ARCT1F443E and ARCT1F443E-1

North America

Europe

Asia Pacific

China

Japan

Panasonic Electric Works Global Sales Companies



Europe

► Headquarters	Panasonic Electric Works Europe AG	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49(0)8024648-0, Fax +49(0)8024648-111, www.panasonic-electric-works.com
► Austria	Panasonic Electric Works Austria GmbH	Rep. of PEWDE, Josef Madersperger Str. 2, 2362 Biedermannsdorf, Tel. +43(0)223626846, Fax +43(0)223646133, www.panasonic-electric-works.at
► Benelux	PEW Electronic Materials Europe GmbH Panasonic Electric Works Sales Western Europe B.V.	Ennshafenstraße 9, 4470 Enns, Tel. +43(0)7223883, Fax +43(0)722388333, www.panasonic-electronic-materials.com
► Czech Republic	Panasonic Electric Works Czech s.r.o.	De Rijn 4, (Postbus 211), 5684 PJ Best, (5680 AE Best), Netherlands, Tel. +31(0)499372727, Fax +31(0)499372185, www.panasonic-electric-works.nl
► France	Panasonic Electric Works Sales Western Europe B.V.	Prumtyslová 1, 34815 Planá, Tel. (+420-)374799990, Fax (+420-)374799999, www.panasonic-electric-works.cz
► Germany	Panasonic Electric Works Deutschland GmbH	French Branch Office, B.P. 44, 91371 Verrières le Buisson CEDEX, Tél. +33(0)16013 5757, Fax +33(0)1 6013 5758, www.panasonic-electric-works.fr
► Hungary	Panasonic Electric Works Europe AG	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49(0)8024648-0, Fax +49(0)8024648-555, www.panasonic-electric-works.de
► Ireland	Panasonic Electric Works UK Ltd.	Magyarországi Közvetlen Kereskedelmi Képviselő, 1117 Budapest, Neumann János u. 1., Tel. +36(0)14829258, Fax +36(0)14829259, www.panasonic-electric-works.hu
► Italy	Panasonic Electric Works Italia s.r.l. PEW Building Materials Europe s.r.l.	Dublin, Tel. +353(0)14600969, Fax +353(0)14601131, www.panasonic-electric-works.co.uk
► Nordic Countries	Panasonic Electric Works Nordic AB PEW Fire & Security Technology Europe AB	Via del Commercio 3-5 (Z.I. Ferlina), 37012 Bussolengo (VR), Tel. +390456752711, Fax +390456700444, www.panasonic-electric-works.it
► Poland	Panasonic Electric Works Polska sp. z o.o.	Piazza della Repubblica 24, 20154 Milano (MI), Tel. +39022900-5391, Fax +39022900-3466, www.panasonic-building-materials.com
► Portugal	Panasonic Electric Works España S.A.	Sjöängsvägen 10, 19272 Sollentuna, Sweden, Tel. +4659476680, Fax +46859476690, www.panasonic-electric-works.se
► Spain	Panasonic Electric Works España S.A.	Jungmansgatan 12, SE-211 19 Malmö, Tel. +46406977000, Fax +46406977099, www.panasonic-fire-security.com
► Switzerland	Panasonic Electric Works Schweiz AG	Przedstawicielstwo w Polsce, Al. Krakowska 4/6, 02-284 Warszawa, Tel. +48 22 338-11-33, Fax +48 22 338-12-00, www.panasonic-electric-works.pl
► United Kingdom	Panasonic Electric Works UK Ltd.	Portuguese Branch Office, Avda Adelino Amaro da Costa 728 R/C J, 2750-277 Cascais, Tel. +351 214812520, Fax +351 214812529

North & South America

► USA	PEW Corporation of America	629 Central Avenue, New Providence, N.J. 07974, Tel. +1-908-464-3550, Fax +1-908-464-8513, www.pewa.panasonic.com
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Asia Pacific/China/Japan

► China	Panasonic Electric Works (China) Co., Ltd.	2013, Beijing Fortune, Building No. 5, Dong San Huan Bei Lu, Chaoyang District, Beijing Tel. +86-10-6590-8646, Fax +86-10-6590-8647, www.pewc.panasonic.cn
► Hong Kong	Panasonic Electric Works (Hong Kong) Co., Ltd.	RM1205-9, 12/F, Tower 2, The Gateway, 25 Canton Road, Tsimshatsui, Kowloon, Hong Kong, Tel. +852 2956-3118, Fax +852 2956-0398
► Japan	Panasonic Electric Works Co., Ltd.	1048 Kadoma, Kadoma-shi, Osaka 571-8686, Japan, Tel. +81-6-6908-1050, Fax +81-6-6908-5781 http://panasonic-electric-works.net
► Singapore	Panasonic Electric Works Asia Pacific Pte. Ltd.	101 Thomson Road, #25-03/05, United Square, Singapore 307591, Tel. +65-6255-5473, Fax +65-6253-5689