

MACHINE VISION SYSTEM IMAGECHECKER **PV500** User's Manual

• For PV500V2 and PV500



ARCT1F466E-2

Panasonic Electric Works

Before Reading This Manual

Thank you for purchasing the IMAGECHECKER PV500.

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

Safety Precautions

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

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

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



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

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

Table of Contents

Precautions before Use iv			
List	of Menu Options		
1	Names and Descriptions		
1.1	PV50010		
1.2 1.2 1.2 1.2 1.2	.2 Quad-speed/ 2-Mega-pixel Digital Camera		
1.3	Keypad15		
1.4	XGA Monitor16		
2	Installation and Wiring17		
2.1	Basic System Configurations18		
2.2	PV500 Installation19		
2.2			
2.2	.2 Note on Mounting20		
2.3	Mounting a Camera		
2.3 2.3	5 (5)		
2.3	-		
2.4	XGA Monitor Installation26		
2.5	Connecting Cables		
2.5			
2.5			
2.5	.3 Connecting Power to PV50029		
2.6	Supplying Power		
3	Basic Operation		
3.1	About Windows		
3.1			
3.1	.2 SETUP Menu and RUN Menu		
3.2	Basic Key Operation		
3.2	.1 Selecting Items and Inputting Values or Characters		
3.2			
3.2			
3.2	.4 Specifying Checker Area43		
3.2	.5 Copying the Screen Display (Print Screen)48		

4 Setting Inspection Conditions 49

4.1	Proc	cedure for Setting Inspection	. 50
4.2	Sele	ecting a Product Type No	. 51
4.2	.1	What Is a Product Type?	. 51
4.2	.2	Selecting a Product Type	. 51
4.3	Sett	ing Capturing Conditions of Camera	54
4.3	.1	Selecting a Camera Type (ENVIRONMENT)	. 54
4.3	.2	Setting Individual Capturing Condition by Type .	. 55
4.3	.3	Selecting Capture Timing (Camera Trigger)	. 56
4.3	.4	Setting Capturing Condition for Each Camera	. 59
4.3	.5	Error if Checker Area Outside Image	
4.4	Insp	ecting Divided Type (Execution Mode)	. 65
4.4	.1	Selecting an Execution Mode	. 65
4.4	.2	Inspecting in "Execute All" Mode	. 66
4.4	.3	Inspecting in "Automatic Switch" Mode	
4.4	.4	Inspecting in "User Defined" Mode	
4.5	Сар	turing an Image	. 69
4.6	Ima	ge Preprocessing (Slice Level / Preprocess)	70
4.6		Binarizing an Image (Slice Level)	
4.6		Setting Preprocess	
1.0			
4.7	Sett	ing Inspection Area and Conditions (Checker).	
4.7	.1	Types and Overview of Checkers	. 79
4.7	.2	Creating a Checker	. 82
4.7	.3	Moving Checkers in Group	. 86
4.7	.4	Line	. 87
4.7	.5	Binary Window	. 91
4.7	.6	Gray Window	. 94
4.7	.7	Binary Edge	. 96
4.7	.8	Gray Edge	
4.7	.9	Feature Extraction	105
4.7		Smart Matching	
4.7		Flaw Detection	
4.7	.12	Connector (Binary Window) and Connector	
4 7	10	(Gray Window)	
	.13	Connector (Gray Edge)	
	.14	Smart Edge (Circle)	
4.7	.15	Smart Edge (Line)	171
4.8	Adju	sting Area Position (Position Adjustment)	185
4.8		What Is Position Adjustment?	185
4.8	.2	Position Adjustment Type	186
4.8	.3	Setting a Position Adjustment	189
4.8	.4	Applying Position Adjustment to Checkers	194
4.9	Adju	usting Area Size (Area Size Adjustment)	195
4.10	Geo	metry Calculation of Detected Data	198
4.1		What is Geometry Calculation?	
	0.2	Setting a Geometry Calculation	
		J ,	

4.11 Calo 4.11.1	culation of Detected Data (Numerical Calculat Setting a Calculation		
4.11.2	Data That Can Be Used in Numerical Calculat		
4.11.3	Operators and Functions	. 222	
4.12 Tota	ally Judging Results of Checkers (Judgement		
4.12.1	Setting Judgement Conditions		
4.12.2	Total Judgement		
4.12.3	Selecting an Image Output Condition	. 232	
4.13 Cha	aracter/Figure Drawing		
4.13.1	What is Character/Figure Drawing?	. 234	
4.13.2	Creating Character/Figure Drawing	. 236	
4.13.3	Setting the Drawing Position and Size of a Drawing	238	
	Drawing	. 200	
4.14 Che	ecker List	.248	
4.15 Out	putting Inspection Results to the External Dev	ice251	
4.15.1	Outputting through Parallel I/O	. 251	
4.15.2	Outputting to COM.0/ Ethernet Port/ SD Memo	ory	
	Card	. 257	
4.16 Sav	ing/ Outputting an Inspection Image		
4.16.1	About Image Memory		
4.16.2	Saving Images into External Device		
4.16.3	Saving Images in the Image Memory of PV	. 265	
4.16.4	Operation of Test Image Memory	. 266	
4.17 Rea	ading/saving Setting Data (Save/Read)	. 268	
4.17.1	Saving Setting Data	. 268	
4.17.2	Reading Setting Data	. 269	
4.17.3	Deleting Setting Data	. 270	
4.18 Displaying Data on the Screen and Updating Settings			
	W)		
	Setting Data R/W		
4.18.2	Data R/W in RUN Menu	. 274	
4.18.3	Registerable Items	. 276	
4.19 Mar	ker	. 289	

5 Setting of Operation and RUN Menu293

5.1	Start /Stop RUN Mode	
5.2 5.2 5.2		enu 296
5.3 5.3 5.3 5.3 5.3 5.3	Setting Display in RUN Menu 3.1 Selecting a Preset Layout 3.2 Arranging Layout 3.3 Registering/copying/deleting	

6	Environment Settings (Changing	
	System Settings)	309

6.2 5	system Settings
6.2.1	Setting Startup Status (Startup Setting)
6.2.2	
	Menu (Operation/Password)312
6.2.3	Inspection Process and Output Timing
6.2.4	Setting Default Variable (System Register) 316
6.3 li	nput/output
6.3.1	Changing Setting of I/O Terminals (Parallel I/O)318
6.3.2	Changing Communication Condition of COM.0
	port (Serial)
6.4 0	hanging Color of Menu and Window
6.4.1	Changing Color of Letters and Background 319
6.4.2	Changing Window Transparency (SETUP
	Menu)
6.5 li	itializing Environment Settings

7 Changing Configuration (TOOL).. 323

7.1	Ove	erview of TOOL	324
7.2	Ge	neral Settings	325
7.2	2.1	Specifying Data to Read at Startup	325
7.2	2.2	Changing Network Setting	326
7.2	2.3	Adjusting Calendar Date	327
7.2	2.4	Switching Language	327
7.2	2.5	Initializing General Settings	328
7.3	Info	rmation Display and Ejection of SD Memory	
7.3	3.1	Displaying Information of SD Memory Card	329
7.3	3.2	Preparing to Eject SD Memory Card (Eject SI Card)	
7.4	Set	ting Help	330
7.4	1.1	Adjustment of Focus and Aperture	330
7.4	1.2	Gray Data Analysis	331
7.4	1.3	Capture Delay Control	332
7.4	1.4	I/O Test	333
7.4	1.5	Communication Test	334
7.5	Infc	ormation Display and Updating of PV500	335
7.5	5.1	Displaying PV Information	335
7.5	5.2	Version Upgrading of PV500	336
7.5	5.3	Customizing Splash Screen (Update)	337

	/lain Items that can be Communicated through I/ .ce	
8.2 S	Specification of I/O Interface	341
8.2.1	I/O Connector	341
8.2.2	I/O Terminal Block	346
8.2.3	Main Function of Signals	348
8.2.4	Cause of Turning On ERROR 0 Signal and ERROR 1 Signal	352

8.3	Tim	ning Chart	. 356
8.3	.1	Typical Operations in Inspections	356
8.3	.2	Outputting All Results (Output = All)	360
8.3	.3	Type Switch (TYPE)	362
8.3	.4	FLASH Output Timing	363

9 Control with Communication Port365

9.1 A	bout Communication Port
9.1.1	RS-232C Interface
9.1.2	Ethernet Interface
9.2 C	ommunication Command
9.2.1	List of Commands
9.2.2	Details of Commands
9.3 P	LC Communication
9.3.1	Overview and Communication Specifications 391
9.3.2	Outputting Data in PLC Communication
9.3.3	Switching Types by PLC Communication400

10.1 Ab	out PVWIN404
10.2 Co	mmunication405
10.2.1	Upload and Download of Setting Data 405
10.2.2	Reading the Latest Image of PV500 406
10.2.3	Uploading Images in Storage Space in PV500.406

11	Specifications and List of I Numbers		
11.1	General Specification	410	
11.2	Product Numbers	413	
11.3	Dimensions	416	
IND	EX	422	
Rec	Record of Changes425		

Installation Environment

Avoid installing and operating the PV500 in the following locations:

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

Static Electricity

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

Cleaning

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

Power Supply Unit and Power Sequence

- Use an insulated power supply with a built-in protection circuit. Applying an abnormal voltage might damage the internal circuit. If you use a power supply unit without a protection circuit, supply power through a protective device such as a fuse.
- Consider the power supply sequence so that the power supply unit for the PV500 can be turned off before the one for the input/output is turned off.
 If you turn the input/output power off before turning off PV500, the device will detect a change in the input signal level and may malfunction.

Before Turning on the PV500

- Pay attentions to the followings when turning on the PV500 for the first time:
 - Confirm no wiring waste or especially any conductive substance is on the printed circuit board.
 - Confirm that the power wiring, input/output wiring and power supply voltage are correct.
 - Confirm that the fixing and terminal screws are securely tightened.

General Cautions

- Use the keypad, camera, camera cables, monitor and a monitor cable of the product numbers specified by Panasonic Electric Works Co., Ltd. A breakdown, damage or destruction by using any other than the specified will not be covered by our guarantee.
- Do not change or set items that should not be as described in the manuals or the specifications. Breakdown, damage or destruction resulting from changing or setting them will not be covered by our guarantee.
- Do not perform a test of insulation resistance or withstand voltage between the power source or input/output signals and the metallic part of connectors or camera cases.
- To avoid loss of data by accident, also save the setting data stored in PV500 into a PC or an external storage media.

List of Menu Options

Language selecting	g window (Disp	played only at the first	startup after delivery)							
Language selecting window	g ⊤ Lang I		 Japanese/ English/ German/ French /Spanish / Italian/ Simplified Chinese/ Korean/Traditional Chinese 							
▶p.34	L Do n	└ Do not show this window at the next start-up.								
SETUP MENU										
F :	To RUN Menu Start RUN Mode Stop RUN Mode	► p.294								
ENVIRONMENT + 3	System Settings	Startup Setting	┳ Layout No. Layout No. Layout No.	▶ p.311						
		⊢ Operation 	 RUN Mode in SETUP Menu When Switching to SETUP… Inspection Process Output Results Image Output 	▶p.312						
			 Parallel I/O Output Reset Condition Continuous Inspection Template Setting Template Registration Smart Matching Performance 	 ▶ p.315 ▶ p.315 ▶ p.116 						
		I └ System Register	 Smart Matching Performance SYS: Register 0-7 Default 	▶ p.124 ▶ p.316						
 	Input/Output	→ Parallel I/O I I	 	▶ p.318						
		├ Parallel I/O Output 	 Output Data/ Handshake/ Scan Count/ Judgement/ Numerical Calculation/ Bit Width/ Data Bit/ Output Signal Guarantee Time (ms)/ Timeout (ms) 	▶ p.234						
Ì		⊢ Serial I	 Baud Rate (bps)/ Bit Length/ Stop Bit/ Parity Check/ Flow Control 	▶ p.318						
		⊢ General Output I ▶ p.258	⊤ Destination — None/ Serial(COM.0)/ Ethernet/ SD Card							
			Protocol — General Purpose Comr Communication	m./ PLC						
			 Date and Time Scan Count Total Judgement Judgement Numerical Calculation BCC 							
			 ⊢ No. of Digits ⊢ Decimal Digit ⊢ Unused Digit ⊢ PLC Type 	b n 201						
			► PLC Communication Setting	▶ p.391 ▶ p.391						
		⊢ Image Output 	 Destination/ Output Conditions/ Interval/ Camera No.0-3 Output/ File Header/ Additional Information 0-3/ Overwrite/ No. of Folders/ ERR Signal ON at Output Error/ Forced Outage at Output Error 	▶ p.260						
		⊢ Image Memory	- Saving Condition/ Overwrite	▶ p.265						
Ι		L Print Screen	- Destination	▶p.48						

	⊢ Camera I ⊢ Color I ⊢ Password ▶ p.31 └ Initialize ▶ p.32	3	 Type of Camera No.0 - 3 FLASH Polarity 0-3 rency (SETUP Menu) 	▶ p.54 ▶ p.55 ▶ p.319 ▶ p.320
TYPE	→ Select Type		ion T Execution Mode Number of Blocks Common Setting Camera Trigger Error if Checker Area outsid Camera No. to Set Connected Camera Shutter Speed Gain Capture Delay (ms) FLASH Signal Delay (ms) FLASH Span (ms) Partial Imaging Calibration	be Image ▶ p.59 ▶ p.59 ▶ p.61 ▶ p.62
	┝ Marker Display ┝ Data R/W └ Initialize	▶ p.289 ▶ p.271 ▶ p.53		
INSPECTION	 Position Adjustment Area Size Adjustment Checker Checker Geometry Calculation Slice Level Preprocess Numerical Calculation Judgement Char./Fig. Drawing Checker List Group Move 	 ▶ p.185 ▶ p.195 ➡ Line ➡ Binary Window ➡ Gray Edge ➡ Gray Edge ➡ Feature Extraction ➡ Smart Matching ➡ Flaw Detection ➡ Connector (Binar) ➡ Connector (Gray) ➡ Connector (Gray) ➡ Smart Edge (Circ) ➡ Smart Edge (Line) ▶ p.199 ▶ p.70 ▶ p.70 ▶ p.198 ▶ p.225 ▶ p.235 ▶ p.234 ▶ p.86 	 ▶ p.111 ▶ p.125 y Window) ► 135 Window) ► 135 Edge) ► p.140 le) ► p.153 	
SAVE/READ	 F Save Setting Data F Read Setting Data F Save Image Memory Clear Image Memory 	► p.268 ► p.269 ► p.265 ► p.298		

TOOL	 → PC Communication → General PC Communication Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point Point	329 335	 p.325 p.326 p.327 p.327 p.328
F1 Image Menu	 	▶ p.40 ▶ p.40	
	 Pattern Display Scroll Magnification Full Screen Save Image Read Image Window Transparency (SETUPMenu) 	- Pattern Display /	Scan Direction / Geometry Calculation / ▶p.309 Drawing / Calibration Scale
RUN MENU			
OPERATION	 T Select Type ⊢ Reset Statistics ⊢ Start RUN Mode ⊢ Stop RUN Mode └ To SETUP Menu 	▶ p.296 ▶ p.296 ▶ p.294	
VIEW	 	•	
LAYOUT	— Layout	▶ p.299	
TOOL p.323	 Figet SD		
F1 Select Window			Area / Scan Direction / Detect Position / Display Condition / Geometry Calculation / Character/Figure Drawing / Marker / Calibration Scale
F2	⊢ ⊢ ⊢ ⊢ ⊢ □ Data R/W 0-3 — Switch Layout	Scroll Magnification Full Screen Move Window Change Size Optimize Size ► p.274 ► p.307	
Γ 4	ownon Layout	- p.307	

Chapter 1

Names and Descriptions

1.1 PV500

1

2

3

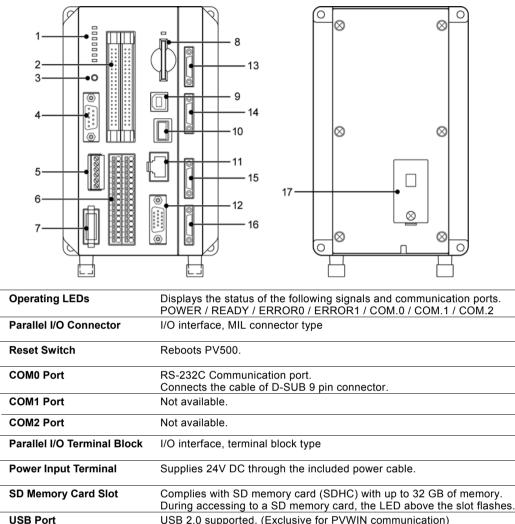
4

5

6

7

8



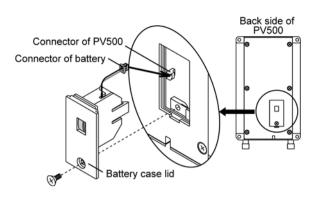
- 9
 USB Port
 USB 2.0 supported. (Exclusive for PVWIN communication)

 10
 Keypad Connector
 Connects a keypad (ANPVP03 / ANPVP10).

 11
 Ethernet Port
 Connects an Ethernet cable. When connecting an Ethernet cable, either one of two LEDs lights. The LED to light and the color varies depending on baud rate.)
- 12 MONITOR Analog RGB output terminal. Connects a monitor. Camera 0 Connect Port 13 Connects a camera 0. **Camera 1 Connect Port** 14 Connects a camera 1. 15 **Camera 2 Connect Port** Connects a camera 2. (Only for 4-camera type) 16 **Camera 3 Connect Port** Connects a camera 3. (Only for 4-camera type) 17 **Battery Case** Attaches the battery retaining the following information. See the next page and attach the battery before use. Built-in calendar - Type No. and Layout No. when turning off the power - Status of keypad operation

Connecting Backup Battery

- **1.** Cut the power of PV500.
- Open the lid on the back side.
 Note that the battery is attached to the lid.
- **3.** Connect the connector of the battery with the connector of PV500.
- 4. Put the battery case lid back in place.



Note

- Backup battery life is approximately 10 years at 25 °C of ambient temperature. If the battery is running out, a message saying "Change Battery!" appears in the information display area. Replace with a new one then. (Battery product No.: AFPX-BATT)
- To replace the battery, before the procedure described above, turn on the power of PV500 a minute or more and replace it in two minutes after turning off the power.

1.2 Camera

1.2.1 Camera Type and Precautions for Use

Camera Type

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

	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	
Image Transferring Time	Approximately 34 ms	Approximately 9 ms	Approximately 17 ms
Dimension	29 x 29 x 58 mm		12 x 13 x 48 mm
CCD Size	1 /1.8 inch	1/3 inch	
Pixel Size	4.4 x 4.4 μm	7.4 x 7.4 μm	

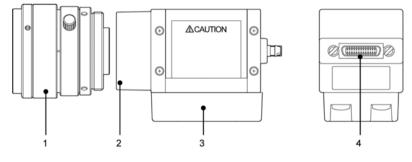
Precautions for Use

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

1.2.2 Quad-speed/ 2-Mega-pixel Digital Camera

Product No.:

Quad-speed Digital Camera=ANPVC1040 /2-Mega-pixel Digital Camera=ANPVC1210



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. Connect the connector labeled the product number of the cable to a camera.

Note This manual describes the cameras as follow.

2-Mega-pixel Digital Camera = 2-Mega camera, Quad-speed Digital Camera = Quad-speed camera

1.2.3 Ultra Compact Double Speed Digital Camera

Camera Head

Product No.: ANPVC1021

1	Lens	Attach an exclusive lens for Ultra compact camera.
2	Lens fixture	Special mounting fixture.
3	Lens securing ring	A ring to secure the lens to the camera. Use it to fix the lens at the close position to the edge of the camera.
4	Mounting plate	Insulation type plate.
5	Camera cable	Mounted directly to the camera. It cannot be removed.
6	CCU connector	Connects to Camera Control Unit (CCU).

Camera Control Unit (hereinafter called "CCU")

7	Camera head connector	Connects the cable of the camera head.
8	Mounting plate	Insulation type plate.
9	Cable connector	Connects a camera cable. Connect the connector labeled the product number of the cable to a camera.

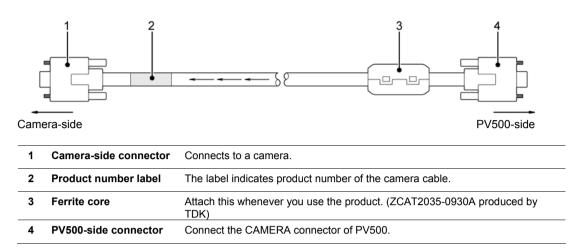
Note

This manual describes the camera as follow.

• Ultra Compact Double Speed Digital Camera = Ultra compact camera

1.2.4 Camera Cable

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

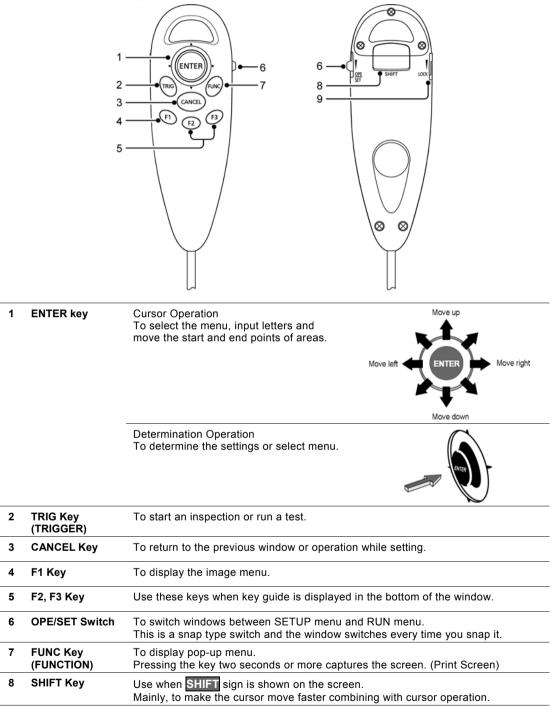


Note

The camera cable has directionality. Be sure to connect the cable at the connector with a product number sticker to the camera, and the connector with a ferrite core to the PV500.

1.3 Keypad

Typical operations of the keypad are described below.



To lock or disable the 1 - 8 keys by setting in "LOCK" side. The switch prevents undesired operation of the keys by mistake.

▶ Note

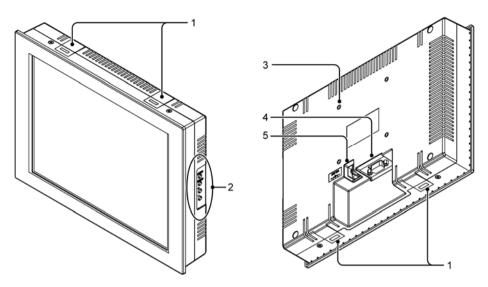
9

LOCK Switch

The operation from the keypad may be off on the PV500. Refer to page 313 for details.

1.4 XGA Monitor

Product No.: ANPVM11021



1	Mounting hole for mounting bracket	Attach the included mounting brackets.								
2	Adjustment volume	The following	adjustments are ava	ailable.						
	-	BRIGHT Brightness		Adjusts the brightness. (Brightness: approx. 20 to 100%)						
		V-POS.	Vertical Position	Adjusts the screen vertical position (in 16 lines).						
		H-POS.	Horizontal Position	Adjusts the screen horizontal position (in 16 pixels).						
		PHASE	Phase	Adjusts the screen flickering.						
		CONT.	Contrast	Adjusts the contrast.						
3	Mounting hole VESA mount	4-M4 (depth: 7mm), 75 x 75 mm								
4	RGB input connector		A connector for RGB signal input. To connect to the monitor with the VGA monito cable -ANMX8331X. (Connector: Mini D-sub, 15 pins, female)							
			$5^{5} - 4^{4} - 3^{3} - 2^{2} - 1$	R Image signal: Red	_					
		((00	$O \otimes O \otimes O$	G Image signal: Green						
		1	ത്രി ന് ത് ന് ന് ന്		_					
		1		B Image signal: Blue	_					
		\c	0 ¹⁵ ¹⁶ ¹⁴ € ¹³ O ¹² O ¹¹ /		_					
			<u>5614613012011</u>	B Image signal: Blue	_					
				B Image signal: Blue GND Signal ground						
5	Power terminal	Acceptable in	1) ¹⁵ © ¹⁴ © ¹³ O ¹² O ¹¹	B Image signal: Blue GND Signal ground HS Horizontal synchronizing signal VS Vertical synchronizing signal						

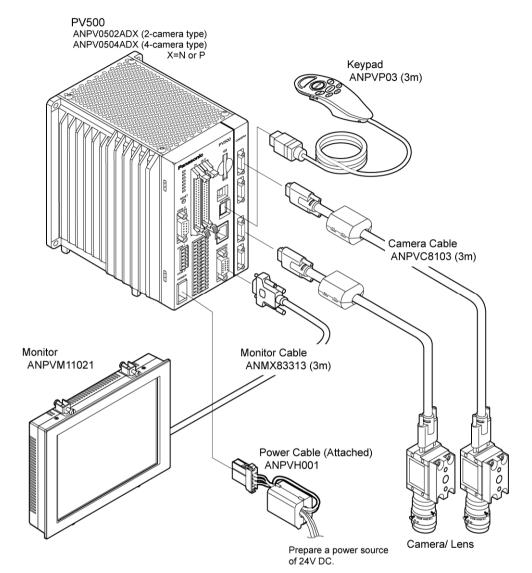
Note

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

Chapter 2

Installation and Wiring

An example of basic system configuration when connecting two cameras



Chapter 2 1BInstallation and Wiring

18

2.2 PV500 Installation

2.2.1 Mounting Arrangement

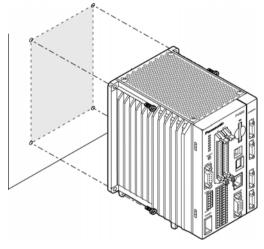
Install the main unit of PV500 by using the four mounting holes on the back side or using the screw holes on the bottom side after replacing the rubber legs.

Note

Before mounting PV500, attach a backup battery to it. Refer to page 295 on how to attach the battery.

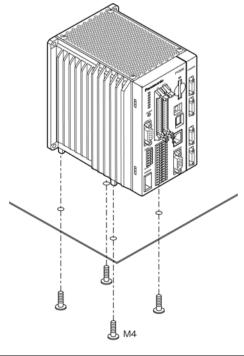
Back Side Mount

Mount PV500 using four mounting holes (\phi4.6). Use M4 screws (length of 10 mm or more) to mount.



Bottom Side Mount

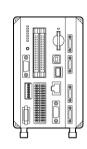
Replace the rubber legs from the bottom side and fixate with M4 screws (length of screw joint is up to 8 mm).

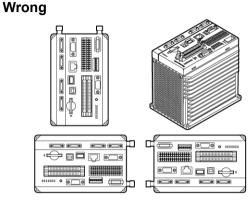


Mounting Direction

Install PV500 in the correct direction (see the figures below) for heat radiation. Do not mount it sideways or upside down.

Correct



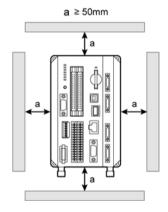


About Mounting Space

Keep more than 50 mm of space around PV500 for ventilation. In addition, to wire cables safely, keep more than 100 mm of space in front of PV500.

Note

When installing another PV500 next to it, keep more than 50mm of space between PV500s.



*1) Back Side Mount



- Do not block the ventilators on the top and bottom of the unit. It might lead to a malfunction due to the internal heat retaining.
- When installing PV500 on a control board, take some measures such as attaching a cooling system (a fan motor, etc.) to lower the operation ambient temperature into the specified range; 4-camera type: 0 - 40 °C, 2-camera type: 0 - 45 °C.

1666.7

1875.0

2083.3 2083.3

2.3 Mounting a Camera

Selecting a Lens (View Range Table) 2.3.1

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

Note

1

800

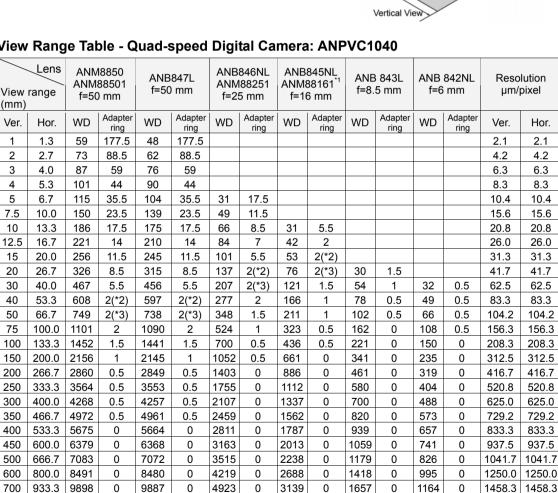
900

1066.7 11306

1200.0 12714

1000 1333.3 14121

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



View Range Table - Quad-speed Digital Camera: ANPVC1040

14110 WD = The distance from the front of the lens to the object.

11295

12703

0

0

0

The values in the table are around the focal point of ∞ , except as otherwise noted.

0

0

0

5626

6330

7034

*1: WD=+4 mm *2: Lens focal position is in the closest position. *3: Lens focal position is in the middle position.

3589

4040

4490

0

0

0

0

0

0

1897

2136

2375

0

0

0

1333

1502

1671

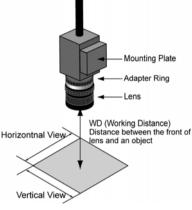
0

0

0

1666.7

1875.0



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

View Range Table - 2-Mega-pixel Digital Camera: ANPVC1210

WD = The distance from the front of the lens to the object

The values in the table are around the focal point of ∞ , except as otherwise noted.

Lens focal position

- *1: Around 0.3
- *2 : Around 0.5
- *3 : Around 1
- *4 : Around 2

	Lens	ANPVL3001				ANPVL1	201	ANPVL0401		Resolution		
	Range m)	f=30 mm			f=12 mm		f=4 mm			(µm / Pixel)		
Ver.	Hor.	WD	Gap	Adapter ring	WD	Gap	Adapter ring	WD	Gap	Adapter ring	Ver.	Hor.
1	1.3	33	0	110(*1)							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(*1)	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
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(*1)	211	1.1					125.0	125.0
65	86.7	573	0	5(*1)	228	1.1					135.4	135.4
70	93.3	658	0	5(*1)	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

View Range Table - Ultra Compact Camera: ANPVC1021

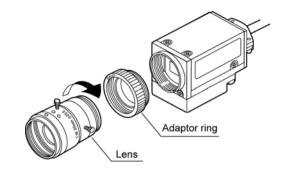
*1: Replace the lens securing ring to use.

1. Attach a lens to a camera.

Remove the camera cap and attach the selected lens.

Note

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



Fixing a Lens of Ultra Compact Camera

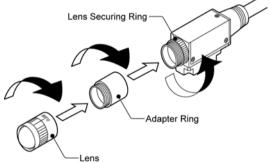
1. Rotate a lens securing ring, which fixes a lens to a camera, and place it at the appropriate position.

2. Screw the lens into it.

When you use adaptor rings, fix them to the lens before attaching the camera.

3. Rotate the lens securing ring to fix the lens.

Adjust the gap between the lens securing ring and the camera to be the size confirmed in the view range table.



2. Use the mounting plate (insulation type) screwed to the camera to fixate the camera to the installation point.

Note

- When you directly screw the camera without a mounting plate, do not screw into the bottom of the camera over 3 mm for 2-Mega and Quad-speed, and 1.5 mm for Ultra Compact camera.
- Keep the camera cable more than 100 mm away from a power cable and a power source cable.
- The side of the plate mounted is the bottom of capturing images displayed on the screen. Regarding to Quad-speed Random camera and 2-Mega-pixel camera, it is the side of the face where the plate is initially attached. Even if an image was captured upside-down or rotated by 90-degree, it is impossible to rotate captured images with the PV500. Be sure to mount it with attention.



Be sure to electrically insulate to mount the camera.

Without insulation, the internal circuit might be damaged because the camera case connects GND of the internal circuit if the electric potentials of the mounting point and the camera case are different. Use the mounting plate (insulation type) initially attached on the camera to mount it in an electrically

Use the mounting plate (insulation type) initially attached on the camera to mount it in an electrically insulated way.

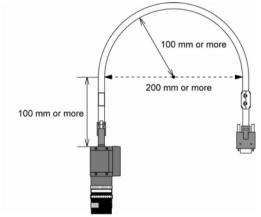
Mounting a Camera

- Use the mounting plate (insulation type) initially attached on the camera to mount it in an electrically insulated way.
 Without insulation, the internal circuit might be damaged because the camera case connects GND of the internal circuit if the electric potentials of the mounting point and the camera case are different.
- When you directly screw the camera without a mounting plate, do not screw into the bottom of the camera over 3 mm for 2 Mega and Quad-speed, and 1.5 mm for Ultra Compact camera.
- The side of the plate mounted is the bottom of capturing images displayed on the screen. ¥line Regarding
 to Quad-speed Random camera and 2 Mega-pixel camera, it is the side of the face where the plate is
 initially attached. If an image was captured upside-down or rotated by 90-degree, it is impossible to rotate
 captured images with the PV500. Be sure to mount it with attention.

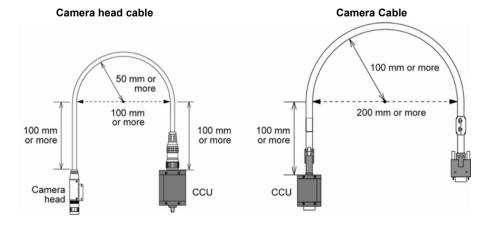
Camera cables

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

For Quad-speed, 2 Mega camera



For Ultra Compact camera



2.4 XGA Monitor Installation

Never block the ventilation slits of the XGA monitor.

1. Prepare a panel to attach a monitor. Applicable panel thickness: 1 - 5 mm

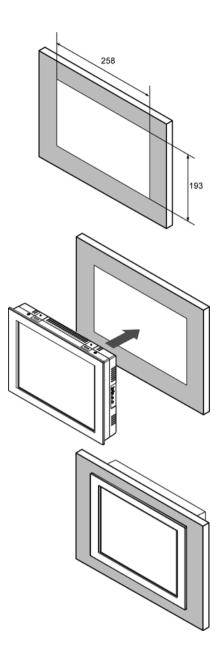
2. Insert the monitor into the panel.

- **3.** Attach the included attachment brackets to the monitor. (4 places)
- **4.** Screw the attachment brackets to fix the monitor to the panel.

Tightening torque: 0.5 to 0.6 N/m

Note

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



Ferrite core

2.5 Connecting Cables

2.5.1 Connecting Peripherals

► Caution

Be sure to turn off the power source for PV500 before connecting peripherals.

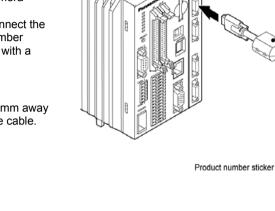
1. Connect a camera to PV500.

Connect a camera cable with a camera connector.

The camera cable has polarity. Connect the cable at the end with a product number sticker to the camera, and the end with a ferrite core to the PV500.

Note

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

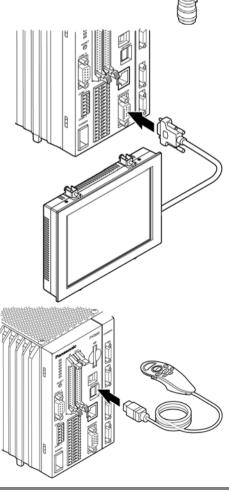


2. Connect a monitor to PV500.

Connect a monitor cable to "MONITOR" connector.

3. Connect a keypad.

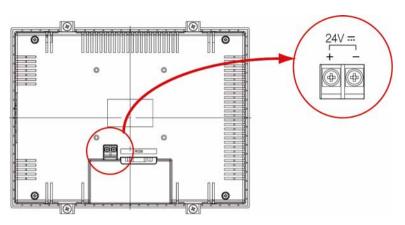
Connect the designated keypad to "KEYPAD" connector.



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

► Caution

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



Rated voltage: 24 V DC Operating voltage range: 21.6 to 26.4 V DC Power consumption: 1A or less

Applicable Solderless Terminal

- Terminal screws are M3.
- Screw the terminal block with tightening torque of 0.8 Nm. Failure to do so might damage to the product.
- It is advisable to use solderless terminals to wire. Use wires of 0.5 mm² to 1.25 mm² diameter if you do not use a solderless terminal.

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

2.5.3 Connecting Power to PV500

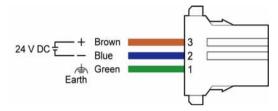
Connect the power of 24 V DC to PV500 with the included power cable.

► Caution

Do not supply power until every connection has completed.

Power Cable

The arrangement of the cables is as follows.



- Wire size: AWG18
- Cable length: 1m
- Twist the electric wires for noise reduction.

Connecting Power

1. Prepare a power supply unit which fulfills the following conditions and connect with the power cable.

Conditions for power supply

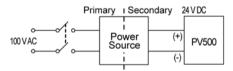
- Power voltage: 24 V DC +/- 10 %
- Current capacity: 3.0A or more
- Insulated power supply with a built-in protection circuit

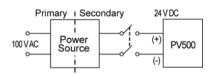
► Caution

- Ensure to use the separate power supply for the PV500 from the power supply for power devices.
- Turn ON/OFF the power supply at the primary side. If you turn ON/OFF it at the secondary side, the fuses of PV500 may melt down.

Correct

Wrong

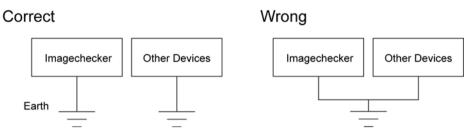




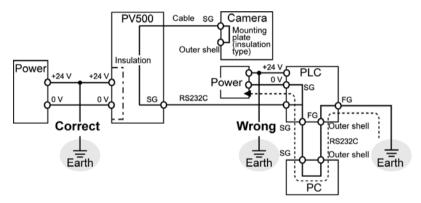
2. Connect an earthing conductor.

► Caution

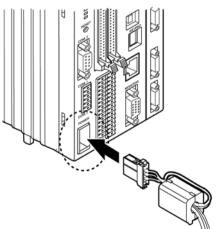
- Do not share the grounding system with other devices.
- Install the PV500 as close to the ground point as possible and keep the ground wire short.



- The power circuit of PV500 is insulated and you can ground the positive (+) terminal of 24V DC power supply without fault.
- When connecting PV500 with the other devices such as PLC, do not ground the positive terminal of the power supply of the device. If the power supply circuit of the device is not insulated, the connection between the outer shell of the PC and the 0V-power supply may cause a short-circuit condition and burnout.



3. Connect the POWER connector of PV500.

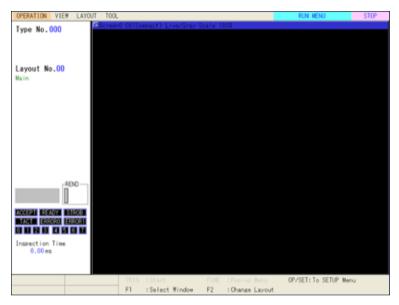


2.6 Supplying Power

Confirming Start

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

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



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



► Note

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

- Is power supplied to PV500 correctly?
- Is the power switch of the monitor ON?
- Does the monitor cable connect correctly?

Refer to

You can change splash screen. Refer to page 337 for details.

Chapter 3

Basic Operation

3.1 About Windows

3.1.1 Language Selecting Window (Ver.1.10 or later)

When you start the very first time after delivery, the English dialog to select interface language appears. You can display multiple languages in Ver.1.10 or later of PV500. Select an appropriate language in this dialog. Since the language can be changed in SETUP menu later as well, select your most accessible language for now.

Refer to

Switching Language: see page 327.

1. Turn on the power.

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

2. Press the Enter key.

Settable languages are displayed.

Japanese English German French Spanish Italian Simplified Chinese Korean Traditional Chinese (for Ver.2.00)



- **3.** Tilt the ENTER key up/down to move the cursor onto the language you want to use and press the ENTER key.
- Da not show this window at the next start-up:
- **4.** Tilt the ENTER key up/down to move the cursor onto the lower message and press the ENTER key.

The message says "Do not show this window at the next start-up."

Pressing the ENTER key checks the check box and the window does not appear from the next startup.

The English dialog appears also at the next startup without checking it.

Note

Even if the check box is not checked, the language selecting window will not be displayed after you change the setting of "General" in SETUP menu including language.

5. Tilt the ENTER key up/down to select "OK" and then press the ENTER key.

RUN menu is displayed on the screen.

Note

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

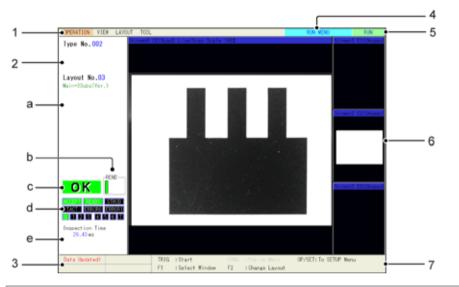
About windows

PV500 has two windows; RUN menu for performing inspections and SETUP menu for making settings such as inspection conditions.

When power is turned on, RUN menu is displayed. To make a configuration, switch to SETUP menu with Ope/Set Switch of the keypad. As a default setting, switching to SETUP menu stops operation. You can change the setting to operate in SETUP menu as well.

RUN menu

In RUN menu, you can change its layout (type, size and position of displayed windows). Also, you can choose the colors of each area of display (common to SETUP menu).



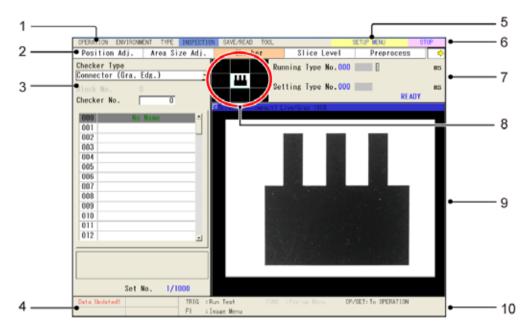
1 Menu bar Displays the menu to set in RUN menu.

2 Information display area

	-	а	Information	Displays the current type, display pattern and the status of the PV500.				
	b		READ END signal status	Displays the status of READ END (REND) signal. ON: Green, OFF: Black				
	_	C	Total judgement result	Displays the result of judgement formula registered as Total Judgement.				
	_	d	I/O terminal status	Displays the status of OUT 0 - 7. ON: Green, OFF: Black				
		е	Time	Displays inspection time and cycle in ms unit. (For details of each time, see page 293.)				
3	Message area	9	Displays the message to Example)	inform.				
			The setting was upda	ted.				
			The voltage of the atta	ached battery became lower.				
4	Display type		Displays "RUN MENU". (Indicates the current window is RUN menu.)					
5	Status		Displays the status operation	ating (RUN) or pausing (STOP).				
6	6 Screen window This is a window to display an image. In addition, a data R/W window which shows da can be displayed in the area.							
7	Key guide		Displays the operations of	of each key on the keypad.				

SETUP menu

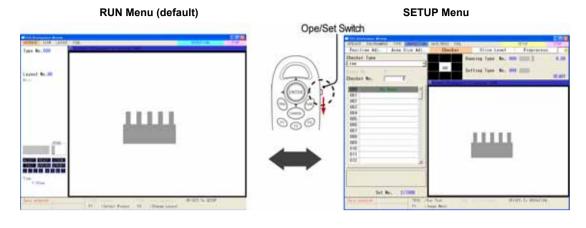
In SETUP menu, the display changes depending on operation. You can choose the colors of each area of display.



1	Main menu	Displays the menu to set in SETUP menu.
2	Sub menu	Displays a submenu of the menu selected in the main menu.
3	Setting windows	Setting windows displayed in the upper left of the screen. The above image is an example of screen displaying the checker setting window
4	Message display area	Displays the message to inform. Example) The setting was updated. The voltage of the attached battery became lower.
5	Display type	Displays "SETUP MENU". (Indicates the current window is SETUP menu".)
6	Status	Displays the status operating (RUN) or pausing (STOP).
7	Information display area	Operating type number and setting type number
		The status of READ END0 - READ END3 signal when continuing running.
		Inspection time and cycle (unit: ms) (For details of each time, see page 295.)
8	Screen window navigator	Displays the range currently shown on the screen window in light blue.
9	Screen window	Displays a camera image.
10	Key guide	Guide for the keypad.

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

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



Entering a Password

When you switch the window from RUN menu to SETUP menu, a password may be requested to enter. This is the function that prevents undesired setting changes by mistake. A password can be set from ENVIRONMENT menu in SETUP menu.

Refer to

For the information of setting a password to switch to SETUP menu, refer to page 312.

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

Password window is displayed.

2. Enter a password.

Use the software keyboard.

3. Select "Login".

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

Note

"Do not request a password every time."

Check this item to switch to SETUP menu without entering a password. However, after you reboot PV500, it requests a password again.



3.2 Basic Key Operation

3.2.1 Selecting Items and Inputting Values or Characters

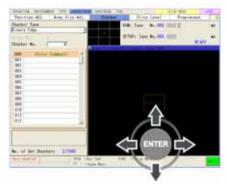
Selecting an Item

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

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

2. Press the ENTER key.

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



Inputting Values

- **1.** Select a box to Input value.
- 2. Tilt the ENTER key on the keypad upward/downward to change and specify the value.

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

3. Press the ENTER key.

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



Constant

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

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

1. Select a box to Input characters.

A software keyboard is displayed. Depending on menus, you need to press the FUNC key to show pop-up menu and select the item to input them.

						<-	<-			->				Contraction of
•	:	•	2	x	\$	1	1	0	()	<	>	1	Enter
n	0	p	q	r	s	t	u	v	w	×	y	2	1	
a	b	C	d		t	8	h	1	1	k	1	m	1	8
N	0	P	0	R	\$	T	U	۷	W	х	Y	12	*	
A	В	С	0	E	F	6	н	1	1	ĸ	1,	M	-	DEL.
1	2	3		5	6	17	8	9	0		-	=	*	BS

2. Input character one by one.

To select characters, move the cursor onto the character to input and press the ENTER key. To input a space, select a blank key at the lower left.To delete characters, select the right/left arrows and move the cursor onto the character to delete. Selecting "DEL" deletes the character. Selecting "BS" deletes the previous character.

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

The specified characters are determined.

3.2.2 Selecting a Display Image (Image Menu)

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

Note

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

Displaying Image Menu

In SETUP Menu

1. Press the F1 key of the keypad.

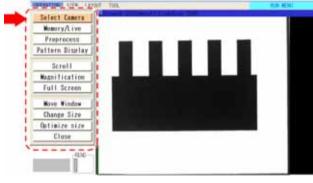
In SETUP menu, Image menu is displayed.

Whenever "F1: Image Menu" is shown in the key guide, Image Menu can be activated.

But, some items of Image Menu may be grayed out to limit changing the settings depending on windows.

Refer to

The transparency of the background of setting dialog window can be changed. Refer to page 320 for details.



In RUN Menu

1. Press the F1 key of the keypad.

The screen number list is displayed to select window.

2. Select a screen number to set.

Image menu is displayed.

In RUN menu, the menu includes the items to set size and position of screen other than how to display images.

Selecting a Camera Image

1. Select "Select Camera" from Image menu.

Settable camera No.s are displayed.

2. Select the camera No. to display.

The image on the screen window is replaced.

Note

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



Selecting an Image Type

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

SETUP Menu Camera No.	→ Memory → Gray → Preprocess: No ↓ ↓ ↓
RUN Menu Camera No.	→ Memory → Gray → Preprocess: No ↓ Preprocess A-E
	<pre>Image Preprocess A-L I I I I I I I I I I I I I I I I I I I</pre>
	⊢ Live — Same as "Memory" │ └ NG Image ┬ Latest ¬ │ Previous ├ Same as "Memory" └ Before the Previous ┘
Options Memory/Live	 Memory: An image stored in a memory for inspection. The image does not change even if you cover the lens or uncover it. Live: An image changes in real-time. When you cover the lens with your hand, a captured image will be darker, while it will be lighter
Gray/Binary	 Gray scale: A gray image in 256 gray levels captured by a camera. Binary: A binarized image in black and white based on a gray image. Refer to For details, refer to Chapter 4.6.1 "Binarizing an Image (Slice
NG Image (only for RUN Menu)	Level)", page 70. Displays a memory image when the result of a judgement formula registered as Total Judgement is "NG". Select from "Latest", "Previous", and "Before the Previous". • Latest: Displays an image of the latest NG total judgement. • Previous: Displays an image of the previous NG total judgement. • Before the Previous: Displays an image of before the previous NG total judgement.
Preprocess	 A preprocessed image can be displayed when using the function. No: Displays an image before preprocess.
	 A to E: To select a Preprocess Group. Step: 1st to 10th (only for SETUP Menu) Displays an image preprocessed by the set step of the selected preprocess group. Example) When 10 steps are set in preprocess group A Selecting "3rd" for preprocess step displays the image
	preprocessed by the 3rd step, and inspects on the image preprocessed by the 10th step.

Y

Selecting Image to Display on Screen Window in SETUP Menu

1. Select "Memory / Live" from Image menu.

The selection screen is displayed.

- 2. Select Memory or Live in "Memory / Live".
- 3. Select Gray or Binary in "Gray / Binary".
- 4. Press the Cancel key.
- 5. Select "Preprocess".

The preprocess selecting screen is displayed.

- 6. Select a Preprocess group (A to E) in "Preprocess". Set "Step" under the item when you selected A to E for "Preprocess".
- 7. Press the CANCEL key.

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

Selecting Image to Display on Screen Window in RUN Menu

1. Select "Memory / Live" from Image menu.

The selection screen is displayed.

2. Select Memory, Live, or NG Image in "Memory / Live".

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

- 3. Select Gray or Binary in "Gray / Binary".
- 4. Press the CANCEL key.
- 5. Select "Preprocess" to set a preprocess group.

6. Press the CANCEL key.

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

Memory/Live	NG Image	×
NG Image	Latest	-
Gray/Binary	Gray Scale	-

Memory/Live

Gray/Binary

Live

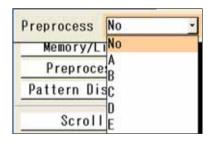
Gray Scale

No

1st

Preprocess

Step



3.2.3 Zooming In/out Image (Image Menu)

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

Specifying Magnification (Zoom In/out)

You can change Magnification between 2% and 400% by 1%. Magnification 100% indicates the status displayed in the following size.

- When using Quad-speed / Ultra Compact Camera: 640 x 480 pixels
- When using 2-Mega-pixel Camera: 1600 x 1200 pixels

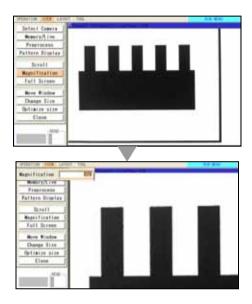
1. Select "Magnification" from Image menu.

The screen of magnification setting is displayed.

2. Tilt the ENTER key up/down to change the magnification and then press the ENTER key. Pressing the ENTER key displays the image in

the specified magnification. To change the magnification again, press the ENTER key.

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



Scrolling

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

1. Select "Scroll".

The SHIFT key is activated.

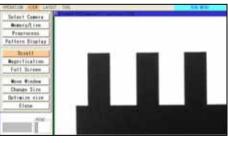
2. Tilt the ENTER key to scroll the image.

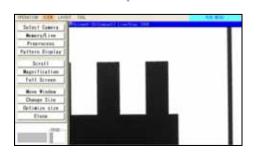
The position of the current image in the whole image is displayed in the upper screen. Use it to make the setting.

Note

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

3. After displaying a desired image, press the CANCEL key.





Displaying Image Full-screen (Full Screen)

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

1. Select "Full Screen".

The image is displayed full-screen. In SETUP menu, the image is displayed in 100% for Quad-speed/ Ultra Compact camera and in 40% for 2-Mega-pixel camera.

Note

In RUN menu, because the size of screen window can be changed, the aspect ratio of a window might be different from the ratio of an image. In this case, the image will be displayed adjusting to the smaller side.

Resizing Image in 100% (or 50%) (Optimize Size)

(Only for RUN menu)

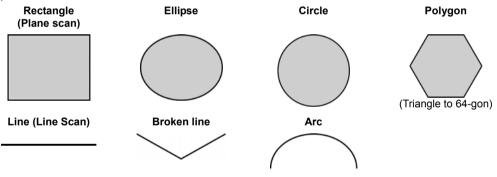
The screen window is changed into the size that can display an image in 100% for Quad-speed/ Ultra Compact camera and in 50% for 2-Mega-pixel camera.

1. Select "Optimize Size".

The size of the screen window is changed.

3.2.4 Specifying Checker Area

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



Depending on checker type, some shapes cannot be set.

Specifying an Inspection Area

Rectangle (Plane scan)

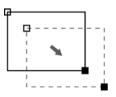
1. Select "Rectangle" or "Plane" from "Change Shape" menu.

2. Select "Change".

Now you can draw an area.

3. Move the whole rectangle.

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



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

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

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

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

6. Set the angle of the area.

Set the angle combining the following methods.

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

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

Circle/ Ellipse

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

1. Select "Circle" or "Ellipse" from "Change Shape" menu.

2. Select "Change".

Now you can draw an area.

3. Move the area.

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

After moving is completed, press the ENTER key.

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

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

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

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

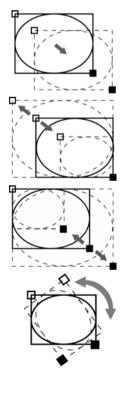
Now you completed drawing a circle.

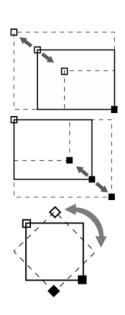
6. Set the angle of the ellipse.

Set the angle combining the following methods.

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

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





Polygon

To draw a polygon, add vertices to a rectangle.

1. Select "Polygon" from "Change Shape" menu.

2. Select "Change".

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

3. Move the area.

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

4. Set the position of a vertex.

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

Increasing the Number of Polygon Vertices

- 1. Select "Change".
- 2. Press the FUNC key at the point where you want to add a vertex.

The menu adding/deleting vertices is displayed.

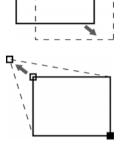
3. Select "Add Vertex".

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

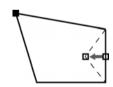
4. Adjust the position of the added vertex. After adjusting is completed, press the ENTER key.

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

5. Adjust the position of the added vertex.







Deleting a Vertex of Polygon

1. Select "Change".

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

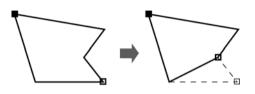
3. Press the FUNC key.

The menu adding/deleting vertices is displayed.

4. Select "Delete Vertex".

The vertex you selected is deleted.

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



Line Scan

1. Select "Line" from "Change Shape" menu.

2. Select "Change".

Now you can draw an area.

3. Move the area.

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

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

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

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

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

Modifying an Inspection Area (when adding a mask area)

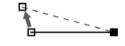
When a mask area is set, the inspection area to edit is needed to select.

1. Select "Change".

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

- 2. Press the ENTER key to select the inspection area.
- **3.** Edit the inspection area.
- 4. After editing is completed, press the CANCEL key.

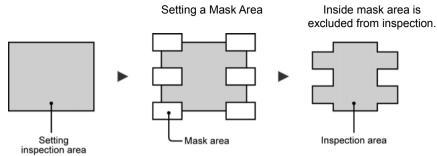






Setting a Mask Area

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



Adding a Mask Area

- 1. Select "Add Mask" in "Area Setting".
- 2. Select a mask shape to add.
- 3. Select "Change".

The inspection area is displayed in orange.

- 4. Tilt the ENTER key upward/downward to display the area in orange.
- 5. Draw a Mask Area

For details, refer to page 43, "Drawing an Inspection Area".

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

Editing a Mask Area

- **1.** Select "Change" in "Area Setting" window. The inspection area is displayed in orange.
- 2. Tilt the ENTER key upward/downward to display the area in orange and press the ENTER key.
- Edit a Mask Area.
 For details, refer to page 43 "Drawing an Inspection Area".
- 4. After drawing is completed, press the CANCEL key.

Deleting a Mask Area

- Select "Delete Mask" in "Area Setting". The mask area is displayed in orange.
- 2. Tilt the ENTER key upward/downward to display the area to delete in orange.
- **3.** Press the ENTER key.

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

3.2.5 Copying the Screen Display (Print Screen)

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

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

1. Display an image to copy.

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

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

Note

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

About Image File Name

Example of file name: 071215_150848_0.bmp

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

- Date and Time: Calendar data of PV500
- Image number:
 0 to 9. Numbered consecutively within the same hour.

About Save Folder of Image Files

For SD card: /Panasonic MEW Vision/PV500/Screen For Ethernet: Specify with Image Receiver.

Changing Destination of Image Files

1. Select "ENVIRONMENT" > "INPUT / OUTPUT" from the menu bar.

The screen of communication setting is displayed.

2. Select "Print Screen".

3. Select "Destination".

SD card (default): Saves in the SD card inserted in PV 500. Ethernet: Outputs to Ethernet. Saves in devices such as a PC connected with an Ethernet cable.

Setting Inspection Conditions

4.1 Procedure for Setting Inspection

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

Select a product type No. (Type Switch)	page 51
	ı
Set camera type and capturing conditions	
(ENVIRONMENT > Camera, TYPE > Type Setting)	page 54
Select Execution Mode condition	page 65
(TYPE > Type Setting)	1 0
Capture an image	
	page 69
—	Т
Preprocess the image to be appropriate for inspection Slice Level, Preprocess	page 70
Set an inspection	
Checker, Position Adjustment, Area Size Adjustment	page 79
	4
Calculate the measured data	
- Geometry Calculation	page 19
- Numerical Calculation	page 21
Total Judgement	nogo 22
Judgement	page 22
	<u>.</u>
Display detection results with figures or characters on the screen window	page 23
Character/Figure Drawing	page 20
Output Settings	D000 05
Output judgements, calculated data, and images	page 25
Save settings (Save, Read)	nage 26
Save in the save memory of PV or a SD memory card	page 26
as necessary.	
Display inspection results during inspections and	
change the setting values* (Data R/W)	noce 07
(* The settings of checkers, numerical calculations, and judgements)	page 27
Judgements)	1
Display a fixed shape on the screen window	
Marker Display	page 28

4.2 Selecting a Product Type No.

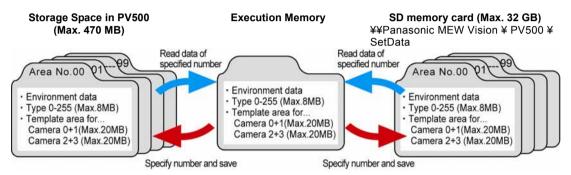
4.2.1 What Is a Product Type?

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

Regarding types No.0 - 255 as a set of data, PV500 saves up to 100 sets of data in "Storage Space in PV500". The data can be also saved in a SD memory card.

Every time PV500 starts up, it reads one data from the storage space in PV500 to the execution memory ^{(*1}. And, it calls up a product type ^{(*2} from it to set inspection conditions and execute inspections.

Type switching, data calling up to the execution memory, and data saving from the execution memory to the storage space in PV500 or a SD memory card can be executed by inputting I/O signal or sending a command from an external device.



Refer to

- *1) About how to specify the data to read (Area No.) from the storage space in PV500 at startup, see chapter 7.2.1 (page 325).
- *2) About how to specify a type to read at startup, see page 52.
- About how to save/read the setting data, see chapter 4.17 (page 268)

Note

If the data amount of types reaches to the maximum capacity of the setting data area, not all of 256 types may be created. If the storage space in PV500 used up its maximum capacity, not all of 100 data may be created.

You can confirm the free space for Type data and storage space in PV500 in "Free Space for Setting Data" and "Free Storage Space in PV500" from "TOOL" > "Information". (page 335).

4.2.2 Selecting a Product Type

Adding/switching a Product Type

1. Select "TYPE" > "Select Type" from the menu bar.

Type selecting window is displayed.

2. Select a product type No.

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

Note

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

Current Typ Type No. at			
Type Title	o can top	·	
Type No. C	ommon Setting	Type Title	
000	Yes	(Enter Title)	
001			
002			
003			
004			
005			

3. Press the FUNC key and select "Enter Title" from the displayed menu.

A software keyboard is displayed.

4. Enter a title and select "Enter" on the keyboard at the last.

The entered title will be displayed in "Type Title" field.

Setting a Type to Be Read at Startup

The type to be read at PV500 startup can be specified. This setting can be operated from ENVIRONMENT, and also the type switching window. If you change the setting in the window, the setting of ENVIRONMENT is also updated.

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

The pop-up menu appears.

2. Select "Type No. at Startup".

The last Type No. (default):

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

- 3. Specify "Selected Type No.".
- 4. After setting is completed, press the CANCEL key.
- 5. Save the data.

About how to save it, see page 268.

OPERATION E		pe Setting	Marker Di		Data R
Сору					
Paste		002			
Delete	•	000			
Enter Title					
Type No. at	Startup				
Type No. at	Startup				
	Common Sett	ing	Type Tit	tle	
		ing KEnter		tie	-
Type No. [Common Sett		Title>	tle	-1
Type No. (000	Common Sett Yes	<enter< td=""><td>Title> Title></td><td>tle</td><td>-1</td></enter<>	Title> Title>	tle	-1

Select by	oe Iy	or Setting	Harber D	splay	Data R,	٠
Current Type Type No. at Type Title		007 000				e . 901
000	Yes	Maler	Jan II	ile:	-1	
001	Yes	dater 1	itle>		-	
002	Yes	Cater J	FT142			
	Yes	Cater 1	511e2			
003				_		1.1

Copying Product Type

- 1. In type selecting window, move the cursor onto the product type which you want to copy.
- 2. Press the FUNC key and select "Copy" from the displayed menu.
- **3.** Move the cursor onto the product type which you want to paste.
- **4.** Press the FUNC key and select "Paste" from the displayed menu.

OPERATION	ENV1RONMENT	TYPE	INSPECTIO	N SAVE/F	READ TO	0L		
Select 1	ype	Type Set	ting	Marker	Displa	У	Data	R
Сору		002						
Paste Delete								
Enter Title	. 1	000						
Type No. at								
A COMPANY OF A COMPANY							_	1
	Common Set	_			Title			
000	Yes	<e< td=""><td>nter Ti</td><td>tle></td><td></td><td></td><td>-</td><td></td></e<>	nter Ti	tle>			-	
001	Yes	<e< td=""><td>nter Ti</td><td>tle></td><td></td><td></td><td></td><td></td></e<>	nter Ti	tle>				
002	Yes	<e <="" td=""><td>nter Ti</td><td>tle></td><td></td><td></td><td></td><td></td></e>	nter Ti	tle>				
003	Yes	<e< td=""><td>nter Ti</td><td>tle></td><td></td><td></td><td></td><td>н</td></e<>	nter Ti	tle>				н

The copied type is pasted.
Note
If the type already exists in the destination, the message of overwrite confirmation appears.

Deleting a Product Type

- 1. In type selecting window, move the cursor onto the product type which you want to delete.
- 2. Press the FUNC key and select "Delete" from the displayed menu.
- 3. Select "Yes" following the displayed message.

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

Deleting All Product Types

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

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

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

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

2. Select "Yes".

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

When "Template Registration" is set to "Common"

- 1. Select "TYPE" > "Initialize" from the menu bar. The window to choose whether to initialize all types or not is displayed.
- 2. To initialize all types, select "Yes". Not to initialize them, select "No". Selecting "Yes" initializes all types at the time.

The window to choose whether to clear all common templates or not is displayed.

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

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

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

Set conditions of capturing an image of an object.

Camera Type:

Four cameras (or two cameras) of three types can be connected. Set a type of camera for each connecting camera ports.

Camera Trigger:

When connecting multiple cameras, you can select Common Trigger or Individual Trigger. Common Trigger captures images simultaneously by all cameras and Individual Trigger captures them at separate timings. Selecting Common Trigger allows using Detect Trigger function which detects whether an object is in the inspection area.

Capturing Condition for Each Camera

- Shutter speed: page 59.
- Camera gain: page 59.
- Capture delay: page 60.
- FLASH delay, FLASH span: page 60.
- Partial imaging: page 61.
- Calibration: page 62.

Error if Checker Area outside Image:

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

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

4.3.1 Selecting a Camera Type (ENVIRONMENT)

PV500 provides for three types of cameras and can connect two cameras or four cameras. Set a type of camera connecting to each camera port. (You can use two or three types of cameras at the same time.)

Selecting a Camera Type

- 1. Select "ENVIRONMENT" > "Camera" from the menu bar.
- 2. Select "Camera".

Camera setting window is displayed. PV500 recognizes the connecting cameras at startup and displays their types in "Connected Camera" field.

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

The confirmation message appears. Selecting "Yes" changes the camera type.

Note

- If the types for "Connected Camera" and "Camera Type" are different, an image cannot be captured correctly.
- Changing camera type initializes capturing conditions of cameras. It is advisable to set the correct camera types before setting capturing conditions.
 Switching camera type between Quad-speed camera and Ultra Compact camera does not clear capturing conditions.

Setting Polarity of FLASH Signal

PV500 sends a FLASH signal which notices the timing of light emission to a strobe lighting. Four terminals (FLASH 0-3) are provided for four cameras. The polarity of the FLASH signals can be selected for each camera.

1. Select "FLASH Polarity".

2. Select polarity of FLASH Signal.

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

Refer to

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

4.3.2 Setting Individual Capturing Condition by Type

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

- 1. Select "TYPE" > "Type Setting" from the menu bar.
- 2. Select "Camera".
- 3. Select "No (Individual)" for "Common Setting".

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

To return to Common Setting

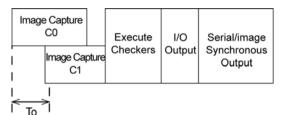
- **1.** Select "Type Setting" > "Camera".
- 2. Select "Yes (Common)" for "Common Setting".

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

When using multiple cameras, images can be captured at separate timings by inputting a start signal to the cameras. This is "Individual Trigger". On the other hand, the trigger starting image capturing with multiple cameras simultaneously is "Common Trigger".

Processing image of "Individual Trigger"

(in the case of two-camera connection)



START 0-3 signals correspond to camera 0-3. After capturing images of all cameras, checkers and result output are executed.

To: Individual Trigger Timeout

If image capture of all connecting cameras is not started after inputting the first START signal and within the time of set timeout period, Timeout error (ERROR0 signal output) will occur and the inspection will be terminated.

Processing image of "Common Trigger"

(in the case of two-camera connection)

Image Capture C0	Execute	I/O	Serial/image
Image Capture C1	Checkers	Output	Synchronous Output

Inputting START 0 signal starts capturing an image.

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

1. Set "Camera Trigger" in "Camera" window.

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

2. When you selected [Individual], select whether you use [Individual Trigger Timeout] or not.

If you select [Yes] (default), set a timeout period. Timeout period value can be set within 1 to 10000 ms (default: 5000ms).

Note

*1) When Live image is displayed, a delay time occurs until starting image capture after inputting the START signal.

Decide the timeout period considering this delay time. Refer to page 358 for details.

Restrictions on when waiting for Individual Trigger

Note the following restrictions on when waiting for Individual Trigger (at the time of "To" in the above figure) without using the timeout function.

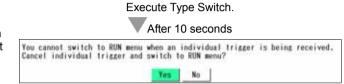
"Type Switch" and "Read Setting Data" with signals from the external device

Type Switch or Read Setting Data will be executed if the signal of Abort Inspection/Process or the signal of the rest of Image Capture is input within 10 seconds from input of Type Switch signal or Read Setting Data signal. If 10 seconds passed, Type Switch or Read Setting Data will be canceled and ERROR 1 signal will be output.

When Individual Trigger Timeout function is employed, Type Switch or Read Setting Data will be executed after the period of the Timeout passed.

Type Switch with the keypad in RUN Menu

If the signal of the rest of image capture is input within 10 seconds from the execution of Type Switch, the type will be switched at the time. If the signal of image capture is not input after 10 seconds passed, the message on the right appears.



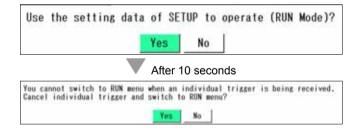
Yes:	Discards the images already captured, cancels Individual Trigger, and switches Type. The status will be the one to start an inspection again from the beginning.
No:	Cancels the operation of Switch Type, and returns to the state of waiting for Individual Trigger.
Not select: (Keep displaying the message)	The state will be the one of waiting for Individual Trigger displaying the message. If the signal of the rest of image capture is input, the type will be automatically switched.

Switching to RUN Menu form SETUP Menu

Switching to RUN Menu from SETUP Menu displays the message on the right. (*1)

If the signal of the rest of image capture is input within 10 seconds after selecting "Yes", the screen will be switched to RUN Menu at the time.

If the signal of image capture is not input after 10 seconds passed, the message on the right appears.



Yes:	Discards the images already captured, cancels Individual Trigger, and switches to RUN Menu. The status will be the one to start an inspection again from the beginning.
No:	The state will be the one of waiting for Individual Trigger in SETUP Menu.
Not select: (Keep displaying the message)	The state will be the one of waiting for Individual Trigger displaying the message in SETUP Menu. If the signal of the rest of image capture is input, the screen will be automatically switched to RUN Menu.

Note

*1) Only when changing the setting in SETUP Menu.

About Detect Trigger (common)

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



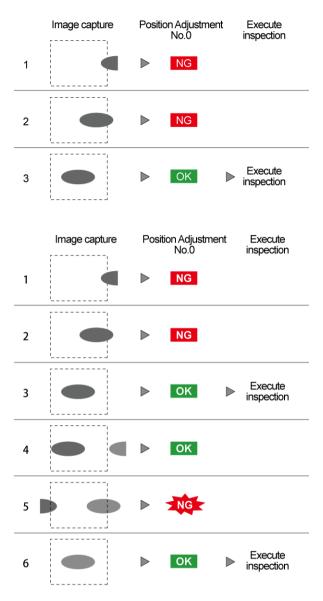
After an inspection is complete, the device executes image capture and Position Adjustment No.0 again.

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

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

Refer to

How to set Continuous Inspection: See page 315.



Note

 When execution mode is "User Defined", the Position Adjustment of the smallest number in the execution block is executed repeatedly.

For example, Position Adjustment No.200 for block No.2 and Position Adjustment No.900 for block No.9.

• When Inspection Process mode is "Parallel", Detect Trigger (common) cannot be used.

Selecting Camera to Set

- Select "TYPE" > "Type Setting" from the menu bar.
- 2. Select "Camera".

Camera setting window is displayed.

3. Select "Camera No. to Set".

Camera No. which can be used is displayed.

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

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

When "Unused" is shown in "Connected Camera" field, change Camera setting of "Environment".

Setting Shutter Speed

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

- **1.** Select the camera No. to set in "Camera" window.
- 2. Select "Shutter Speed".

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

Note

On PV500 Ver.1.50 or older, the shutter speed is selected from the following values. 30µs, 100µs, 250µs, 500µs, 1ms, 5ms, 10ms, 50ms, 100ms, 500ms, 1000ms.

3. Select desired shutter speed.

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

Adjusting Camera Gain

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

Note

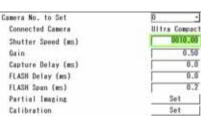
As increasing the sensitivity or the gain value, an image turns to be lighter and also rougher due to increased noises.

Setting	
Inspection	
Conditions	

Chapter 4

3 B S

IPERATION ENVIRONMENT THE	THEFECT	the second second and second se		DETUP WENT
Select Type Type	Setting	Marker Display	Data R/	W Initia
Execution Condition	Common	Setting		Yes (Common)
	11140	Trigger Seet to seet to seet of tool s Error Outside Sear		Common No +
	Conn Shut Gain Capt FLAS FLAS Part	No. to Set ected Camera ter Socod ure Delay (ms) H Delay (ms) H Span (ms) ial (maging bration		0 + 0 1 2 3 3 0,6 0,6 0,7 3et 3et



1. Select the camera No. to set in "Camera" window.

2. Select "Gain".

Gain value is displayed.

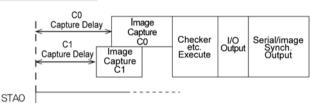
- Gain Range: 0.25 to 1.00 (Initial Value: 0.50)
- Setting unit: 0.01

3. Set gain value.

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

Setting Delay Time from START Signal Input to Image Capture

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



This setting can be set individually for each camera.

(Processing image when 2 cameras are connected and Common trigger is used.)

- **1.** Select the camera No. to set in "Camera" window.
- 2. Select "Capture Delay".
- 3. Specify the time from START signal input to capture start.

Settable range: 0.0 to 999.9 ms

Setting FLASH Delay and Pulse Output Width

After inputting START 0-3 signals, light emission timing signal is output from FLASH 0-3 of I/O connector to external strobe flash in pulse. Specify output delay of FLASH signal and outputting pulse width.

- 1. Select the camera No. to set in "Camera" window.
- 2. Select "FLASH Delay" and specify delay time.

Settable range: 0.0 to 999.9 ms

3. Select "FLASH Span" and specify pulse width of FLASH signal.

Settable range: 0.2 to 999.9 ms

Note

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

Refer to

FLASH signal timing chart: Page 363.

Capturing a Part of Image (Partial Imaging)

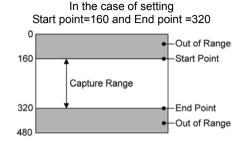
This function takes a part of image captured by camera in PV500. (The size of image is 640 x 480 pixels for ANPVC1040 and ANPVC1021, and 1600 x 1200 pixels for ANPVC1210.) Decreasing area to be taken shortens capturing time.

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

Partial Imaging is the setting by a camera and up to 2 areas can be set per camera.

Note

The gray value of the area other than imaging target will be zero.



- 1. Select the camera No. to set in "Camera" window.
- 2. Select "Partial Imaging". "Partial Imaging" window is displayed.
- 3. Set "Part Area No.0" to "Yes".

Now you can set the start/end point.

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

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

OPERATION ENVIRONMENT TYPE		SETUP MENU STOP
Select Type Select	etting Marker Display Da	ita R/W Initialize
Part Area No.0 Yes Start Point End Point	• RUN: Typ	e No.000
Data Undated!	RIG Ibn Test FINC (Per-y	e Beru - 1975ETI Ta RIN Meru
Data (Brdated)	F1 Deage Menu	e Mario Origentina HUN Mario

- 5. Select "End Point" and specify the ending line of the capturing area.
- 6. To set two partial imaging areas, set "Part Area No.1" to "Yes" and specify the start/end point as Area 0.

Set Area No.0 and No.1 in order to keep 3 lines away from each other. (If the end point of Area No.0 is 320, the start point of Area No.1 can be set 324 or after.)



Minimum value of settable capturing area

- Quad-speed camera (ANPVC1040), Ultra compact camera (ANPVC1021): 1 line
- 2-Mega-pixel camera (ANPVC1210): 100 lines
- 7. After setting is completed, press the CANCEL key.

Changing the Coordinate Origin and Unit (Calibration)

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

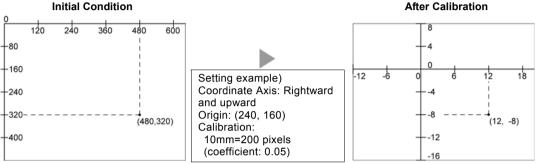
Note

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

Setting example)

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

Initial Condition



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

Setting Calibration

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

Select the camera No. to set in "Camera" window. 1.

2. Select "Calibration".

"Calibration" window is displayed.

3. Set "Calibration" to "Yes".

Now you can set all items.

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

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

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

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

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

Comment	
Calibration	Yes •
Origin X	
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 X	0.0500
ractor f	0.0000

Changing Coordinate Origin

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

- **1.** Select the camera No. to set in "Camera" window.
- 2. Select "Calibration".

"Calibration" window is displayed.

3. Set "Calibration" to "Yes".

Now you can set all items.

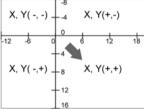
4. Enter value for "Origin X" and "Origin Y".

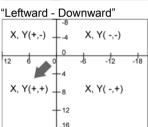
For example, if you want the position of coordinate (100, 100) to be the origin, enter "100" for them.

5. Select "Coordinate Axis".

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

"Rightward - Downward" (default)





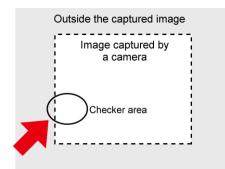
"Rightward - Upward" X, Y(-,+) + 4 X, Y(+,+) -12 -8 0 6 12 18 X, Y(-,-) -8 X, Y(+,-) -12 -16

Leftward -	Upw	vard"	
X, Y(+,+)	8	X, Y(-,+)	
	0		
12 6 0	-	-6 -12 -18	3
	-4		
X, Y(+, -) _	8	X, Y(-, -)	
-	12		
	-16		

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

OPERATION ENVIRONMENT	TYPE INSPECTIO	N SAVE/		TOOL	0.1	0.04
Select Type	Type Setting	Marker	Disp	olay	Data	R/W
Comment						
Calibration			Yes			
Origin X					100	
Origin Y					100	
Coordinate Axis (po	sitive direction	on)	Right	ward	- Downwar	rd •
Real Length X (e.g.	[nn])				- Downwar	rd
Real Length Y (e.g.	[nn])				 Upward Downward 	
Length X in Pixels					Upward	' I
Length Y in Pixels					200	
Factor X			0.050	0		
Factor Y			0.050	0		

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



 Select "TYPE" > "Type Setting" from the menu bar.

2. Select "Camera".

Camera setting window is displayed.

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

No (Default):

Executes a checker even if the checker area is beyond the camera image.

Yes:

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

Note

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

OPERATION DAVISOMENT TYPE	INSPECTION SAVE/READ TOD,	SETUP NEW
Select Type Type 5	etting Warker Display Data R/W	Initialize
Execution Condition	Common Setting	Yes (Common)
	Camera Trigger Individual Trigger Timeout Timeout (ms) Error if Checker Area outside image	Compon to Component Status No 1
	Camera No. to Set Connected Camera	No Yes Ultra Compact

4.4 Inspecting Divided Type (Execution Mode)

In PV500, checkers can be divided by checker number to execute just one checker, multiple checkers or all checkers. Divided part is "Block" and the mode to decide how to execute is "Execution mode".

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

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

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

Note

Although checkers No.0 to 999 can be selected if you set the number of blocks to "10", not all checkers can be always created because the memory capacity of PV500 is constant regardless of the number of blocks.

4.4.1 Selecting an Execution Mode

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

							Execution Mode
To execute	e inspection	using only or	ne product ty	/pe.			"Execute
	ny product ty	ypes when th	nere is enou	gh time to s	witch the product		All"
types.	inspections	s of many pa	ts in a cantu	ired image :	at a time		Executes all Checkers
	•	, ,	•	•	ent expressions to	P	Numeric Calculations and Judgements in a
perform co	omplicated ca	alculations ir	an inspection	on.			product type.
o execute d n the type a			is, checkers	s or conditi	ons, depending		
Example 1		-					"Automatic
To determi	ine if the obj	ect is reverse	ed or not and	d inspect wit	h the proper		Switch"
		an assembly f obiects are	line		B)	Executes multiple inspections effectively
running do		and inspect	with	7_/			
o execute v	arious type	s of simple	inspections				
Example: Only a few product typ o save time Example: To execute	to switch p e inspections		s	type, but m	ore than 256 up to 10) of		"User Defined"
Example: Only a few product typ o save time Example:	to switch p e inspections	oroduct type s speedily, sv	s	type, but mo tiple types (i			Defined" Executes some of the
Example: Only a few product typ o save time Example: To execute	v checkers ar bes exist. to switch p e inspections	s speedily, sv	s vitching mult	type, but mo tiple types (i			Defined" Executes some of the inspections in a
Example: Only a few product typ o save time Example: To execute conditions.	v checkers ar bes exist. to switch p e inspections Type	oroduct type s speedily, sv 0 Condition	s vitching mult Type (Condition	type, but me tiple types (t Condition			Defined" Executes some of the inspections in a product type. (Specify before
Example: Only a few product typ o save time Example: To execute conditions.	to switch p to switch p inspections	s speedily, sv Condition 5 Condition	s vitching mult Type (Condition	type, but mo tiple types (t 0 Condition 5 Condition			Defined" Executes some of the inspections in a product type. (Specify before
Example: Only a few product typ o save time Example: To execute conditions.	to switch p to switch p e inspections Type Condition Condition	oroduct type s speedily, sv 0 Condition 5 Condition 6 Condition	s vitching mult Type (Condition Condition	type, but mo tiple types (r 0 Condition 5 Condition 6 Condition			Defined" Executes some of the inspections in a product type.

4.4.2 Inspecting in "Execute All" Mode

The "Execute All" is a factory default execution mode.

This mode executes all set checkers. You do not have to be concerned about "Block" in this mode.

Specifying Execution Mode and Number of Blocks

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

"Type Setting" window is displayed.

- 2, Select "Execution Condition".
- **3.** Select "Execute All" for "Execution Mode".

OPERATION ENVIRONMENT TYPE INSPECTION SAVE/READ TOOL SETUP KENU					
Select Type	Type Setting	Marker Display	Data R∕₩	Initialize	
Execution Condition Camera Number of Blocks		Execute All -			

4. Enter the number of blocks 1 to 10 for "Number of Blocks".

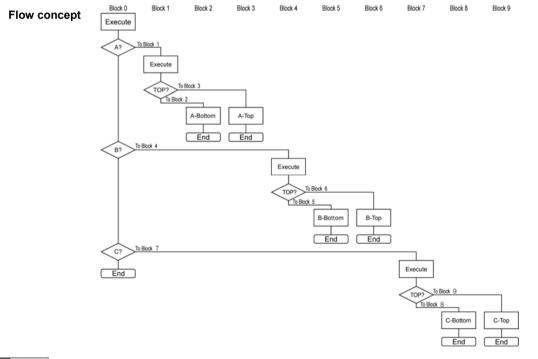
4.4.3 Inspecting in "Automatic Switch" Mode

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

Example)



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



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

Specifying Execution Mode and Number of Blocks

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

"Type Setting" window is displayed.

- 2. Select "Execution Condition".
- **3.** Select "Automatic Switch" for "Execution Mode".
- **4.** Enter the number of blocks 2 to 10 for "Number of Blocks".

OPERATION ENVIRONMEN	NT TYPE IMSPECTI	ON SAVE/READ TOOL		SETUP MENU
Select Type	Type Setting	Marker Display	Data R/W	Initialize
Execution Condi Camera	Executi	on Mode of Blocks	Autor	natic Switch 🕛

Preprocess

Setting a Branch Condition

 Select "INSPECTION" > "Judgement" from the menu bar.

The screen of Judgement setting is displayed.

2. Select "Set Branch Condition".

The branch condition setting screen is displayed.

3. Select "Block No.0".

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

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

4. Set branch conditions.

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

Checker

Thits Issel

Note

As "Destination", you can set the block number that is larger than the currently setting block or "End". For instance, Block 0 cannot be set as a branch destination for Block No.1. "End" indicates to end the inspection.

To set the behavior when no branch conditions are fulfilled, select "Destination" field in "False" line.

Set branch conditions as necessary.

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

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

	Chapter 4
_	3BSetting Inspection Conditions

lieck Mo., Type	UKEExternal 2	a l		
Checker Ba.	-	-		
8.778 August	11.0010	N/PE	_	10000 COL
JDC090 Depet 1	1000	11.1	-	
J00007 Secont				
JBC003 Sweet				
JDC004 Kene 1 JDC005 Rene 1				
JOCODS Enset				
JBC007 Secont				
Condi Fran	Det 1			
Set Branch Condition	Set			
		COLOR PROPERTY	ST. BORNE	in the second latest
CONTRACTOR OF A DW				
Total Judge.				a land street of any
Total Judges Dave Tag Reason Tage Delaist	Bit Bit Bit			
Auge Chipper	No.			
Augo Galpart	No. No. No.			Save JBC/JDC at NG stant JBC/JDC at NG
Block No.	Bi So Bi 1100 Aur So 11 Dage	11		etaut JBC/JDC at N
Block No.	No No No 1910 - Kur S 19 19 19 19 19 19 19 19 19 19 19 19 19	1.000 CEA 100	o de la companya de	when decide at w
Block No.	No No No No No No No No No No No No No N	ed News 050 051	OK OK	eteet JRC/JOC at W
Taxes they are the second seco	No So No 1110 Rach So 1110 Rach	1.000 CEA 100	o de la companya de	eteet JRC/JOC at W
Branch U Branch J Branch J Branch J	No No No No No No No No	ed News 050 051	OK OK	eteet JRC/JOC at W
Block No.	No No No No No No No No No No No	ed News 050 051	OK OK	eteet JRC/JOC at W
Tanne Golgert Stel Mahlen Branch 9 Branch 9 Branch 9 Branch 9 Branch 9 Branch 9 Branch 9	No. No. No. No. No. No. No. No. No. No.	ed News 050 051	OK OK	when ARC/AC at N
Elect No. Block No. Branch 0 Branch 1 Branch 1 Branch 1 Branch 1 Branch 1 Branch 1 Branch 1 Branch 1 Branch 1	No. No. No. No. No. No. No. No. No. No.	ed News 050 051	OK OK	eteet JRC/JOC at W
Block Ne, Block Ne, Branch 0 Branch 2 Branch 3 Branch 3 Branch 3 Branch 4 Branch 5	No. No. No. No. No. No. No. No. No. No.	ed News 050 051	OK OK	when ARC/AC at N

Num. Callen.

4.4.4 Inspecting in "User Defined" Mode

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

Select Ivne

scution Condition

Camera

Type Setting Marker Display

Execution Mode

Number of Riocks

Specifying Execution Mode and Number of Blocks

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

"Type Setting" window is displayed.

2. Select "Execution Condition".

- **3.** Select "User Defined" for "Execution Mode".
- **4.** Enter the number of blocks 2 to 10 for "Number of Blocks".

How to Set a Block

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

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

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

Note

When using "Individual Trigger" for camera trigger, you cannot execute different blocks for each camera. After specifying block No.0 with the first camera, specifying the other block numbers with the second camera stops inspections and outputs ERROR 0 signal.

Block	I/O (S	I/O (STA0-3 +)			Serial
	IN3	IN2	IN1	IN0	command*
No.0	off	off	off	off	%S0
No.1	off	off	off	ON	%S1
No.2	off	off	ON	off	%S2
No.3	off	off	ON	ON	%S3
No.4	off	ON	off	off	%S4
No.5	off	ON	off	ON	%S5
No.6	off	ON	ON	off	%S6
No.7	off	ON	ON	ON	%S7
No.8	ON	off	off	off	%S8
No.9	ON	off	off	ON	%S9

Data R/W

Initialize

Uner Defined

(*Individual Trigger: No)

Starting an Inspection by Keypad

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

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

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

2. Select the block No. to execute.

The specified block is executed.

4.5 Capturing an Image

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

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

1. Press the F1 key and select "Delete" from the displayed menu.

- 2. Select "Live" for "Memory/Live".
- **3.** Place an object beneath the camera.

4. Press the TRIG key.

A test run is executed and an image is captured.

Note

You can call up the images saved in PV500 or a SD memory card to set checkers and execute a test. About how to save and read images, refer to Chapter 4.16, page 260.

4.6 Image Preprocessing (Slice Level / Preprocess)

PV500 takes in signals from a camera as an image with 256 intensities (0 to 255). The image is "gray image" and the 256 intensities are "gray value". The higher gray value indicates the brighter pixel, and the lower gray value the darker pixel.

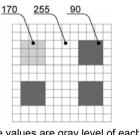
The function that applies filtering process on an image in order to execute desired inspections based on the gray image is "Preprocess".

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

4.6.1 Binarizing an Image (Slice Level)

In PV500, up to 26 sets of slice level (A to Z) can be registered, which is called slice level group. Which slice level group is used to inspect an image is set in the checker setting window.

Gray Image



Slice Level Group A Maximum value is 255 Minimum value is 200 200 to 255 = white 0 to 199 = black Slice Level Group B Maximum value is 255 Minimum value is 150 150 to 255 = white 0 to 149 = black

The values are gray level of each pixel.

Setting a Slice Level

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

"Slice Level" setting window is displayed.

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

2. Select a group to set from the table.

"Slice Level" setting sub-window is displayed.

3. Select "Auto Adjustment".

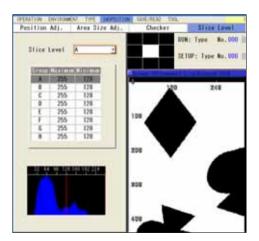
If the image turned to be a desired binary image, setting is completed.

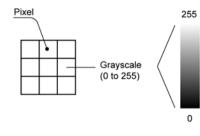
4. Select "Minimum" to specify the minimum value.

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

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

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





Chapter 4

4.6.2 Setting Preprocess

In PV500, up to five sets of preprocess (A to E) can be registered per type and camera. The sets of preprocess A-E are preprocess groups. Up to 10 steps of filters can be set for a preprocess group. PV500 also has a function to temporarily disable a part of the specified 10 steps. (from Ver.2.0)

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

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

Preprocess group selecting window is displayed.

- **2.** Select a camera image to set preprocess from "Camera". The camera image selected in "Camera" is displayed.
- **3.** Select a preprocess group to set from "Preprocess". The current setting of the preprocess group is displayed.
- 4. Select "1ST".

The screen of preprocess setting is displayed.

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

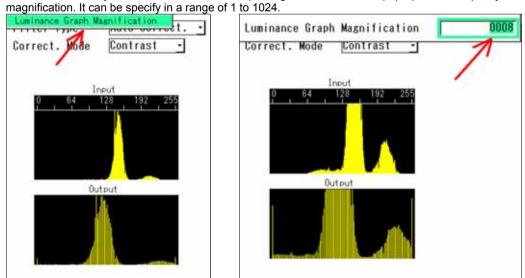
The image is updated to be an image applied the specified filter. The image before applying preprocess can be confirmed in the window navigator area (pointed by the arrow in the right figure).

Note

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

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

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



OPERATION ENVIRONMENT TYPE INSPECTION Slice Level Preproces: Canera Preprocess Filter 181 2ND None 380 None 4TH None 5TH None



6. Set the parameter for the selected filter.

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

Note

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

7. Set 2ND to 10TH process as necessary.

When multiple steps are set, PV500 processes from 1ST step in numeric order.

8. After setting is completed, press the CANCEL key.

Note

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

Copying Preprocess

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

The pop-up menu appears.

- 2. Select "Copy".
- 3. Select the step that you want to paste and press the FUNC key.

The pop-up menu appears.

4. Select "Paste".

The preprocess is copied.

Note

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

Copy

Invalid

1ST

2ND

3RD

4TH

5TH

Preprocess

0

A

Tophat

Dilation

Rotation

None

None

•

-

aram.

Black

3x3

30.00

Disabling the Set Preprocess

(Ver.2.00 or later)

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

Note

The invalid/valid setting is saved as type data.

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

The pop-up menu appears.

2. Select "Invalid".

The display in the column showing [Step] of the selected step changes to "----".

In the example on the right, "2ND" changed to "----" to show the step is invalid. In this case, the image rotation of the third step is executed after the feature extraction of the first step.

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

Step	Filter	Param.
1ST	Topha t	Black
	Dilation	3x3
3RD	Rotation	30.00
4TH	None	
5TH	None	1

Denoising

Size: 3x3, 5x5, 7x7, 9x9

Direction: X/Y, X(only), Y(only)

Index 1

- Main application:
- Common parameter:

Dilation

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

Erosion

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

Erosion -> Dilation

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

Dilation -> Erosion

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

Index 2

Main application: Change in gray level

Auto Correction

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

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

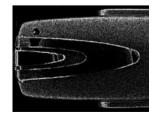
Area Averaging

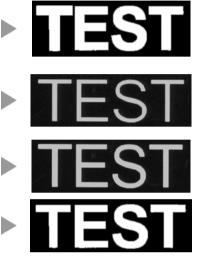
Averages the brightness in the specified area.



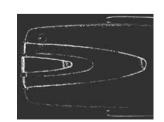


Panasonic









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





Inp

Output

Area Avging

50

Filter Type

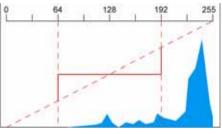
Noise Range

Cntr Gray Lev.

Area Averaging

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

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



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

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

Correction Setting

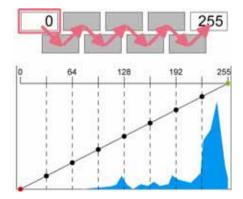
Gray levels in a range of 0 to 255 are divided into 8 blocks, and the gray levels can be changed at 9 points.

1. Select "LUT Setting".

The values are displayed only for the two points (i.e. 0 and 255) among nine points. Tilting the ENTER key up/down increases or decreases the values at the points where the values are displayed.

The luminance graph indicates the point that the value has been input in green and the point that is being changed in red.

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



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

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

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

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

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

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

Index 3

Main application: Defocusing

Median Removes light or fine noises.

Smoothing

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

Index 4

- Main application:
- Common parameter:

Sobel

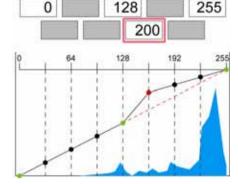
Same as "Prewitt". More easily extracts the area of lower contrast.

Prewitt

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

Laplacian Extracts the area of which grayscale value changes.







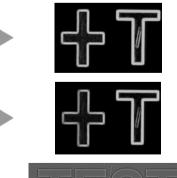




Contour enhancement

Size: 3x3, 5x5, 7x7, 9x9







Edge Extract X

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

Edge Extract Y

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

Sharpen

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



Main application: Flaw detection

Tophat

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

Dvnamic

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

Refer to Page 76

Frequency Extraction

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

Refer to Page 76

Setting Tophat

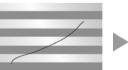
1. Select the color of foreign objects you want to extract in "Segment Color".

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

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

The background information larger than the size specified here (such as patterns. The black horizontal lines in the example on the right) is removed.

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





□ Set size X/Y individually.

Tophat

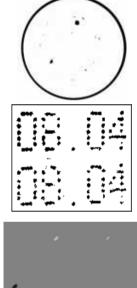
Black

31

Filter Type

Size X/Y

Segment Color

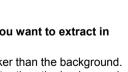


EST



Chapter 4

76



IES'

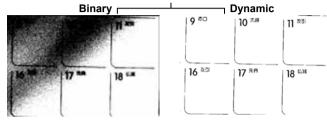
TES'

Setting Dynamic thresholding

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

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



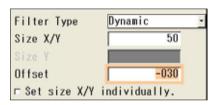


1. Set "Size X/Y".

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

2. Set "Offset".

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



About Frequency Extraction

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

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

1. Select and check "Smoothing Filter".

2. Set "Size X/Y".

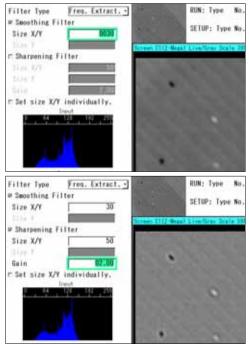
If "Sharpening Filter" is unchecked, only the result of the application of Smoothing Filter can be confirmed. Set the appropriate value to remove unnecessary edges by increasing the value checking the image.

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

3. Select and check "Sharpening Filter".

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

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



Index 6

Main application: Rotation and Reflection

Rotation

Rotate the whole captured image at a specified angle. The gray level can be specified for the blank spaces of the image created by the rotation (i.e. the gray area in the right figure). When rotating the image partially captured, the area out of the capturing range is also displayed in the specified gray level.

If Preprocess is set after the image rotation, Preprocess will be executed using the blank spaces as a part of the image.

Reflect

Reflects an image.

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



TESI

TEST

Vertical axis

> Horizontal axis

4.7.1 Types and Overview of Checkers

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

Sixteen types of checkers are available in the PV500. You can set up to 999 checkers per product type and checker type (when the number of used blocks is 10). However, the maximum number of checkers available for a type is 1000.

Note

The way of counting differs depending on checkers. One checker is not always counted as one. Before you create a new checker, confirm the number of set checkers displayed on the checker number selecting window.

Types of Checkers

The following checkers are available in the PV500.

Line

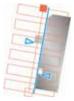
Line		
Main application:	Presence/absence inspection, Counting	1000
Description:	Line binarizes an image captured by a camera and measures white or black pixels on a line. Judges as OK or NG on the measured value.	0 0 /0
Refer to:	87 p	B. B.
Binary Window		
Main application:	Measurement of size, Presence/absence inspection	nnni
Description:	Binary Window binarizes an image captured by a camera and measures an area or the number of white or black pixels. Judges as OK or NG on the measured value.	
Refer to:	91 p	
Gray Window		
Main application:	Measurement of brightness, Orientation recognition	
Description:	Calculates the gray average values of all pixels in a specified area and judges as OK or NG using the measured number.	CW5
Refer to:	94 p	CM2
Binary Edge		
Main application:	Position detection, Measurement of length (at high speed)	
Description:	Binary Edge binarizes an image captured by a camera and detects an edge between white and black pixels. Judges as OK/NG according to its existence.	
Refer to:	96 p	
Gray Edge		
Main application:	Position detection, Measurement of length (at high inspection accuracy)	Æ
Description:	Gray Edge detects a brightness changing point on a grayscale image and judges as OK or NG in accordance with the number of detected points. This function is effective if the variation in image brightness is small and the contrast of an edge is low.	
Refer to:	100 p	

Light

Dark

Feature Extraction		
Main application:	Position detection, Angle detection, Counting	
Description:	Binarizes an image captured by a camera and detects a specified size of clusters of white or black pixels and judges as OK or NG depending on the measured number. Outputs the feature quantity such as the coordinates of a center of gravity or principal axis angle (+/-90 degrees).	$\begin{array}{c} \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \\ \bullet & \bullet &$
Refer to:	105 p	
Smart Matching		
Main application:	Position detection, Angle detection, Type recognition	E A
Description:	Smart Matching searches and detects a similar part to the registered image pattern. Outputs the detected position and angle, and similarity degree or correlation value. Scans with a gray image.	
Refer to:	111 р	
Flaw detection		
Main application:	Flaw detection, Detection of a flaw, missing edge, burr on the surface, Detection of a dirt	
Description:	Calculates gray average value within the segmented area (cell) in a line, arc and circle or rectangular area. If the PV500 detects an area more than a certain level of difference in average gray, the device judges it as a flaw.	
Refer to:	125 p	
Connector (Binary Wir	ndow Grav Window)	
Main application:	Appearance inspection of lead pins	
Description:	Inspects appearance of many pins using the method of Binary Window checker.	
Refer to:	135 р	
Connector (Gray Edge		
Main application:	Measurement of pitch of lead pins, float check, Connector gap, Width measurement	
Description:	Using the edge detecting principle of Gray Edge, Connector (Gray Edge) measures pitches of many pins, detects floats, and measures gaps of a connector. It has also Detect Mode which inspects width or height of parts, using many edges.	
Refer to:	140 p	
Smart Edge (Circle)	Available from Ver.1.6	
Main application:	Detection of the center point of round object, detection of a missing edge, burr on the surface, detection of the position or angle of projection, circularity inspection	×
Description:	Detects the radius or diameter of a round object based on the coordinate value of the edge of the object detected by setting a number of cells. A ring-shaped object or circular object can be inspected.	
Refer to:	153 p	X

Smart Edge (Line) Main application:	Available from Ver.2.0 Detection of the position or angle of uneven end face.
Description:	Detects the approximate line based on the coordinate value of the edge of the end face detected by setting a number of cells. Detecting the coordinate value or angle of the approximate line enables the detection of the position or angle of the object by setting only one checker.
Refer to:	171p



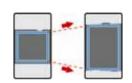
Position/Rotation Adjustment

Main application:	Adjustment of object position and rotation angle	
Description:	Detects the misalignment and rotation angle of the object from the base position.	
Refer to:	185 p	



Area Size Adjustment

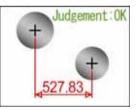
Main application: Adjustment of area size of checkers



Geometry Calculation Main application:	Available from Ver.2.0 Geometry calculation using detected data	
Description:	Conduct seven kinds of geometry calculations using the coordinate values and lines detected by each checker. Items such as the intersection point of two lines or approximate circle can be calculated without setting operation expressions.	
Refer to:	198 p	
Character/Figure Drawi	ng Available from Ver.2.0	
Main application:	Display of inspection data or results on the screen window	
Description:	Draw six kinds of figures including characters using	

Draw six kinds of figures including characters using detected data on the screen window It is possible to Description: change the drawing color or draw figures in the detected area depending on inspection results. 234 p

Refer to:



Creating a New Checker

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

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

Note

As the default setting, the number of available checkers is 100 (0-99) for each checker. Increasing the number of blocks enables to create checkers after No.101. To set the number of blocks, select "TYPE" > "Execution Condition" > "Number of Blocks".

Copying Checker

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

The Pop-up menu appears.

- 2. Select "Copy".
- **3.** Move the cursor onto the checker number you want to paste and press the FUNC key.

4. Select "Paste".

The checker is copied.

Note
If a checker already exists in the destination, the message of overwrite confirmation appears. Selecting "Yes" executes copying the checker.

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

The setting window of the pasted checker is displayed.

Deleting a Checker

- **1.** Move the cursor onto the checker number you want to delete and press the FUNC key. The pop-up menu appears.
- 2. Select "Delete".

The confirmation screen is displayed.

3. Select "Yes".

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

Position Adj.	Area	Size	Adj.	1	Chec	ker:
Checker Type						
Line					6	
Line					9	
Binary Window						
Gray Window				Calula	71/7	
Binary Edge					1112	
Gray Edge						
Feature Extraction	1.1				1	
Smart Matching						
Flaw Detection						
Connector (Bin. Wi	n.)					
Connector (Gra. Wi	n.)					
Connector (Gra. Ed	(s.)					
Smart Edge(Circle)						

. 1	Area	Size	Adj.
ers on	y	-	
-		0	
or Co		D)	-1
			_
	ers on	ers only	

Displaying a checker list

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

Checker status, Comment

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

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

Camera No.

Checker number and comment fields are displayed in a maximum of 4 colors for each camera number selected in "Camera" in the checker setting window. Colors are set in "ENVIRONMENT" > "Color". When selecting "Standard", the list is displayed in the following colors.

- Camera No.0: Gray
- Camera No.1: Pink
- Camera No.2: Yellow
- Camera No.3: Green

Inspection Result

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

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

1. Press the FUNC key.

The pop-up menu appears.

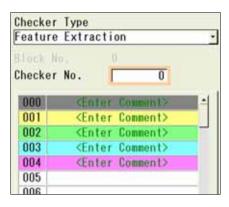
2. Select "Display NG checkers only".

Only the checkers that are judged as NG are displayed.

Note

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

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







Selecting Display Pattern on Screen Window

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

The display methods are selected for the following patterns.

- Arrows indicating the inspection area and scan direction of checkers (including Position Adjustment and Area Size Adjustment)
- **Result of Geometry Calculation**
- Figures set in Character/Figure Drawing
- **Calibration Scacle**
- However, in the window to set the above checkers (e.g. when selecting "INSPECTION" > "Geometry Calculation"), select whether or not to display only the patterns of the specified checker number instead of selecting "Display/Hide".

1. Press the F1 key in SETUP Menu.

Image menu is displayed.

2. Select "Pattern Display".

3. Select "Display" or "Hide" for "Pattern Display".

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

All Checkers (Default):

When selecting this, all the set checker patterns are displayed.

Selected Checker Type:

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

Selected Checker:

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

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

Target Checker

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

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

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

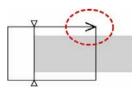
6. Select "No" or "Yes" for "Calibration Scale".

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

Position Adj.	Area Size Adj.	Checker
Select Camera	1	
Memory/Live	j:	
Preprocess	1	
Pattern Display	0	Charges Children

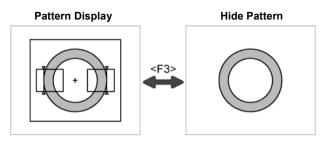
Calibration Scale	No	•
Display Patterns	All Checkers	•
Preprocess	All Checkers	
Pattern Display	Selected Checker Type Selected Checker	

Display Patterns	Display	-
Scan Direction	Display	
Geometry Calculation	Display	÷
Character/Figure Drawing	Display	
Calibration Scale	Hide	



Hiding Pattern on Screen Window

The checker patterns displayed on the screen window can be hidden in SETUP Menu. Pressing the F3 key switches between displaying and hiding.



Note

This selection is kept until you cut the power of PV500. Once you reboot PV500, the patterns will be displayed.

Common settings for checkers

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

Selecting Preprocess / Slice Level

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

1. Select "Inspection Condition" > "Preprocess".

"Preprocess" window is displayed.

2. Select a Preprocess group (A to E) in "Preprocess".

Note For details of preprocess, refer to page 71.

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

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

4. Select "Slice Level".

"Slice Level" setting window is displayed.

5. Select a Slice Level group (A to Z).

For the details on binarization, refer to page 70.

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

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

Selecting Position Adjustment

Position Adjustment is helpful when position or angle of an inspection object is unstable. Select a Position Adjustment checker that has been already set. Refer to page 185 for details of position adjustment.

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

The list of position adjustment is displayed. Note If a position adjustment checker is not created, "Position Adj." cannot be selected.

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

4.7.3 Moving Checkers in Group

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

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

1. Select "INSPECTION" > "Group Move".

- 2. Specify a camera No. used by the checkers you want to move in [Camera].
- **3.** Specify conditions of checkers to move in "Position Adjustment".

No:

To move the checkers that select "No" for Position Adjustment in the checker setting window.

Select All:

To move all checkers regardless of the settings of Position Adjustment in the checker setting window.

Select Position Adjustment No.:

Select a Position Adjustment which is already set. To move the checkers that select the same Position Adjustment No. in the checker setting window.

4. Set the checker to exclude from group move to [No].

Unset checkers are not needed to be set to [No].

Note

As a result of the above setting, if there is no checker to be moved, the "Move" button is shown in gray and cannot be selected.

5. Press [Move] button to move the areas.

After moving them, press the ENTER key to fix the position. Pressing the CANCEL key cancels group move.

Now you have completed group move.

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

Block No.	0
Checker No.	0
	No
	Select All
000 <e< td=""><td>nter Comment></td></e<>	nter Comment>
001 <e< td=""><td>nter Comment></td></e<>	nter Comment>

Casera	þ	•	
Position Adjustment	No		
Line	Yes	•	
Binary #indow	Yes		
Gray Window	No		

4.7.4 Line

What is Line?

Line checker binarizes an image captured by a camera and counts target colored pixels and the number of objects on a line. Judges as OK/NG according to those values.

Output Data

No. of Pixels:	Outputs in the number of target colored pixels on the line.
No. of Objects:	The number of parts of pixel string.
	Example) Target color = black No. of Pixels = 7, No. of Objects = 2
Pixel Judgement:	If detected pixel count is within the allowable range you have set, the object will be judged as "OK", if it exceeds the allowable range, the object is judged as "NG".
Objects Judgement:	If detected object count is within the allowable range you have set, the object will be judged as "OK", if it exceeds the allowable range, the object is judged as "NG".
(Total) Judgement:	Total judgement result of Pixel Judgement and Objects Judgement. If two of them are "OK", the object will be judged as "OK"; otherwise, the object will be judged as "NG".

Specifying Checker No.

- 1. Select "Line" in "Checker Type".
- 2. Select the checker No. list and specify a checker number to set.
- 3. Press the ENTER key to determine the checker No. "Line" setting window is displayed. The binary image is displayed on the screen window.

Selecting a Camera

Select a camera image to set "Line" checker.

- 1. Select "Area Setting" in "Line" setting window.
- 2. Select a camera No. in "Camera".

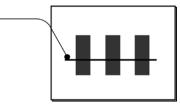
The selected camera image is displayed.

Note

Select a displayed image type (Live/Memory and Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.







Area



Selecting Preprocess / Slice Level / Position Adjustment

Refer to page 85

Setting an Inspection Area

Set a line which is the inspection span.

Note

You cannot set a Mask Area in Line checker.

1. Select "Area Setting" in "Line" setting window.

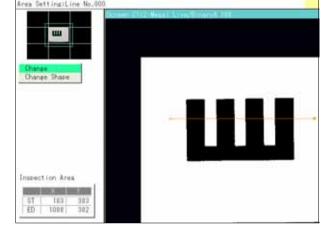
2, Select "Area Setting".

Area setting window is displayed.

3. Select a shape of inspection area from "Change Shape".

Line, Broken line, and Ellipse are available.

- Select "Change" and draw an area.
 Refer to the section of Drawing an Inspection Area, page 43.
- 5. After drawing is completed, press the CANCEL key.



Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker.

Refer to Chapter 4.9, page 195 about Area Size Adjustment and the setting procedure.

Selecting a Target Color

Set to count pixels of either white or black on a binary image. Target color can be selected for each of pixel counting and object counting.

- Select "Inspection Condition" > "Count Pixel Color".
- 2. Select "White" or "Black" to detect.

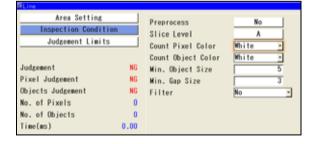
White (default):

Counts the number of white pixels within the area.

Black:

Counts the number of black pixels within the area.

- 3. Select "Count Object Color".
- 4. Select "White" or "Black" to detect.



White (default): Counts the number of white objects within the area. Black: Counts the number of black objects within the area.

Dilation and Erosion on Binary Image (Filter)

This is the function that dilates or erodes the pixels of color selected for target color to count. Use this function mainly when you delete a slight noise or enhance a detected area. If applying this function is not necessary, proceed to the next step.

1. Select "Inspection Condition" > "Filter".

The list of settable filters is displayed.

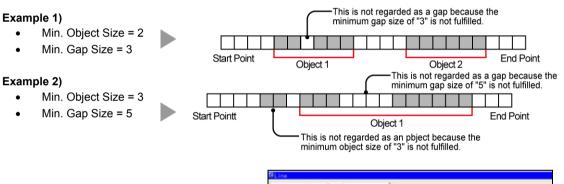
2. Select "Filter" to process the image to be a desired image.

Changing filters updates the displayed image. Confirm it and set.

Setting Criteria for Counting Objects

Set object criteria to count. The following two items are the criteria.

- Min. Object Size: Decides the number of pixels to regard as an object.
- Min. Gap Size: Decides the minimum value of gap which is the number of pixels lying between objects and with different color from target.



- **1.** Select "Inspection Condition".
- 2. Enter "Min. Object Size" and "Min. Gap Size".

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

Setting Judgement Limits

Set tolerance (Maximum and Minimum values) of the counted pixels and objects. If the counted pixels and objects are within the tolerance, the object will be judged as "OK", if it is out of it, the object is judged as "NG".

- 1. Select "Judgement Limits".
- 2. Enter "Max. No. of Pixels." and "Min. No. of Pixels".

Enter the values in pixels.

3. Enter "Max. No. of Objects." and "Min. No. of Objects."

Area Setting Inspection Conditi Judgement Limits		Win. N Max. N	lo. of lo. of	Pixels Pixels Objects Objects	125938 0 41979	
Judgement	NG			objects		
Pixel Judgement	NG					
Objects Judgement	NG					
No. of Pixels	0					
No. of Objects	0					
Time(ms)	0.00					

4. After inputting is completed, press the CANCEL key.

Running a Test

Confirm if the current settings perform an inspection properly.

1. Press the TRIG key.

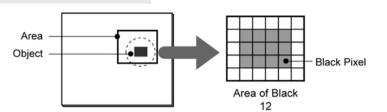
When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images. Note

Position adjustment and area size adjustment are also executed at the same time if they are used.

2. Confirm the inspection result.

What Is Binary Window?

Binary Window binarizes an image captured by a camera and measures an area or the number of white or black pixels. Judges as OK/NG according to the measured area.



Output Data

Area: Outputs in the number of pixels.

Judgement: If the number of detected area is within the allowable range you have set, the object will be judged as "OK", if it exceeds the allowable range, the object will be judged as "NG".

Specifying Checker No.

- 1. Select "Binary Window" in "Checker Type".
- 2. Select the checker No. list and specify a checker number to set.

3. Press the ENTER key to determine the checker No. "Binary Window" setting window is displayed. The

Selecting a Camera

Select a camera image to set Binary Window checker.

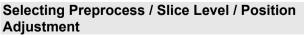
- 1. Select "Area Setting" in "Binary Window" setting window.
- 2. Select a camera No. in "Camera".

displayed camera image is binary.

The selected camera image is displayed.

Note

Select a displayed image type (Live/Memory or Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.



Refer to page 85





Setting an Inspection Area

Set a range to measure area.

- **1.** Select "Area Setting" in "Binary Window" setting window.
- 2. Select "Area".

"Area Setting" window is displayed.

- **3.** Select a shape of inspection area from "Change Shape". Select from Rectangle, Ellipse, Circle and Polygon.
- Select "Change" and draw an area.
 Refer to section of Drawing an Inspection Area (page 43).
- 5. After drawing is completed, press the CANCEL key.

When you want to exclude a part from inspection (Mask area)

Up to 16 mask areas, where checker does no inspection, can be set in an inspection area. Select "Add Mask" in "Area Setting", specify a shape and draw an area. Refer to section of Setting a Mask Area (page 47) for details.

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker.

Refer to Chapter 4.9, page 195 about Area Size Adjustment and the setting procedure.

Select a Target Color

Set to detect pixels of either white or black on a binary image.

1. Select "Inspection Condition" > "Target".

2. Select "White" or "Black" to detect.

White (default): Measures the area of the pixels in white.

Black: Measures the area of the pixels in black.



Dilation and Erosion on Binary Image (Filter)

This is the function that dilates or erodes the pixels of the color selected in "Target". Use this function mainly when you delete a slight noise or enhance a detected area. If applying this function is not necessary, proceed to the next step.

1. Select "Inspection Condition" > "Filter".

The list of settable filters is displayed.

2. Select "Filter" to process the image to be a desired image.

Changing filters updates the displayed image. Confirm it and set.

Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of the measured area. If the measured area is within the tolerance, the object will be judged as "OK", if it is out of it, the object is judged as "NG".

- 1. Select "Judgement Limits".
- 2. Input the setting values for "OK Judge. Max." and "OK Judge. Min".

Enter the values in pixels.

3. After inputting is completed, press the CANCEL key.

Running a Test

Confirm if the current settings perform an inspection properly.

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

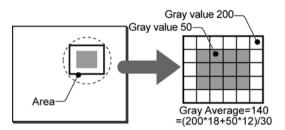
Note

Position adjustment and area size adjustment are also executed at the same time if they are used.

2. Confirm the inspection result.

What Is Gray Window?

Gray Window calculates the gray average of the inspection area based on the gray values of every pixel on a gray image captured by a camera. And then the checker judges as OK/NG using the value.



Output Data

 Gray Average:
 Average of gray value within an area.

 Judgement:
 If the calculated gray average is within the allowable range you have set, the object will be judged as "OK", if it exceeds the allowable range, the object will be judged as "NG".

Specifying Checker No.

- 1. Select "Gray Window" in "Checker Type".
- 2. Select the checker No. list and specify a checker number to set.
- **3.** Press the ENTER key to determine the checker No.
 "Gray Window" setting window is displayed. The gray image is displayed on the screen window.

Position Adj. Area Size Adj.	Checks	IF
Checker Type		RUN
Gray Window 🔄	+	SET
Checker No. 0		of t
000 (Enter Common1) -		
001		
002		
003		

Selecting a Camera

Select a camera image to set "Gray Window" checker.

- 1. Select "Area Setting" in "Gray Window" setting window.
- 2. Select a camera No. in "Camera".

The selected camera image is displayed.

Note

Select a displayed image type (Live/Memory or Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

Selecting Preprocess / Position Adjustment

Refer to page 85

Setting an Inspection Area

Set an area to measure gray average.

- 1. Select "Area Setting" in "Gray Window" setting window.
- 2. Select "Area".

"Area Setting" window is displayed.

- **3.** Select a shape of inspection area from "Change Shape". Select from Rectangle, Ellipse, Circle and Polygon.
- 4. Select "Change" and draw an area.

Refer to section of Drawing an Inspection Area (page 43).

5. After drawing is completed, press the CANCEL key.

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker.

Refer to Chapter 4.9, page 195, about Area Size Adjustment and the setting procedure.

When you want to exclude a part from inspection (Mask area)

Up to 16 mask areas, where checker does no inspection, can be set in an inspection area. Select "Add Mask" in "Area Setting", specify a shape and draw an area. For details, refer to page 47, "Setting a Mask Area".

Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of gray average. If the measured gray average is within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG".

- 1. Select "Judgement Limits".
- 2. Input the setting values for "OK Judge. Max." and "OK Judge. Min".
- 3. After inputting is completed, press the CANCEL key.

Running a Test

Confirm if the current settings perform an inspection properly.

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images. Note

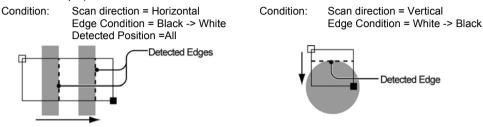
Position adjustment and area size adjustment are also executed at the same time if they are used.

2. Confirm the inspection result.

What Is Binary Edge?

Binary Edge binarizes an image captured by a camera and detects an edge between white and black pixels. The checker judges as OK or NG in accordance with the number of detected points.

Detect Example)



Output Data

Coordinates X and Y of edge	S
Detect color of edges (+ / -):	Type of an edge, which is white -> black (-) or black -> white (+).
No. of Objects:	The number of detected edges. The value is 0 to 256.
Judgement:	If the number of detected objects is within the range you have set, the object will be judged as "OK", if it exceeds the range, the object is judged as "NG".

Specifying Checker No.

- 1. Select "Binary Edge" in "Checker Type".
- 2. Select the checker No. list and specify a checker number to set.
- **3.** Press the ENTER key to determine the checker No.

"Binary Edge" setting window is displayed. The binary image is displayed on the screen window.

Position Adj.	Area Siz	e Adj.	Checks	er 👘
Checker Type				RUN
Binary Edge		-	-	1.55
FLACE RAN				SET
Checker No.	0			
emered we.			Street Store	
000 Enter C	(ment)	- 4		
001				
		-		
002				

Selecting a Camera

Select a camera image to set Binary Edge checker.

- **1.** Select "Area Setting" in "Binary Edge" setting window.
- 2. Select a camera No. in "Camera".

The selected camera image is displayed.
Note
Select a displayed image type (Live/Memory or Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

Selecting Preprocess / Slice Level / Position Adjustment

Refer to page 85

Setting an Inspection Area

Set a range to detect an object.
Note
You cannot set a Mask Area in Binary Edge checker.

1. Select "Area Setting" in "Binary Edge" setting window.

2. Select "Area (Set)".

"Area Setting" window is displayed.

3. Select a shape of inspection area from "Change Shape".

Select from Line and Plane. For detecting a flat edge at high speed, Line scan is suitable. And Plane scan suits for detecting a round or pointed edge.

4. Select "Change" and draw an area.

Refer to section of Drawing an Inspection Area (page 43).

5. After drawing is completed, press the CANCEL key.

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker. Refer to Chapter 4.9, page 195 about Area Size Adjustment and the setting procedure.

Selecting Detect Condition of Edge

Set detailed conditions such as detecting direction of edge.

1. Select "Inspection Condition".

Set Scan Direction, Edge Condition, Detected Position.

2. Select "Search Method".

Set "Filter" and "Width".

About Conditions

Scan direction (Horizontal/Vertical) -- Only Plane scan

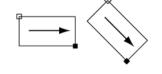
Horizontal: Scans horizontally* from the start to the end points.

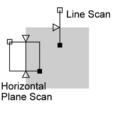
Vertical: Scans vertically* from the start to the end points.

Note

*If you set a rotated area, it scans at the rotated angle.

Scan direction = Horizontal

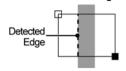




Edge Condition (White -> Black(-) / Black -> White(+) / Both)

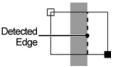
White -> Black(-)

Detects a point changing from white to black as an edge.



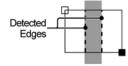
Black -> White(+)

Detects a point changing from black to white as an edge.



Both

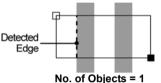
Detects both point from white to black and from black to white.



Detected Position (Front / All)

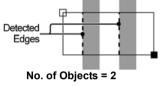
Front

Scans from the start point and detects the first edge.



All

Detects all edges which meet the condition in the area. Use this to count the number of edges.



Filter/Width

These are conditions of object size. The function prevent from detecting undesired part such as noise within the area. Adjust them when desired edge cannot be detected after testing.

Filter:	Condition of length in scan direction.
Width:	Condition of length in the direction at right angle to the scan.

Example:

When you want to detect "A" in the right figure as an edge, set Filter to 20 and Width to 40.

The first object with length in scan direction 10 and the nose with width 30 are not detected. And only "A" meets the condition and is detected.



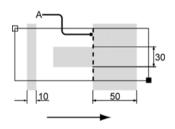
This is the function that dilates or erodes the pixels of color selected in "Edge Condition". Use this function mainly when you delete a slight noise or enhance a detected area. If applying this function is not necessary, proceed to the next step.

1. Select "Inspection Condition" > "Filter".

The list of settable filters is displayed.

2. Select "Filter" to process the image to be a desired image.

Changing filters updates the displayed image. Confirm it and set.



Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of the number of detected edges. If the number of detected edges is within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG".

- 1. Select "Judgement Limits".
- 2. Input the setting values for "OK Judge. Max." and "OK Judge. Min".
- 3. After inputting is completed, press the CANCEL key.

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set "Window Transparency (SETUP menu)" to larger value. (See "Changing Window Transparency (SETUP Menu)", page 320)

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images. Note

Position adjustment and area size adjustment are also executed at the same time if they are used.

2. Confirm a judgement result and the number of detected objects.

Note

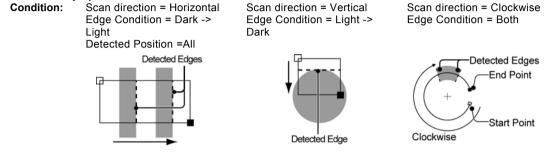
The list of detected edges is displayed in the lower part of the setting window.

When selecting this table and highlighting an edge data, the mark on the screen window indicating the detect position turns to red.

What Is Gray Edge?

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

Detect Example)



Output Data

Coordinates X and Y	Y of edges
Edge Differential:	Differential value of detected edge (degree of gray value change)
No. of Objects:	The number of detected edges. The value is 0 to 256.
Judgement:	If the number of detected objects is within the allowable range you have set, the object will be judged as "OK", if it exceeds the allowable range, the object will be judged as "NG"

Specifying Checker No.

- 1. Select "Gray Edge" in "Checker Type".
- 2. Select the checker No. list and specify a checker number to set.
- **3.** Press the ENTER key to determine the checker No.

"Gray Edge" setting window is displayed. The gray image is displayed on the screen window.

Selecting a Camera

Select a camera image to set Gray Edge checker.

- **1.** Select "Area Setting" in "Gray Edge" setting window.
- 2. Select a camera No. in "Camera".

The selected camera image is displayed.

Note

Select a displayed image type (Live/Memory and Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

Positi	on Adj.	Area S	ize Adj.		Chec	ker.	
Checker							6
Gray Ed	şe		*		+		
Block N							3
Block N Checker		0					44
Checker	No. [0		diser	een (3)	Compa	ct
Checker	No. [4	dScr	een (X)	Совра	ct
Checker	No. [0	-1	discr	een (0)	Compa	ct

Chapter 4

Selecting Preprocess / Slice Level / Position Adjustment

Refer to page 85

Setting an Inspection Area

Set a range to detect an object.

Note

You cannot set a Mask Area in Gray Edge checker.

1. Select "Area Setting" in "Gray Edge" setting window.

2. Select "Area (Set)".

"Area Setting" window is displayed.

3. Select a shape of inspection area from "Change Shape".

Select from Line, Plane, and Ellipse. For detecting a flat edge at high speed, Line scan is suitable. And Plane scan suits for detecting a round or pointed edge.

4. Select "Change" and draw an area.

See the description in the next section for setting procedure of an arc. For the setting procedure of other shapes, refer to section of "Drawing an Inspection Area" (page 43).

5. After drawing is completed, press the CANCEL key.

Setting Procedure of Arc

To draw an arc in Gray Edge checker, firstly specify its size and position, select scan direction (clockwise/ counterclockwise), and then set an arc start point and an arc end point.

1. Move the area.

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

After deciding the position, press the Enter key.

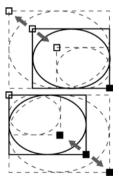
2. Set the start point (a square mark).

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

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

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





4. Press the FUNC key and select a scan direction "Clockwise" or "Counterclockwise".

Default is "Clockwise".

5. Tilt the ENTER key left/right to specify a start point and an end point.

Tilting it right moves the start/end point clockwise and tilting left moves counterclockwise.

The coordinates of the start point and end point are displayed in the lower left on the screen. Use them to make setting.

6. After setting the end point, press the CANCEL key.

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker. Refer to Chapter 4.9, page 195 about Area Size Adjustment and the setting procedure.

Selecting Detect Condition of Edge

Set detailed conditions such as detecting direction of edge.

1. Select "Inspection Condition".

Set Scan Direction, Scan Method, Edge Condition, Edge Threshold and Detected Position.

2. Select "Search Method".

Set Scan Pitch, Filter, Width and Average Range.

About Conditions

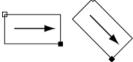
Scan direction (Horizontal/Vertical) -- Only for Plane scan

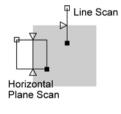
Horizontal: Scans horizontally* from the start to the end points.

Vertical: Scans vertically* from the start to the end points.

Note *If you set a rotated area, it scans at the rotated angle.

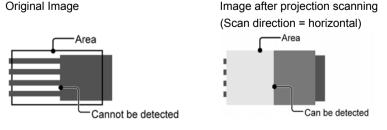
Scan direction = Horizontal

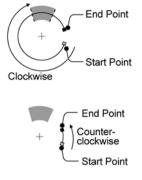




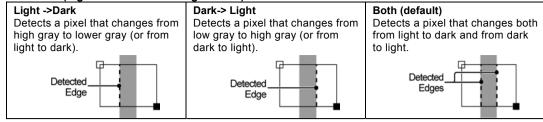
Scan Method: Projection / Single

Set this when using projection scan. Projection scan calculates average brightness in the vertical direction against the scan direction per column (or row) and detects the edges based on the composite image.





Edge Condition (Light -> Dark/ Dark-> Light/ Both)

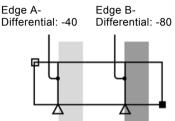


Edge Threshold: 1 - 255

This is a condition on contrast or bright differential of an edge to detect. Setting it to larger extracts only edges with high contrast and lower extracts also low contrast edges. Quantified value of the contrast is differential value.

Example)

When edge threshold=30, the edge A and B are extracted. When edge threshold=50, only the edge B is extracted.



B

(+30)

(-80)

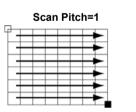
Detected Position (Front / Peak / All / Front/ Rear)

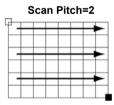
Among the edges meeting the condition, decides which edges to output.

Front	Scans from the (arc) start point and detects the first edge. In the right figure, A is detected.
Peak	I Detects the position having the highest absolute differential value as an edge.n the right figure, A is detected.
All	Detects all edges which meet the condition. In the right figure, all edges A, B, C, and D are detected.
Front/ Rear	Detects the two points, the nearest position from the (arc) start point and from the (arc) end point. In the right figure, A and D are detected.

Scan Pitch (only for Plane scan)

With this item, set amount of scan skipping. As you set larger value, the skipping pitch increases. If you have enough inspection time to spend, use default value, 1.





C (-28) D

(+75)

Filter and Width

These functions allow checkers to ignore undesired objects in front (in the start point side) of the area to detect. If the undesired objects are detected by running a test, increase the "Width" value.

In addition of above, if the detect object is other than a straight line, including round and pointed object, increase both "Width" and "Filter" values.

Average Range

This item decides how many pixels from the detected edge positions are averaged. If the desired position cannot be detected as a result of the test using the default value, change the Average Range value. Increasing the Average Range value detects the position slightly inside the edge of the object. Decreasing the value detects the position on the edges of the object.

To detect a front edge of a circle, pointed or irregular object, set the Average Range value to be low as much as possible.

Average = 0	The detection position is the edge position on the tip of the detected part. (In the example on the right, the detection position is located on the bottom line.)	Scan Direction→		
Average = 1	The coordinate values of the edge on the tip of the detected part are averaged. (In the example on the right, the tip edge is located on the line 105. Thus, the coordinate values of the edge on the lines from 105.0 to 105.9 are averaged.)		× × ×	
Average = 2	The coordinate values of the edges located between on the tip line and on the next line are averaged. (In the example on the right, the tip edge is located on the line 105. Thus, the coordinate values of the edge on the lines from 105.0 to 106.9 are averaged.)		× × × × ×	

Note

If you set the Average Range value to 1 or more, Y coordinate of the horizontal scan and X coordinate of the vertical scan will be averaged as well.

Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of the number of detected edges. If the number of detected edges is within the tolerance, the object will be judged as "OK", if it is out of it, the object is judged as "NG".

- 1. Select "Judgement Limits".
- 2. Input the setting values for "OK Judge. Max." and "OK Judge. Min".
- 3. After inputting is completed, press the CANCEL key.

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set "Window Transparency (SETUP menu)", page 320)

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images. Note

Position adjustment and area size adjustment are also executed at the same time if they are used.

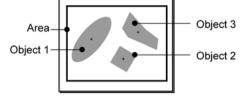
2. Confirm a judgement result and the number of detected objects.

Note

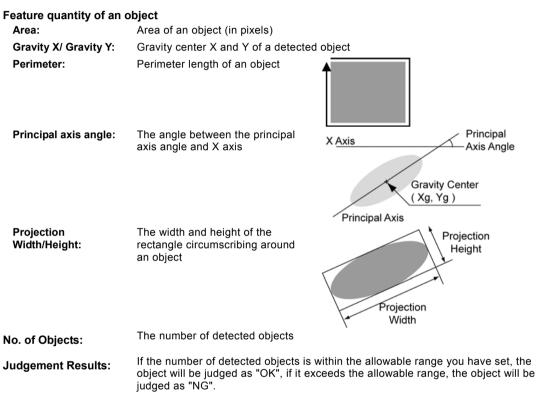
The list of detected edges is displayed in the lower part of the setting window. When selecting this table and highlighting an edge data, the mark on the screen window indicating the detect position turns to red.

What Is Feature Extraction?

Feature Extraction binarizes an image captured by a camera, detects a specified size of clusters of white or black pixels (hereinafter called "object"), and then judges as OK or NG depending on the measured number. The checker outputs the feature quantity such as the coordinates of a center of gravity or principal axis angle (+/-90 degrees).



Output Data



Specifying Checker No.

- 1. Select "Feature Extraction" in "Checker Type".
- 2. Select the checker No. list and specify a checker number to set.

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

OPERAT			INSPECTIO		
Position Adj. Area Size Adj.			Checker		
	er Type				RUN
Featu	re Extractio	n		+	057
Block					SET
Checke	er No.	0		Screen CO(C	Compact) Li
000	<enter (<="" td=""><td>Comment></td><td>-1</td><td></td><td></td></enter>	Comment>	-1		
001					
002					

3. Press the ENTER key to determine the checker No.

"Feature Extraction" setting window is displayed. The binary image is displayed on the screen window.

Selecting a Camera

Select a camera image to set Feature Extraction checker.

- **1.** Select "Area Setting" in "Feature Extraction" setting window.
- 2. Select a camera No. in "Camera".

The selected camera image is displayed.
Note

Select a displayed image type (Live/Memory or Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

Search Weines No Extraction Condition Judgement Limits Judgement Limits Area Size Adj. Judgement NG Bo No. of Objects Down Time (ms) 0.00	
No. Area Grav.t Grav.t Principal Acts Angle Permeter Proj. #16tb Proj.	Heisht

Selecting Preprocess / Slice Level / Position Adjustment

Refer to page 85

Setting an Inspection Area

Set a range to detect an object.

1. Select "Area Setting" in "Feature Extraction" setting window.

2. Select "Area (Set)".

"Area Setting" window is displayed.

3. Select a shape of inspection area from "Change Shape".

Select from Rectangle, Ellipse, Circle and Polygon.

4. Select "Change" and draw an area.

Refer to section of Drawing an Inspection Area (page 43).

5. After drawing is completed, press the CANCEL key.

When you want to exclude an area from inspection (Mask

area)

Up to 16 mask areas, where checker does no inspection, can be set in an inspection area.

Select "Add Mask" in "Area Setting", specify a shape, and draw an area. Refer to section of Setting a Mask Area (page 47) for details.

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker.

Refer to Chapter 4.9, page 195 about Area Size Adjustment and the setting procedure.

Select a Target Color

Set to detect which object of white or black on a binary image.

- 1. Select "Inspection Condition" > "Target".
- 2. Select "White" or "Black" to detect.

White (default): Detects a white object. Black: Detects a black object.

Dilation and Erosion on Binary Image (Filter)

This is the function that dilates or erodes the pixels of color selected in "Target". Use this function mainly when you delete a slight noise or enhance a detected area. If applying this function is not necessary, proceed to the next step.

1. Select "Inspection Condition" > "Filter".

The list of settable filters is displayed.

2. Select "Filter" to process the image to be a desired image.

Changing filters updates the displayed image. Confirm it and set.

Set the Number of Objects to Detect

Set the maximum number of objects to detect. Specifying "10" detects 10 prior objects after sorting or in order of appearance.

- **1**. Select "Inspection Condition" > "Output: Objects 1 x".
- 2. Set the number of objects to detect.

Default: 100 Settable Range: 1 to 10000

Select a condition to number objects (Sorting)

This is a function used to output and calculate feature data. When multiple objects were detected, the function arranges in a certain rule and numbers the first object as No.0 in ascending order.

1. Select "Sorting" and specify information to use in sorting.

Select from Area, X, and Y.

2. Select "Sorting Order" and then select either of Ascending or Descending.

Ascending: Sorts with the object of small value in the top.

Descending: Sorts with the object of large value in the top.



When setting "Area" and "Descending", it sorts with the object of the largest area in the top in descending order. You can confirm the result in the detected result list.



Selecting Feature Data to Measure

Select feature quantity data to measure on a detected object. Setting unnecessary items to "No" decreases the inspection time.

Selectable feature data types are Perimeter, Projection Width/Height and Principal Axis Angle.

- **1.** Select "Search Method".
- 2. Set whether or not to detect Perimeter, Projection Width/Height and Principal Axis Angle.

Yes (default): Measures the selected item. **No**: Does not measure the selected item.

Note

Area Setting Labeling Yes Inspection Condition Yes Boundary Search Method Perimeter Yes Extraction Condition Proj. Width, Height Yes Judgement Limits Principal Axis Angle Yes Fill Holes dgement

When setting labeling to "No", Perimeter and Projection Width/Height cannot be detected. When setting Principal Axis Angle to "No", Projection Width/Height cannot be detected.

Changing Other Search Methods (Labeling/Boundary/Fill Holes)

- 1. Select "Search Method".
- 2. Change the setting of Labeling, Boundary, or Fill Holes as necessary.

Extracting Each Data of Multiple Objects (Labeling)

This is a function t	o detect each Feature data when multiple objects exist within the area.
Yes (default):	Measures feature quantity of each object.
No:	Feature quantity of each object is not measured and only total area, coordinate of the gravity center, and principal axis angle are output.

Decides Whether or not to Detect an Object on the Boundary of an Area (Boundary)

No: Ignores an object on the area frame.

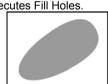
Note

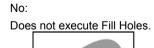
You can set Boundary to "Yes" only when Labeling is set to "Yes".

Selecting Whether or not to Fill inside an Object with the Target Color (Fill Holes)

If there is a part with different color from the target color inside an object, measurement of coordinate of gravity center or principal axis angle is interfered. To prevent this, processes to fill inside the object with the target color.

Yes (default): Executes Fill Holes.







Note

Fill Holes is available when Labeling is set to "Yes".

1.000

Set the Condition of Objects to Detect (Extraction Condition)

Set the range of area, projection width, and projection height of objects to detect.

Setting example of an area

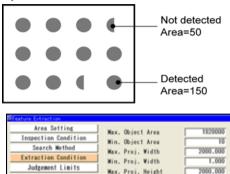
In the right figure, setting "Min. Object Area" to 100 detects 10 objects.

- **1.** Select "Extraction Condition" in "Feature Extraction" setting window.
- 2. Set the range of area, projection width, and projection height of objects to detect.

When using no conditions for area, projection width and projection height, changing these is not necessary.

Note

The default value of Minimum Object Area is "1" which indicates that detecting an object with a pixel or more. For a noisy binary image, it is advisable to set Minimum Object Area to larger value to prevent detecting noise as an object.



0.00

Win, Proj. Height

Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of the number of detected objects. If the number of detected objects is within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG".

Judgement

No. of Objects Time (ms)

- 1. Select "Judgement Limits".
- 2. Input the setting values for "OK Judge. Max." and "OK Judge. Min".
- 3. After inputting is completed, press the CANCEL key.

Running a Test

Confirm if the current settings perform an inspection properly. To observe the image easily, set ""Window Transparency (SETUP menu)" to larger value. ("Changing Window Transparency (SETUP Menu)", page 320)

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

Note

Position adjustment and area size adjustment are also executed at the same time if they are used.

2. Confirm a judgement result and the number of detected objects.

The list of detected objects is displayed in the lower part of the setting window.

When selecting this table and highlighting an object data, the mark on the screen window indicating the detect position turns to red.

Note

When 40000 or more areas of specified color are detected regardless of whether or not the extraction condition is met, the judgement result will be NG and detected count will be 0.

In this case, to inspect correctly, adjust the lens aperture and the slice level not to display undesired noises on the image, or set Preprocess to remove undesired noises.

Area Setting Impection Condition Search Method Extraction Condition	DK Judge, Mux. DK Judge, Min.	F	0000
Judgement Limits Judgement OK So. el Objects 4 Lime (ms)			
1 996 172.400 00.400 1 996 172.400 00.400 1 907 198 178 198 498 1 1280 174.504 255 54	125,444	424 - 327,114 424 - 327,114 433 - 327,114 433 - 327,114	1

What Is Smart Matching?

This is a function that searches and detects a similar part to the registered image pattern.

It outputs the detected position and angle, and similarity degree or correlation value. The registered image pattern is a template, and the range to search is a search area.

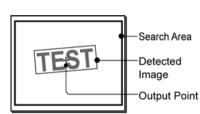
Smart Matching of PV500 can register up to 64* templates per checker. This checker is suitable to detect a target having variable image pattern or to recognize its type.

Subtraction function, which detects difference between the detected part and the template in gray level, can inspect a detailed difference.

Note

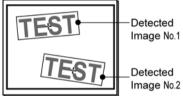
* Templates are saved in the dedicated memory. To check the free space for templates, select "TOOL" > "Information" from the menu bar.





Detected Image

Detected Image (Sorted in ascending order of Y)



Output Data

No. of Objects:	0 to 256
Template No.:	(0 to 63)
Correlation:	0 to 1.000
Coordinate X, Y:	(Output point)
Detection Angle:	-179.999 to 180.000
Subtraction:	Pixels of Max. subtracted Object, No. of Subtracted Objects: 0 to 128

Specifying Checker No.

- 1. Select "Smart Matching" in "Checker Type".
- 2. Select the checker No. list and specify a checker number to set.
- **3.** Press the ENTER key to determine the checker No.

"Smart Matching" setting window appears. The gray image is displayed on the screen window.

OPERATI	ON ENVIRONME	NT TYPE	INSPECT	TION	SAVE/REA	D TO	ÓL.
Posit	ion Adj.	Area S	ize Adj		Chec	ker.	
Checke							RUN
Smart	Matching			- I	+		
Block					_		SET
Checke	r No.	0					
-					creen (0)	(Compa	ct) L
000	<enter (<="" th=""><td>Commen t></td><th>-</th><th></th><td></td><td></td><th></th></enter>	Commen t>	-				
001							
002			_				

Selecting a Camera

Select a camera image to set "Smart Matching" checker.

1. Select "Area Setting" in "Smart Matching" setting window.

2. Select a camera No. in "Camera".

The selected camera image is displayed.

Note

Select a displayed image type (Live/Memory and Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

Selecting Preprocess / Position Adjustment

Note

Position Adjustment function is helpful when position or angle of an inspection object can be detected in advance. In this case, the search area for Smart matching or the range of detect angle can be smaller, so that the processing speed can be faster.

Refer to page 85

Setting a Template

Register an image pattern to detect.

Up to 64 templates can be registered per Smart Matching. When registering multiple templates, the checker inspects based on all the templates and outputs the area with the largest correlation value and the number of the template used to detect the area.

1. Select "Area Setting" in "Smart Matching" setting window.

2. Select "Set" for "Template".

Template setting window is displayed.

3. Tilt the ENTER key up/down/left/right to select a template No. Select a template No.0 when registering a template for the first time.

4. Select "Register".

The screen to draw a template area is displayed.

Note

When opening this screen after the execution of an inspection, the image to be displayed may be the one which the current memory image has been moved and rotated. Refer to "Image to be displayed when reregistering a template" (page 121) for details.

Area Setting	Comment	
Inspection Condition	Camera	0 -
Sequence	Position Adj.	No
Subtraction	Template	Set
	Search Area	Set

	٠	Temp	Register Delete	No Set
		Show	this many: 16 <u></u>	Set
				No. of Sub-
No. of set ineckers by Data ladatedi	TRUD SRun Test D stanswitteru	FUIC: : Forman Menu	OFFICE: To RON Mar	

5. Select a shape of template area from "Change Shape".

Select from Rectangle, Ellipse, Circle and Polygon.

6. Select "Change" and draw a template area.

Refer to section of Drawing an Inspection Area (page 43).

Note

The maximum size to draw (the size of a circumscribing rectangle of the area) is as follow.

- When using Quad-speed/Ultra Compact Camera: 640 x 480 pixels (full screen)
- When using 2-Mega-pixel Camera: 1024 x 1024 pixels

If there is no feature (or the degree of change in gray level is low) within the specified area, the image cannot be registered.

Inspection: Area

When you want to exclude an area from inspection (Mask area)

Up to 16 mask areas, where is excluded from inspection (correlation calculation), can be set for a template. Select "Add Mask" in template setting window, specify a shape and draw an area. Refer to section of Setting a Mask Area (page 47) for details.

7. Select "Output Point" and operate the ENTER key to specify an output point.

Output point is the point that indicates the location where the image resembling the template was detected. You can place the output point at the desired location. (It can be set also outside template.) While you are setting it, the coordinate of the current output point is displayed in the information display area. Use it to make the setting.

Note

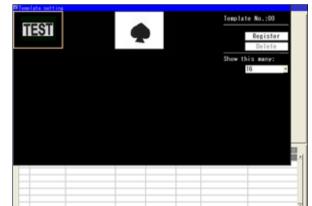
Selecting "Middle Point" sets an output point in the center of a template from the pop-up menu displayed by pressing the FUNC key.

8. After setting is completed, press the CANCEL key.

Return to the template setting window. To set multiple templates, select a template No. and repeat the above procedure.

Note

If there is no feature (or the degree of change in gray level is low) within the specified area, a message will be displayed and the template cannot be registered.



From "Show this many:", the number of displaying templates can be changed. You can choose from the following as necessary; 16 (default), 4, and 1.

9. After setting the template, press the CANCEL key.

The screen returns to "Smart Matching" setting window.

Image to be displayed when reregistering a template

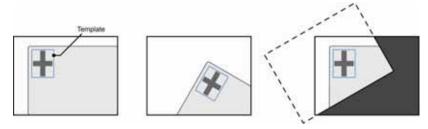
When a template is reregistered after executing an inspection, the image may be displayed in the moved or rotated state. This is because the memory image (fig. 3 below) is displayed after being moved/rotated for the difference between the position/angle when the template has been registered (fig. 1 below) and the position/angle detected when executing the inspection (fig. 2 below).

Displaying the image like this enables the template to be reregsitrated even when the object is inclined. (It is not necessary to replace and recapture the object at the angle when it has been registered.)

1) When setting a template

2) Detection position when executing the inspection (test)

3) Image displayed when reregistering (Dotted line shows the memory image.)



Note

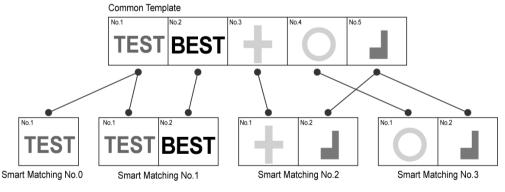
Execute either way of the followings to clear the detection position when you do not want to display the image corrected when reregistering.

- Switching Types
- Turning off the power to PV500

Selecting a Template from Common Image Patterns

Other than templates created in each Smart Matching, PV500 provides with a function that saves common templates to all types, including Position Adjustment and Area Size Adjustment, that can be selected in all Smart Matchings as common using templates.

Common templates can be saved up to 2000 templates in 256 product types.



Setting a Template to Use Commonly

- Select "ENVIRONMENT" > "System Settings" from the menu bar.
- 2. Select "Operation".
- **3.** Select "Common" for "Template Registration".

If templates have already created at this moment, the templates will be registered as common templates automatically.

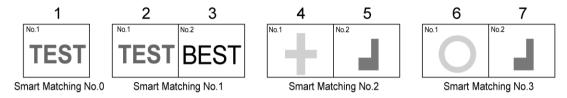
DERVICE DEPENDENCE	THE DEPENDENCE	LARVA LILE		ETUP MENI
System Settings	Input/Output	Camera	Color	Password
Startup Setting Operation	Bun Hode in SETUP Menu When Switching to SETUP.		Not Available - Save image in "lest"	
System Register	Inspection Process Output Results Image Output Parallel 1/0 Output Continuous Inspecti	Serial Success Synchronous Hold Na (Dece)		
	Template Setting Position Area Display Template Registrati Smart Matching Perf		Use the Las Set Positio No Common Per Checke Common	-

Note on resetting to "Per Checker"

When you operate to reset to "Per Checker" from the menu or initialize environment settings, an error message may appear and "Common" setting may be held. This is because of the reason described below.

Changing the setting from "Common" to "Per Checker" copies the common templates that are used by checkers to each checker. In "Per Checker" setting, total number of templates is likely to be increased because each checker holds a template separately even for the same image, while multiple checkers use a single template in "Common" setting.

For example, the total number of templates is five in the figure at the previous page. After copying the templates to each checker, the total number is seven as the figure below which is increased by two.



You cannot reset to "Per Checker" when inadequate memory of PV500 or excessive number of registration prevents copying the templates.

Note that the other settings are initialized even when "Template Registration" remains "Common" due to the above reasons after initializing environment settings.

Creating a New Common Template

- 1. Select a template No. in template setting window and then select "Register".
- 2. Select a blank field for common templates.

When selecting a registered template, you can update or delete the image pattern.

3. Select "Register" for "Common Template Setting".

Template setting window is displayed. Select a shape and draw a template area. Refer to page 112 for details.

► Note To delete the selected template, select "Delete".

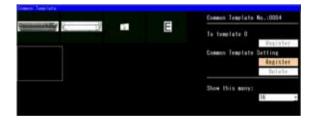
4. After drawing is completed, press the CANCEL key.

The set image pattern is registered as a template.

5. Select "Register" for "To template #".

("#" indicates the number you have specified in step 1.)

Through these steps, you can register the commonly saved template in "Template #".



Selecting from Saved Common Template List

1. Select a template No. in template setting window.

A list of commonly saved templates is displayed.

- 2. Select a template to use.
- 3. Select "Register" for "To template #".

("#" indicates the number you have specified in step 1.)

Through these steps, you can register the commonly saved template in "Template #".



Deleting Common Templates

This function deletes common templates one by one.

Refer to

How to delete all common templates: See page 53.

1. Select a template No. in template setting window.

A list of commonly saved templates is displayed.

- 2. Select a template to delete.
- **3.** Select "Delete" for "Common Template Setting".

Follow the message to delete it.



Condition of Updating Template by External Signals

A created template of Smart Matching can be updated (reregistered) by inputting an I/O signal or a command from the external device. How to select conditions to update is described below.

If you do not reregister it by an external command, setting change is not necessary.

Refer to

Reregistering by command input: page 382.

1. Select "ENVIRONMENT" > "System Settings" from the menu bar.

- 2. Select "Operation".
- 3. Set "Template Setting".

"Use the Last Image"(Default): To reregister using the current memory image which is the last captured inspection image. "Capture New Image":

To capture a new image to register.

OPERATION ENVIRONMENT	TYPE INSPECTION	SAVE/READ TOOL		SETUP MENU
System Settings	Input/Output	Camera	Color	Password
Startup Setting Operation System Register	Run Mode in SE When Switching Inspection Pro- Output Results Image Output Parallel 1/0 O Continuous Ins	to SETUP_ cess utput Reset Condit	Serial Synchrono Synchrono	e in 'Test'
	Template Settin Position Area Display Template Regis Smart Matching	tration	Use the La Set Pesiti No Common Type Swite	•

4. Set "Position".

"Set Position" (Default):

To register the image pattern within the template of selected Smart Matching. **"Adjusted Position":** To execute the Position Adjustment relating to the selected Smart Matching and reregister the image

pattern within the template of selected Smart Matching.

5. Select "Area Display".

"No"(Default):

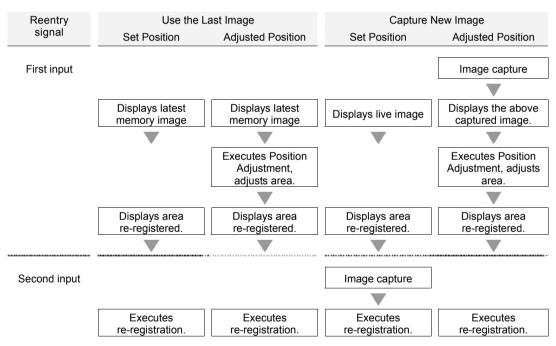
To reregister in the position of the specified condition. "Yes":

To display a template area when the position of the specified condition is determined. Inputting a command calling for a registration once more after confirming the display executes registration.

Now you completed the setting for registration condition.

Operation when setting "Area Display" to "Yes"

When setting "Area Display" to "Yes", the operation when executing re-registration differs depending on the settings of "Template Setting" and "Position". Regardless of the type of the display image (Live image/Memory image) before executing re-registration, the operations for executing re-registration are as below.



Setting a Search Area

Set the range to search the same image pattern as a template.

Note

You cannot set a Mask Area in the search area of Smart Matching checker.

1. Select "Area Setting" in "Smart Matching" setting window.

2. Select "Search Area".

"Area Setting" window is displayed.

3. Draw a search area.

Refer to section of Drawing an Inspection Area (page 43).

Note

Settable shape for search area is only rectangle.

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

Detecting Rotated Object

If a detecting part is rotated or capturing direction is possible to be unstable, it is necessary to scan within a search area rotating the image pattern registered as a template. To do so, set a rotation angle and angle pitch.

1. Select "Inspection Condition".



2. Specify the value of "Rotation Range" from 0 (no rotation) to +/-180 (rotation of 360-degree).

Note that the larger value of rotation angle range you set, the longer time its processing takes.

3. Specify "Angle - Step".

At first, set a pitch to scan. Select from 8, 4, 2, and 1. Selecting "8" scans Rotation Range by 8 degrees and finely scans around the detected angle.

Note

When setting "Recommendation Setting" from "Sequence", "Angle - Step" will be automatically replaced to the Recommendation Setting.

4. Specify "Angle - Accuracy".

This item is to set an angle to scan finely around a detected angle. Select either "1 Degree" or "0.001 Degree". The detected angle is output lastly in the unit set here. Setting "0.001 Degree" takes longer process time than "1 Degree."

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

Detecting Black/White Reversed Image

To detect an image which has reversed gray level of registered image pattern, use the function of "Detect B/W Reversed Template". This function allows to perform an inspection without lowering correlation value because of image reversal.

- **1.** Select "Inspection Condition".
- 2. Select "Yes" for "Detect B/W Reversed Template".

Condition to Label Detected Images (Sorting)

When multiple images were detected, the function arranges in a certain rule and numbers them in ascending order from the first object as No.0. This is a function used to output and calculate information on detected images such as coordinate, angle, and correlation value.

1. Select "Sorting" and specify information to use in sorting.

Select from Correlation Value, X, and Y.

2. Select "Sorting Order" and then select either of Ascending or Descending.

Ascending: Sorts with the object of small value in the top.

Descending: Sorts with the object of large value in the top.

Note

When setting X and Ascending, it sorts in ascending order with the object of the smallest X coordinate in the top. You can confirm the result in the detected result list.

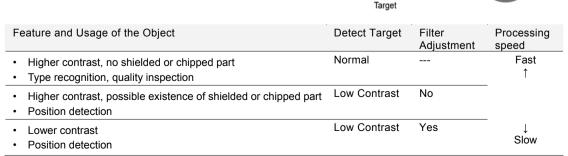
In the Case of Detection Failure

If you cannot detect the part you want to detect as the result of tests, adjust three conditions described below according to the inspection conditions and image status. Using the functions below takes longer time to process compared with the case being not in use.

Target

Detect Mode - Low Contrast

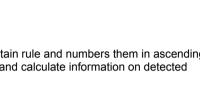
If the difference in brightness is small between an object image and the background, or some parts of object image is chipped or shielded, the checker may not detect it correctly. In such cases, set "Detect Mode" to "Low Contrast" and then specify its intensity (Filter Adjustment).



IES

Template







Threshold to Ignore Dark Image

Target

1. Select "Inspection Condition".

2. Select "Low Contrast" for "Detect Mode".

The "Filter Adjustment" button is activated.

Run a test in the current status. If an object cannot be detected stably, make filter adjustment.

Filter Adjustment

The Filter Adjustment function binarizes an object image and background using multiple items. If desired result cannot be obtained even though you tried auto adjustment (Recommendation Setting), adjust the values of the items. Set the items listed below from the top orderly.

Target (White / Black)

If a detect target is brighter than the background, select "White". If an object image is darker than the background, select "Black".

Denoising (1 - 80)

Removes unnecessary noises around an object image. As the setting value increases, the more noises are removed.

Distortion (1 - 95)

Extracts the part having contrast. If some parts of the extracted object are chipped away, increase the setting value. If the object is expanded, decrease the setting value.

Expansion (1 - 4)

Expands the extracted object. Makes up the chipped or missed parts of the object that cannot be adjusted by using the Distortion function.

3. Select the button of "Filter Adjustment".

Template list is displayed.

4. Select a template to adjust filter and then select "Set Filter".

Filter adjustment screen is displayed. The upper image is a template and the lower is the image after filter adjustment.

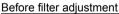
5. Set "Use Filter" to "Yes".

6. Select "Recommendation Setting".

Set it in order to binarize an image into target area and background clearly. If Recommendation Setting cannot binarize it clearly, adjust Denoising, Distortion or Expansion.

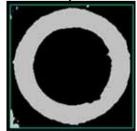
7. After adjustment is completed, press the CANCEL key.

The screen returns to "Inspection Condition" setting window.





After filter adjustment

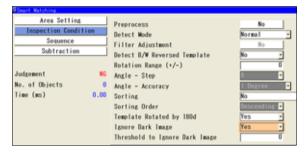


Use Filter Target Denoising Distortion Expansion	Yes Recommendation White Z I I G 4	Setting	TEST
			TEST

Template Rotated by 180d

Use this function when running a test with a specified Rotation Range setting detects a180-degree reversed image by mistake, or a 180-degree reversed image is similar to the image pattern registered as a template.

- 1. Select "Inspection Condition".
- 2. Select "Yes" for "Template Rotated by 180d".



Ignore Dark Image

This function is useful to inspect a dark image undesired areas of which are detected.

The function ignores the part that has lower brightness than the set threshold (0 - 255) for the gray values of the area within a template.

- **1.** Select "Inspection Condition".
- 2. Select "Yes" for "Ignore Dark Image".
- 3. Enter a value of brightness limit in "Threshold to Ignore Dark Image".

Setting a Sequence

Set a sequence to search an image pattern of a template within a search area.

The checker executes a searching on the compressed information of template and search area. The compression rate of the information is lowered every time a searching phase (up to six phases) proceeds. Processing speed is inversely related to compression ratio; the higher compression ratio, the faster processing speed, the lower compression ratio, the slower processing speed.

Specifying Items in "Sequence"

Step

Inspection is performed in up to six steps (1st - 6th) by changing compression ratio and other conditions.

Accuracy

This is compression ratio. There are six types of compression ratio; 32.16, 8, 4, 2, 1, and S. Accuracy 16, for example, refers to compressing of information of 16 x16 (256) pixels. The smaller value indicates the lower compression. Accuracy value must be smaller as a scanning step proceeds.

Accuracy "1" means that searching is performed without compressing the information. Accuracy "S" means that detection is executed per subpixel. If the accuracy is set to "1" or "S", the steps after that will be erased and no more steps can be added. (You cannot include both "1" and "S" in one sequence. (e.g. Step 4TH=Accuracy 1, Step 5TH=Accuracy S))

Maximum Count

Maximum number of the part to be detected in each step.

Setting an intermediate step to "3" detects 3 parts with higher correlation value than the minimum value in descending order, and then inspects the parts with lower compression ratio in the next step. Setting the final step to "3" judges as "OK" three or more parts are detected, and judges as "NG" if less than three parts or nothing are/is detected.

Minimum Correlation

In a certain step, the checker detects the parts having the higher correlation value than this setting value. If there is no image with higher correlation value than it, the inspection stops at the step and judges as "NG".

Squaring Correlation Value

This is a function that squares correlation values to emphasize them. By squaring them, low values become much lower. Use this function when you want to widen the difference of correlation values between the object to detect and the object not to be detected.

The Items can be Confirmed in Sequence

No. of Objects

Number of the objects that were detected in each step.

Correlation Value*

Correlation value of the objects detected at each step. If multiple parts are detected in each step, the lowest correlation value is displayed.

► Note

*Correlation Value for the Low Contrast Function

In the setting of "Low Contrast" for "Detect Mode", correlation may be different between the values displayed in Sequence table and the values output as inspection results. This is because the PV corrects the decreased correlation values that were affected by the distorted, chipped or overlapped parts of the object and output them as inspection results. The correlation values in Sequence are the ones that have not been corrected and the values in Result or output to the external devices are the ones that have been corrected. Therefore, the former is lower than the latter. If there are many distorted or chipped parts over the whole object image, the correlation values can be almost the same.

1. Select "Sequence".

2. Select "Recommendation Setting".

Regarding the current conditions, the recommendation values of sequence is set. "Angle - Step" of "Inspection Condition" is also replaced to a recommendation value at the same time.

3. Set "Square Correlation" to "Yes" as necessary.

4. Select the table of sequence and change Accuracy, Max. Count or Min. Correlation as necessary.

The checker judges as "OK" when it detected the number of "Max. Count" or more of objects.

How to Change Sequence

- To select the items, tilt the ENTER key left/right. To select the steps, tilt it up/down.
- To delete a step, select "0" for "Accuracy". All the steps after that are deleted.
- Maximum Count can be set per step, however, the value of later steps should be smaller than the value of previous steps.

Example: If setting value of "3RD" is "5", the value of "4TH" cannot be set to "6" or more. If setting "4TH" to "6", the values of "1ST" to "3RD" are automatically changed to "6".

5. After inputting is completed, press the CANCEL key.

Chapter 4

Area Setting Recommendation Setting Inspection Condition Acc. Max.Count Win.Corr. nt Corr. 0.600 16 0.000 Subtraction 0.600 0.000 0.600 0.000 0.600 0.000 Judgement 0.000 0.000 No. of Objects 0.000 0,000 ö Time (ms) 0.00 Square No

Using Subtraction Function

Subtraction function extracts a pixel that exceeds a certain degree of the difference in the gray value comparing the detected area and the template. With this feature, the PV can detect up to 128 subtraction parts that are difficult to reflect in the correlation value. It judges the object based on the number of detected subtraction parts.



Items Related to Subtraction

Subtraction Threshold

The checker extracts pixels that exceed the set degree of the difference in the grayscale value or more between the detected image and the template. The lower the Subtraction Threshold value, the stricter extraction standard is.

Filter

Dilates or erodes the pixel clusters extracted under the condition of Subtraction Threshold value, or does so after dilation or erosion. Use the Filter function to enhance the extracted pixel cluster or remove fine noises or dusts.

Min. Subtracted Size

The checker detects only the clusters of the filtered extraction pixels having the area value more than the Min. Subtracted Size. For example, not to detect 10-pixel or less of extracted subtraction parts, set Min. Subtracted Size to "11".

Max. OK No. of Subtracted Objects (0-128)

A tolerance of a detected pixel cluster. If the number of detected pixel clusters is less than the Max. OK No. of Subtracted Objects, the object will be judged as "OK".

1. Select "Subtraction".

- 2. Select "Yes" for "Subtraction".
- **3.** Enter the values in "Min. Subtracted Size" and "Subtraction Threshold".



4. Select "Filter".

No (Default)

3x3 (5x5) Erosion: Deletes fine noises.

3x3 (5x5) Erosion -> Dilation: After deleting noises, restore the left parts to the original size.

3x3 (5x5) Dilation -> Erosion: Filter processing to fill holes within the detect area.

5. Enter the values in "Max. OK No. of Subtracted Objects".

Specify tolerance of the number of extracted parts as the result of subtraction. When performing subtraction, this judgement is a judgement of checker.

Note

When the result of No. of Objects exceeds 128, it becomes "255" automatically and the object is judged as NG.

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

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set "Window Transparency (SETUP menu)" to larger value. ("Changing Window Transparency (SETUP Menu)", page 320)

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images. Note

Position adjustment and area size adjustment are also executed if they have been set.

2. Check data of detected area list.

Note

- The list of detected objects is displayed in the lower part of the setting window. When selecting this
 table and highlighting each No., the mark on the screen window indicating the detected area turns to
 red.
- The value of "255" in the "No. of Objects" column indicates the result exceeds 128.

0	Contraction (\$1,000)	399.803	800,000	8,000	anti-antimettin 🔮 Phone	0 +
-						

Smart Matching Performance (Ver.1.20 or later)

This is the function that speeds up the processing of Smart Matching. The function takes more time of type switch than without the function.

The function has the limit of the number of Smart Matching ("Number of checkers" in the right table) to allow speeding up the process. This number varies depending on the settings of template size, inspection sequence, rotation range, and angle step.

Check the processing time of inspection and type switch on your actual device before you use the function.

- Select "ENVIRONMENT" > "System Settings" from the menu bar.
- 2. Select "Operation".
- 3. Select "Type Switch First" or "Smart Matching First" in "Smart Matching Performance".

Template size	Rotation range	Angle - step	Number of checkers*
128 x 128	±90	8	10
	±180	8	6
384 x 384	±90	4	5
	±180	4	3

*In the case of setting one template per Smart Matching checker.

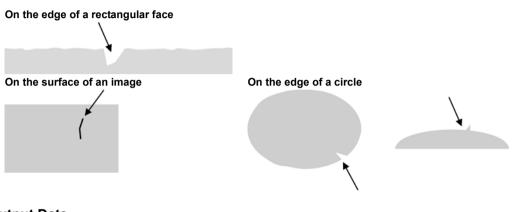
OPERATION ENVIRONMENT	TYPE INSPECTION	SAVE/READ TOOL		SETUP MENU
System Settings	Input/Output	Camera	Celor	Password
Startup Setting Decation System Register	Run Node in SET When Switching Inspection Proc Output Results Image Output Parallel 1/0 Ou Continuous Insp	to SETUP ess itput Reset Conditi	Serial Synchrone Synchrone	e in 'Test' us • us
	Template Settin Position Area Display Template Regist Smart Matching	ration	Use the L Set Posit No Per Check Type Swit Type Swit	er - ch First -

4.7.11 Flaw Detection

What Is Flaw Detection?

Flaw Detection detects fine flaws, burs, cracks, and foreign objects (, which are generally called as "flaw" in this manual). The checker calculates gray average value within the segmented area (cell) on a line, an arc, or a circumference, or in a rectangle. If the PV500 detects an area more than a certain level of difference in average gray, the device judges it as a flaw.

It is useful to detect flaws, burs, missing edges or contamination.



Output Data

	Line	Plane	Ellipse
No. of Objects:	0 - 511	0 - 511	0 - 511
Flaw size:	1 - 256	1 - 256	1 - 3600*
First Cell of Flaw:	0 - 255	0 - 65535	0 - 3599
Coordinate X and Y of first cell of flaw			

Note

* When setting "Detect Mode" to "Gray Range", it may be 3601 - 3854 depending on the settings of "Num. of Cells for Calc. Range" and "Num. of Cells per Shift".

Specifying Checker No.

1. Select "Flaw Detection" in "Checker Type".

image is displayed on the screen window.

- 2. Select the checker No. list and specify a checker number to set.
- **3.** Press the ENTER key to determine the checker No. "Flaw Detection" setting window is displayed. The gray

OPERATION	N ENVIRONMENT	TYPE	INSPECTION	SAVE/REJ	ND TO(L.
Area S	ize Adj.	Check	er	Slice	Level	I
Checker						RUN
Flaw De	tection		-	-		
Block N					-	SET
Checker	No.	0				
				Screen CO	(Compas	st) L
000	<pre><enter com<="" pre=""></enter></pre>	ment>	-			
001						
002						
003						

Selecting a Camera

Select a camera image to set "Flaw Detection".

- **1.** Select "Area Setting" in "Flaw Detection" setting window.
- 2. Select a camera No. in "Camera".

The selected camera image is displayed.

Note

Select a displayed image type (Live/Memory and Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

Selecting Preprocess / Position Adjustment

Refer to page 85

Setting an Inspection Area

Set a range to detect a flaw.

1. Select "Area Setting" in "Flaw Detection" setting window.

2. Select "Area (Set)".

"Area Setting" window is displayed.

3. Select a shape of inspection area from "Change Shape".

Select from Line, Plane, and Ellipse.

4. Select "Change" and draw an area.

The setting procedure differs depending on the shape in Flaw Detection.

5. After drawing is completed, press the CANCEL key.

Using Area Size Adjustment

Area Size Adjustment is a function for inspecting variable-sized objects. The function adjusts an inspection area according to the size of the object detected with Area Size Adjustment checker. Refer to Chapter 4.9, page 195 about Area Size Adjustment and the setting procedure.

DELaw Detection		
Area Setting	Connent	
Inspection Condition	Camera	2 .
Search Method	Position Adj.	No
Threshold Adj.	Area	Set
Judgement Limits	Area Size Adi.	

Drawing an Area: In the case of Area Shape = Line

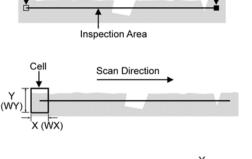
1. Set a start point (ST) and an end point (ED).

You can set an area in the vertical and oblique directions as well as in the horizontal direction.

2. Set the size of a cell (W) which is a rectangle calculating the average brightness.

Note

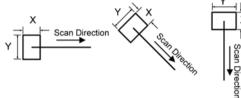
The widths in X and Y directions of a cell are defined as the figures shown right.



Scan Direction

End Point (ED)

Start Point (ST)



3. Set the number of cells (N).

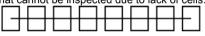
Settable number of cells: 3 - 256 Set the number of cells in order to inspect the object thoroughly from the start point to the end point and not to overlap cells each other as the figure shown on the right.

If the cells overlap each other, the checker repeatedly scans the parts where the cells are overlapping, resulting in increasing inspection time.

► Note

Changed area size by Area Size Adjustment function does not change the number of cells and cell size. Specify the number of cells in order to inspect thoroughly even if an area size will become larger. The lower figure is an example of occurrence of area that cannot be inspected due to lack of cells.

The Number of Cells (N)



	X (Left/right key of the keypad).	Y (Up/down key of the keypad).
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
Ν	Number of cells	



In the case of Area Shape = "Plane"

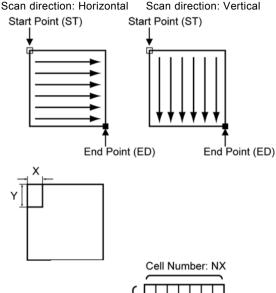
1. Set a start point and an end point.

Set a start point (STX, STY) and an end point (EDX, EDY). PV scans from the start point to the end point.

Note

If the scan direction is set to "Horizontal/Vertical", PV scans in both directions.

2. Set the size of a cell which is a rectangle calculating the average brightness.



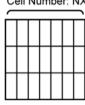
3. Set the number of cells.

- Settable number of cells:
- Number of cells X = 3 256
- Number of cells Y = 3 256

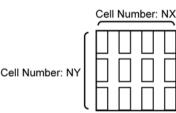
Set the number of cells in order to inspect the object thoroughly from the start point to the end point in both directions of X and Y, and not to overlap cells each other as the figure shown on the right. If the cells overlap each other, the checker repeatedly scans the parts where the cells are overlapping, resulting in increasing inspection time.

Note

Changed area size by Area Size Adjustment function does not change the number of cells. Specify the number of cells in order to inspect thoroughly even if an area size will become larger. Cell Number: NY



The lower figure is an example of occurrence of area that cannot be inspected due to lack of cells.



	X (Left/right key of the keypad).	Y (Up/down key of the keypad).
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
Ν	Number of cells in X	Number of cells Y

In the case of Area Shape = "Ellipse"

 Set the coordinates of the center of a circle as CPX and CPY, and set the radius in the X and Y directions of a circle as RX and RY.

An inspection area (circle) and the rectangle circumscribing around it are displayed.

2. Tilt the ENTER key left/right to set a start point (SPX, SPY) and an end point (EPX, EPY).

If the coordinates of the start point equal to those of the end point, all circumference of the circle is scanned.

Scan direction is always clockwise but counterclockwise.

3. Set the size of a cell (W) which is a rectangle calculating the average brightness.

To change Width-X, tilt the Enter key left/right, to change Width-Y, tilt it up/down.

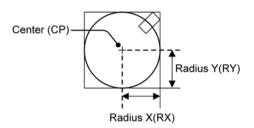
4. Set the number of cells (N).

Settable number of cells: 3 - 3600 Set the number of cells in order to inspect the object thoroughly from the start point to the end point and not to overlap cells each other as the figure shown on the right.

If the cells overlap each other, the checker repeatedly scans the parts where the cells are overlapping, resulting in increasing inspection time.

Note

Changed area size by Area Size Adjustment function does not change the number of cells and cell size. Specify the number of cells in order to inspect thoroughly even if an area size will become larger.



Inspection Area

Scan Direction

Start Point (SP)

End Point

(EP)

Cell

	X (Left/right key of the keypad).	Y (Up/down key of the keypad).
СР	X coordinate of the center of the circle	Y coordinate of the center of the circle
R	Diameter of the circle X	Diameter of the circle Y
SP	X coordinate of the start point	Y coordinate of the start point
EP	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
Ν	Number of cells	

How to exclude from inspection (Mask area)

Mask areas, where checker does no inspection, can be set in an inspection area.

For Flaw Detection, set a first cell and an end cell of the range to be excluded from inspection. The number of mask areas is not limited.

Adding a Mask Area

1. Select "Add Mask".

The border of the first cell from the start point is displayed in yellow.

- 2. Select the start cell of the mask area.
- **3**. Move the cursor to the end cell of the mask area. The borders of the cells from start to end in the mask area are displayed in yellow.

4. On the end cell, press the ENTER key.

The mask area you have set is displayed in blue.

Deleting a Mask Area

1. Select "Delete Mask".

The border of the first cell from the start point is displayed in yellow.

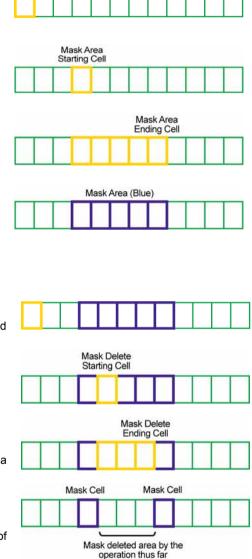
2. Select the start cell of the mask area to delete.

3. Move the cursor to the end cell of the mask area.

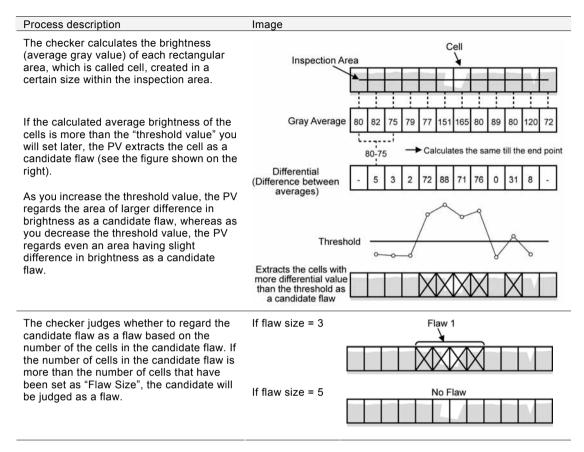
The borders of the cells from start to end in the mask area are displayed in yellow.

4. On the end cell, press the ENTER key.

The mask area is cancelled and the borders of the cells of the area are displayed in green.



Principle of "Differential Mode" of Flaw Detection



Setting Procedure

- Select "Search Method" in "Flaw Detection" setting window.
- 2. Select "Differential" for "Detect Mode".
- 3, Set "Threshold" and "Min. Flaw Size in Cells".

Threshold (1 - 255)

The minimum value of brightness to extract the cells comprising a candidate flaw. The checker extracts the cells with larger gray range than this setting value.

Min. Flaw Size in Cells (1 - 256)

Flaw size in cell unit.

Set the minimum number of the cells in a candidate flaw. The checker decides a candidate flaw consisting of the more than the minimum number of cells you have set here as a flaw.

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



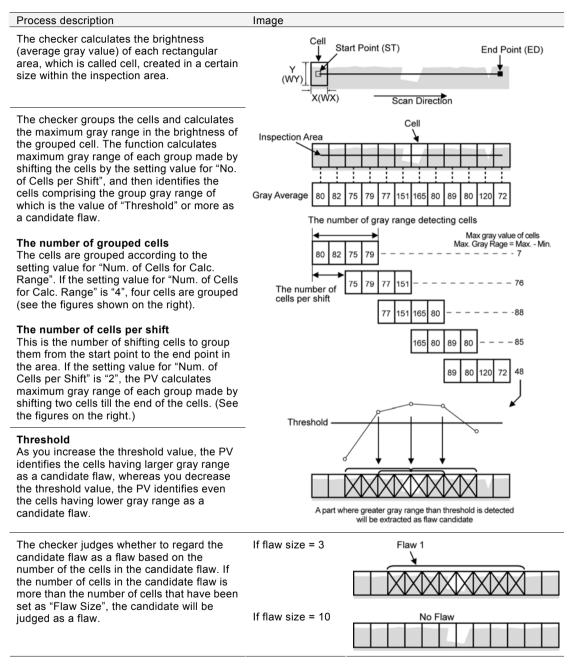
Chapter 4 3BSetting Inspection Conditions

Inspecting in "Gray Range" Mode

Principle of "Gray Range Mode" of Flaw Detection

If the PV failed to detect any flaw after testing in Differential mode, try to test again after switching to Gray Range mode.

Gray Range mode is effective to inspect the object with a surface of uneven brightness, but it will take longer time to process than Differential mode.



Setting Procedure

- 1. Select "Search Method" in "Flaw Detection" setting window.
- 2. Select "Gray Range" for "Detect Mode".

"Num. of Cells for Calc. Range" and "Num. of Cells per Shift" become settable.

3. Set "Num. of Cells for Calc. Range" and "Num. of Cells per Shift".

Num. of Cells for Calc. Range (2 - 256): The number of cells to be grouped. Num. of Cells per Shift (1 - 255): The number of shifting cells to group the cells.

4. Set "Threshold" and "Min. Flaw Size in Cells".

Refer to

For details on threshold and minimum flaw size in cells, refer to "Inspecting in Differential Mode", page 131.

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

How to Find Appropriate Value for "Threshold"

With "Threshold Adjustment", you can check the number of flaws to be detected when changing threshold value. This feature is effective if you do not know what threshold can detect the desired flaw.

After that, you can set the adjusted threshold as inspection condition.

1. Select "Thresh.Adj.".

After a message appears, number of flaws to be detected for each threshold is displayed in descending order of threshold by six rows.

By tilting the ENTER key up/down, you can display data in after the seventh row. Note

Tilting the ENTER key and pressing the SHIFT key moves the cursor faster.

2. Move the cursor to each threshold and check the number and the positions of flaws that are detected according to the selected threshold.

You can confirm the flaw detected according to the threshold in the screen window. The current setting value for threshold is displayed above the table.

Note

To observe the image easily, set "Window Transparency (SETUP menu)" to larger value. (How to change window transparency: Refer to page 320) Otherwise, press the F1key to display the screen window in the front and confirm it.

Area Setting Toppetian Candition Search Mathod Threatoid Adi, Judgement Limits Judgement Mathod No. of Objects t	Design of all LippeLint222511025051 0 22 1 27 2 31 3 20 4 23 5 28 6 27	30
Time (m) 0.03		

3. Select a threshold value to set.

When the dialog message appears, select "YES" to save the threshold. The current threshold displayed above the table is changed. The threshold that has been set in Search Method is also updated.

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

Setting Judgement Limits

Set a tolerance (maximum and minimum values) of the number of detected flaws. If the number of detected flaw is within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG".

- 1. Select "Judgement Limits".
- 2. Input the setting values for "OK Judge. Max." and "OK Judge. Min".
- **3.** After inputting is completed, press the CANCEL key.

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set "Window Transparency" to larger value. ("Changing Window Transparency (SETUP Menu)", page 320)

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

Note

Position adjustment and area size adjustment are also executed at the same time if they are used.

2. Check data of detected area list.

No.: Flaw number

X: The center X coordinate of the first cell from the start point in a flaw

 $\ensuremath{\textbf{Y}}\xspace$: The center $\ensuremath{\textbf{Y}}\xspace$ coordinate of the first cell from the start point of a flaw

Flaw Size: The number of cells making up a flaw

Note

The list of detected areas is displayed in the lower part of the setting window. When selecting this table and highlighting each

No., the mark indicating the flaw on the screen window turns to red.



Checking Gray Level and Differential Value of Cells

You can observe gray level (average) and differential value of each cell.

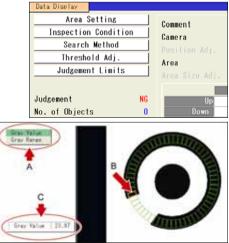
1. Press the FUNC key on Flaw Detection setting window.

The pop-up menu appears.

2. Select "Data Display".

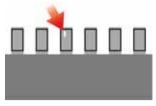
The Data display window appears.

- **3.** Select "Gray Value" or "Differential". (See A shown on the right figure.)
- 4. Tilt the ENTER key left/right to select the cell to check its information. (See B on the right figure) The gray value or differential value of the selected cell is displayed. (See C on the right figure)



What are Connector (Binary Window) and Connector (Gray Window)?

These are the functions that mainly perform appearance inspection such as foreign objects detection on IC pins.



Connector (Binary Window) measures areas of multiple Binary Window cells set on the inspection line and outputs the measured areas. Connector (Gray Window) measures gray average based on gray level of all pixels in multiple Gray Window cells set on the inspection line and outputs the gray average.

These two checkers have different inspection methods as above, however, the setting procedures are the same.

Output Data

Connector (Binary Window)

Area of each cell	
Judgement of each cell:	If the detected area of each cell is within the allowable range you have set, the object will be judged as "OK", if it is outside the allowable range, the object will be judged as "NG".
Judgement:	When judgments of all cells are "OK", judgment of the checker will be "OK".
Connector (Gray Window)	
Gray average of each cell:	0 - 255
Judgement of each cell:	If the detected gray average of each cell is within the allowable range you have set, the object will be judged as "OK", if it is outside the allowable range, the object will be judged as "NG".
Judgement:	When judgments of all cells are "OK", judgment of the checker will be "OK".

Specifying Checker No.

- **1.** Select "Connector (Binary Window)" or "Connector (Gray Window)" in "Checker Type".
- 2. Select the checker No. list and specify a checker number to set.
- **3.** Press the ENTER key to determine the checker No.

"Connector (Binary Window)" or "Connector (Gray Window)" setting window is displayed.



Selecting a Camera

Select a camera image to set a checker.

1. Select "Area Setting".

2. Select a camera No. in "Camera".

The selected camera image is displayed.

Note

Select a displayed image type (Live/Memory or Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

Selecting Preprocess / Slice Level / Position Adjustment

Refer to page 85

Setting Inspection Area

Note

You cannot set a Mask Area.

- 1. Select "Area Setting".
- 2. Select "Set" of "Area Setting".

"Area Setting" window is displayed.

- **3.** Move the area to inspecting area by operating the ENTER key and press the ENTER key to fix the position.
- **4.** Move the start point and fix it. Then, move the end point and fix it.
- 5. Set the size (W) of cells which inspect appearance for each pin.

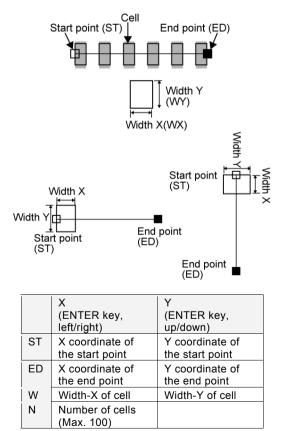
Set a cell for a pin.

Note

The widths in X and Y directions of a cell are defined in accordance with the position of start point and end point as the figures shown on the right.

6. Tilt the ENTER key left/right to specify the number of cells (N), and press the ENTER key to fix it.

Set the number of cells to the same number as of pins.



Setting Judgement Limits

Set a tolerance (Maximum and Minimum values) of gray average and area measured in each cell.

If the detected data are within the tolerance, the object will be judged as "OK", if they are outside of it, the object will be judged as "NG". When judgments of all cells are "OK", judgment of the checker will be "OK".

The maximum/minimum value can be set in two ways, common setting and individual setting. The common setting sets the same value for all cells and the individual setting sets separate values. When you want to set criteria for OK judgement by cells, use individual setting.

- 1. Select "Judgement Limits".
- 2. Press the TRIG key to execute a test.

The area of each cell is displayed for your guide to set maximum/minimum values.

3. To set values individually, select "Yes" for "Set individually".

Select "No" not to employ Individual Setting.

- 4. Select the table of maximum/minimum values.
- 5. To employ the common setting, select the row of "Common" and enter a value.

To use the individual setting, select a cell number and enter a value.

After the setting is completed, press the CANCEL key.

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set "Window Transparency (SETUP menu)" to a larger value. (See "Changing Window Transparency (SETUP Menu)", page 320)

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

Note

Position adjustment is also executed at the same time if it is used.

2. Check data of the result list.

Connector (Binary Window)

No.:	Binary Window cell No.
Area:	Area of each cell
Judgement:	Judgement of each cell

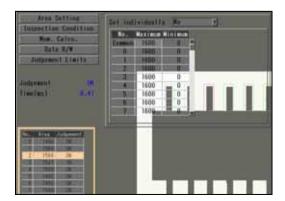
Connector (Gray Window)

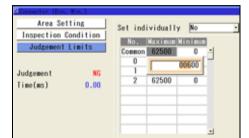
No.:	Gra
Gray Average:	Gra
Judgement:	Juo

Gray Window cell No. e: Gray average of each cell Judgement of each cell

Note

When you highlight each No., the selected cell turns to pink on the screen window.





Registering Inspection Results in Numerical Calculation

(This is supported in Ver.1.30 or later.)

The detected Area of cells (for Connector (Binary Window)) or Gray Average (for Connector (Gray Window)) and Judgement can be registered into Numerical Calculation from the checker setting window. Although you can register them also in Numerical Calculation setting window, information of many cells can be registered efficiently with less operation from the checker setting window.

Area Setting

Inspection Condition

- Select "Num. Calcu." in checker setting window.
- 2. Select "Yes" for "Num. Calcu."
- **3.** Select the setting table and select a data type to register.

Result:Area or Gray average of each cellJudgement:Judgement of each cell

4. Specify Starting Area, Number of Areas, and No.

Starting Area:	Cell No. of the first cell to register.
No. of Areas:	The number of cells to register
No.:	No. of the first Numerical Calculation that is to be registered.

Note

In the setting table, always "0" are displayed. Even after registering the data into Numerical Calculation, the table shows "0" again. The table cannot display the current registration status of Numerical Calculation.

5. Press the CANCEL key to go back to the checker selecting window.

The data is registered at this timing. When the destination Numerical Calculation No. is already set an expression, a message is displayed. Selecting "YES" overwrites the expression.



Num. Calcu.

Yes

No

Num. Calcu.	Yes	×
Starting Area	No. of Areas	No.
0	5	3
0	0	003
J		000

The example shown above is the setting where the results of cell No.0 to 4 are being registered into Numerical Calculation No.3 to 7.

Area Tize Adi. Diecke	r Slice	avel	Preprint	Bin. Sales.
Oucher Bo. 7				
CACOUS Incent CACOUS Incent CACOUS Incent CACOUS Incent	Report	17577794	Minter and	Miniana (b.)
CACOD3 COMDEL_ARE A.D0 CACOD4 COMDOD_ARE A.D1 CACOD5 COMDOD_ARE A.D2	1490.000 1548.000 876.000		0.000 0.000 0.000	0.000 0.000 0.000
CACODE EDW000_AREA.03 CACODE EDW000_AREA.04 CACODE lines 1	1521.000	11 15	0.000	0.009

Registering into Data R/W

(This is supported in Ver.1.30 or later.)

The detected Area of cells (for Connector (Binary Window)) or Gray Average (for Connector (Gray Window)), Judgement Limits, and Judgement can be registered into Data R/W from the checker setting window. Although you can register them also in Data R/W setting window, information of many cells can be registered efficiently with less operation from the checker setting window.

- 1. Select "Data R/W" in the checker setting window.
- 2. Select a sheet of Data R/W to register data in "Data R/W".
- **3.** Select a direction to arrange the data in "Rightward/Downward".
 - **Rightward:** Registers the data from the specified position to the right cell.
 - **Downward:** Registers the data from the specified position to the lower cell.
- **4.** Select the setting table and select a data type to register.

Result No.:	Cell No. of connector checker
Maximum:	Maximum value of cell judgement limits
Minimum:	Minimum value of cell judgement limits
Result:	Area or Gray average of each cell
Judgement:	Judgement of each cell

Note

In the setting table, always "0" are displayed. Even after registering the data into Data R/W, the table shows "0" again.

The table cannot display the current registration status of Data R/W.

5. Specify Starting Area, Number of Areas, and No.

Starting Area:	Cell No. of the first cell to register.		
R/W Row:	The position on a Data R/W sheet of		
R/W Column:	the first data.		
No. of Areas:	Number of connector checker cells data of which are registered in Data R/W sheet.		

6. Press the CANCEL key to go back to the checker selecting window.

The data is registered at this timing. When the destination cell of the Data R/W sheet is already set an expression, the data is overwritten. Note that the confirmation message does not appear.



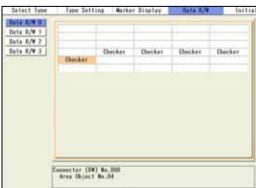


Data R/W	Dat	ta R/W 0	•	
Direction	Rightward -			
8500	eting -	Ards R/W	Colum	n R/W Row N
Result No.	.0		0	0
Maximum	0		0	0
Minimum	0		0	0
Result	0		1	3
Judgement	0		0	0
+	107		1	

The example shown above is the setting where Judgements of cell No.0 to 3 are registered into row No.3 and column No.1 to 4 in Data R/W 0. The data are registered as below.



When Number of Areas is set to 5 under the condition above, the data that cannot be included in the specified row are stored in the next row from the first cell.



What is Connector (Gray Edge)?

This checker measures gaps of IC pins, pitch and float of leads, and parts size (outside/inside diameters). It uses multiple Gray Edge checkers on a line in the area to detect edges of pins and an object, and helps to inspect on a connector IC with many pins. In the same method of Gray Edge checker, it detects a size of an object such as edges of pins and chip parts. Four modes are provided. Use them according to your purpose.

Detect Example	Output Data
Execution Mode = Gap Detects a gap between pins.	Each gap
	 X coordinate, Y coordinate and differential value of two pins making up a gap Maximum value, minimum value, and average of gaps Judgement The checker judges based on the set tolerance of detected gaps. When all gaps are within the tolerance range, the object is judged as OK. Judgement of each gap
Execution Mode = Pitch	
	 Each Pitch X coordinate, Y coordinate and differential value of pins (edges) Maximum value, minimum value, and average of pitches Judgement of pitches The checker judges if the detected pitches are within the set tolerance. (Total Judgement, Judgement of each pin)
Execution Mode = Float	
Detects a tip of each pin and a standard position. The difference between them is the base distance of a float. If the distance is short, it is judged as a float. In this manual, this base distance is "Float".	 Float of each pin X coordinate, Y coordinate and differential value of each pin Maximum value, minimum value, average, and distance difference* of floats Judgement The checker judges if the detected floats are within the set tolerance. (Total Judgement, Judgement of each pin) Distance Difference Judgement The checker judges if the detected distance difference is within the set tolerance. (Total Judgement, Judgement, Judgement of each pin) Total Judgement If the float judgement and Distance Difference total judgement are both OK, total judgement will be OK.
Execution Mode = Width Measurement	
Detects two edges in an area and calculates the difference (width) between them. Multiple widths on the inspection line can be measured at the same time.	 Each width X coordinate, Y coordinate, and differential value of two edges to calculate a width Maximum value, minimum value, and average of widths Judgement The checker judges based on the set tolerance of detected widths. When all widths are within the tolerance range, the object is judged as OK. Judgement of each width

Specifying Checker No.

- 1. Select "Connector (Gra. Edg.)" in "Checker Type".
- 2. Select the checker No. list and specify a checker number to set.
- **3.** Press the ENTER key to determine the checker No. "Connector (Gra. Edg.)" setting window is displayed. The gray image is displayed on the screen window.

Selecting a Camera

Select a camera image to set Connector (Gray Edge) checker.

- 1. Select "Area Setting" in "Connector (Gra. Edg.)" setting window.
- 2. Select a camera No. in "Camera".

The selected camera image is displayed.

Note
Select a displayed image type (Live/Memory or Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

C

C

Selecting Preprocess / Slice Level / Position Adjustment

Refer to page 85

Selecting an Execution Mode and Checker Direction

Connector (Gray Edge) checker has four execution modes. Select one of them according to your inspection purpose.

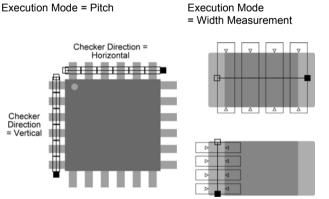
Checker Direction is to set a start point and an end point of an area horizontally or vertically. Changing either of Execution Mode or Checker Direction clears an inspection area. Set them before drawing an area.

- **1.** Select "Inspection Condition" in "Connector (Gra. Edg.)" setting window.
- 2. Select one of four modes for "Execution Mode".

When the dialog message appears, select "YES".

3. Select "Horizontal" or "Vertical" in "Checker Direction".

> When the dialog message appears, select "YES". Now, selecting Execution Mode and Checker Direction is complete.



OPERATI	ON ENVIRONM	ENT TYPE	INSPECTION	SAVE/READ	TOOL
Area S	Size Adj.	Chee	:ker	Slice L	evel
	r Type				RU
connec	tor (Gra. E	dg.)	· ·	+	
lock I					SE
hecke	r No.	0			
			C	Screen CO(C	ompact)
000	<enter< td=""><td>Comment></td><td>-</td><td></td><td></td></enter<>	Comment>	-		
001					
002			_		

Chapter 4

In the case of Execution Mode = Gap

The procedure described below is for area setting and other inspection conditions when Execution Mode is set to "Gap".

Setting an Inspection Area

Note

You cannot set a Mask Area in Connector checker.

1. Select "Area Setting" in "Connector (Gra. Edg.)" setting window.

2. Select "Area (Set)".

"Area Setting" window is displayed. In Gap mode, two sets of areas (Area 0, Area 1) must be set. The orange area displayed in the window when opening it is Area 0.

3. Move the Area 0 to inspecting area by operating the ENTER key. And then, press the ENTER key to fix the position.

4. Move the start point of Area 0 and fix it. Then, move the end point and fix it.

In the lower left on the screen, the coordinates of the start point and the end point of Area 0, and size and the number of Gray Edge cells are displayed. Use them to make setting. (See the right table)

5. Set the size (W) of Gray Edge cells which detect edges in width measuring area.

Note

The widths in X and Y directions of a cell are defined as the figures shown on the right.

6, Tilt the ENTER key left/right to specify the number of cells, and press the ENTER key to fix it.

7. Set Area 1.

Follow the same procedure of Area 0.

Cell size and the number of cells are shared by Area 0 and 1. Changing the values during Area 1 setting changes the value of Area 0. (You cannot set different values.)

Setting Edge Conditions

Specify the condition of detecting edges and scanning.

1. Select "Inspection Condition".

2. Set "Detect Direction".

Set the direction in order to search edges from the side with fewer noises.

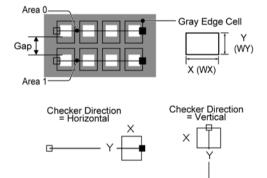
- Inside -> Outside Outside -> Inside
- Top -> Bottom (Checker Direction =Horizontal)



Bottom -> Top (Checker Direction =Horizontal)



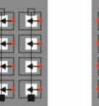
	X (ENTER key, left/right)	Y (ENTER key, up/down)
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
Ν	Number of cells (Max. 100)	





 Right -> Left (Checker Direction =Vertical)





Refer to

For the information of the following conditions, refer to the chapter of Gray Edge checker (page 100).

- Inspection Condition "Scan Method", "Edge Condition", "Detected Position"
- Search Method

Deciding Differential Threshold

Decide a threshold value of differential in detecting area. Only the areas with differential value which is higher than this threshold are subjected to detect.

The threshold can be set in two ways, common setting and Individual setting. The common setting sets the same value for all Gray Edge cells and the Individual setting sets separate values. Use the Individual setting if pins have different brightness or only some of pins are dark due to lighting condition.

1. Select "Thresh.Adj.".

2. Press the TRIG key to execute a test.

The detected edge differentials are displayed. Use them to set the threshold.

- **3.** To set threshold of Gray Edge cells individually, select "Yes" for "Set Individually". Select "No" not to employ Set Individually.
- **4.** Select the threshold setting table.
- 5. To employ the common setting, select the row of "Common" and enter a value.

To use the Individual setting, select Gray Edge cell number and enter a threshold.

6. Press the TRIG key to execute a test.

Press the F1key to display the image and confirm that all parts are detected stably.

Setting Judgement Limits

Set a tolerance (maximum and minimum values) of the values of detected gaps. If the detected widths are within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG". When all widths are detected and judgements of them are "OK", judgement of the checker will be "OK".

- 1. Select "Judgement Limits".
- 2. Input the setting values for "Max. Judge, Pitch" and "Min. Judge. Pitch".

Even when using "Gap" as the execution mode, these items are displayed as "Max. Judge. Pitch" and "Min. Judge. Pitch".

3. After inputting is completed, press the CANCEL key.

In the case of Execution Mode = Float

The procedure described below is for area setting and other inspection conditions when Execution Mode is set to "Float".

Setting an Inspection Area

Note

You cannot set a Mask Area in Connector checker.

1. Select "Area Setting" in "Connector (Gra. Edg.)" setting window.

2. Select "Area (Set)".

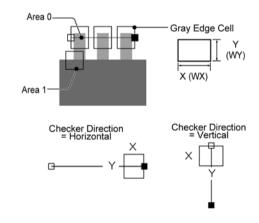
"Area Setting" window is displayed. In Float mode, two areas (Area 0, Area 1) must be set. Area 0 detects a tip of pin and Area 1 detects base position of float such as a foot of pin. An area displayed in orange when selecting the window is Area 0.

3. Move the Area 0 to inspecting area by operating the ENTER key and press the ENTER key to fix the position.

4. Move the start point of Area 0 and fix it. Then, move the end point and fix it.

In the lower left on the screen, the coordinates of the start point and the end point of Area 0, and size and the number of Gray Edge cells are displayed. Use them to make setting. (See the right table)

Х Y (ENTER key, (ENTER key, left/right) up/down) ST X coordinate of Y coordinate of the start point the start point ED X coordinate of Y coordinate of the end point the end point W Width-X of cell Width-Y of cell Number of cells Ν (Max. 100)



5. Set the size (W) of Gray Edge cells which detect edges in width measuring area.

Note

The widths in X and Y directions of a cell are defined as the figures shown on the right.

6. Tilt the ENTER key left/right to specify the number of cells, and press the ENTER key to fix it.

7. Tilt the ENTER key up/down to select Area 1.

In the same steps for setting Area 0, move and set a start point and set an end point.

Note

The relative position of the start point and the end point has no effect on edge detection. Set "Detect Direction" in "Inspect Condition".

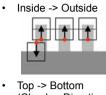
Setting Edge Conditions

Specify the condition of detecting edges and scanning.

1. Select "Inspection Condition".

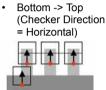
2. Set "Detect Direction".

Set a Detect Direction which is suitable for the captured image. For the image shown below, setting "Outside -> Inside" detects edges correctly.





(Checker Direction = Horizontal)



- Right -> Left (Checker Direction = Vertical)
- Left -> right • (Checker Direction = Vertical)





Refer to

For the information of the following conditions, refer to the chapter of Gray Edge checker (page 100).

- Inspection Condition "Scan Method", "Edge Condition", "Detected Position"
- Search Method

Deciding Differential Threshold

Decide a threshold value of differential in detecting area. Only the areas with differential value which is higher than this threshold are subjected to detect.

The threshold can be set in two ways, common setting and individual setting. The common setting sets the same value for all Gray Edge cells and the individual setting sets separate values. Use the individual setting if pins have different brightness or only some of pins are dark due to lighting condition.

1. Select "Thresh.Adj.".

2. Press the TRIG key to execute a test.

The detected edge differentials are displayed. Use them to set the threshold.

3. To set threshold of Gray Edge cells individually, select "Yes" for "Set Individually".

Select "No" not to employ individual Setting.

- **4**. Select the threshold setting table.
- 5. To employ the common setting, select the row of "Common" and enter a value.

To use the individual setting, select Gray Edge cell number and enter a threshold. "Thre.1" and "Diff.1" are respectively threshold and differential value of Area 1 which detects the base of a float.

Convector (oral Los)		_					
Area Setting		Set indi	ividual	lv.	Yes	•	
Inspection Condition							
Search Method			Interest	0.11.0	1000	Unit-1	
had a second distant		Common	0		0		A
Judgement Limits		0	50	0	50	0	-
Threshold Adj.		1	50	0	50	0	
		2	50	0	50	0	
Judgement	NG						
Time(ms)	0.00						
Max. Pitch	0.000						
Nin Bitch	0.000						-1

6. Press the TRIG key to execute a test.

Press the F1key to display the image and confirm that all parts are detected stably.

Setting Judgement Limits

Set a tolerance (maximum and minimum values) of the values of detected floats and "Distance Difference". If the floats and distance difference are within the tolerance, the object will be judged as "OK", if they are out of it, the object will be judged as "NG". When judgement of floats and distance difference are both "OK", judgement of the checker will be "OK".

Note

"Distance Difference" is a difference between floats of adjacent pins. For example, the distance difference of No.0 is the difference between the floats of No.0 and No.1.

1. Select "Judgement Limits".

2. Input the setting values for "Max. Judge. Pitch" and "Min. Judge. Pitch".

Even when using "Float" as the execution mode, these items are displayed as "Max. Judge. Pitch" and "Min. Judge. Pitch".

3. Input the setting values for "Max. Distance Difference" and "Min. Distance Difference".

Enter maximum/minimum values for distance difference.

4. After inputting is completed, press the CANCEL key.

In the case of Execution Mode = Pitch

The procedure described below is for area setting and other inspection conditions when Execution Mode is set to "Pitch".

Setting an Inspection Area

Note

You cannot set a Mask Area in Connector checker.

1. Select "Area Setting" in "Connector (Gra. Edg.)" setting window.

2. Select "Area Setting".

"Area Setting" window is displayed.

- **3.** Move the area to inspecting area by operating the ENTER key and press the ENTER key to fix the position.
- **4.** Move the start point and fix it. Then, move the end point and fix it.

The position of the start point is a start point of scan of the first Gray Edge.

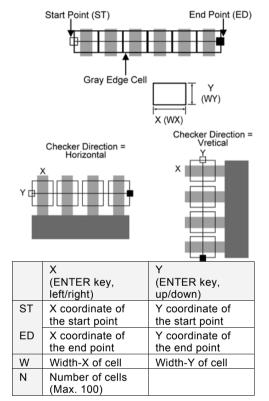
5. Set the size (W) of Gray Edge cells which detect edges of pins.

Set the size to surround a pin with a cell.
Note
The widths in X and Y directions of a cell are defined

as the figures shown on the right.

6. Tilt the ENTER key left/right to specify the number of cells, and press the ENTER key to fix it.

Set the number of cells to the same as the number of pins to be measured.



Setting Edge Conditions

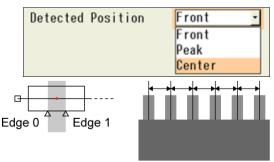
For the information of the conditions listed below, refer to the chapter of Gray Edge checker (page 100).

- Inspection Condition "Scan Method", "Edge Condition", and Front and Peak of "Detected Position"
- Search Method

About Detected Position: Center

"Center" setting detects two points in a cell and outputs the middle point of them as detect position and the distance between the middle points of each cell as Pitch.

The detected point closer to the start point is Edge 0 and the other is Edge 1. Set edge conditions for each edge, Edge Condition 0 and Edge Condition 1.



Setting Edge Threshold

Decide a threshold value of differential in detecting area. Only the areas with differential value which is higher than this threshold are subjected to detect.

The threshold can be set in two ways, common setting and individual setting. The common setting sets the same value for all pins and the individual setting sets separate values. Use the individual setting if pins have different brightness or only some of pins are dark due to lighting condition.

1. Select "Thresh.Adj."

2. Press the TRIG key to execute a test.

The detected edge differentials are displayed. Use them to set the threshold.

3. To set threshold of pins individually, select "Yes" for "Set Individually".

Select "No" not to employ Individual Setting.

- **4.** Select the threshold setting table.
- **5.** To employ the common setting, select the row of "Common" and enter a value.

To use the Individual setting, select pin number (Gray Edge cell number) and enter a threshold.

6. Press the TRIG key to execute a test.

Press the F1key to display the image and confirm that all pins are detected stably.

Setting Judgement Limits

Set a tolerance (maximum and minimum values) of the pitch values of detected pins. If the detected pitches are within the tolerance, the object will be judged as "OK", if it is out of it, the object is judged as "NG". When judgements of all pitches are "OK", judgement of the checker will be "OK".

Judgement Time(ms)

Max. Pitch

Min. Pitch

Area Setting

Inspection Condition

Search Method Judgement Limits

hold Ad

Set individually

0.00

0.000

0.000

No. Thre.0.0111.0 Thre.11

50

No

50 0

50 0

F

11111

- 1. Select "Judgement Limits".
- 2. Input the setting values for "Max. Judge. Pitch" and "Min. Judge. Pitch".
- **3.** After inputting is completed, press the CANCEL key.

4	
3BSetting	
Inspection	
Conditions	

In the case of Execution Mode = Width Measurement

The procedure described below is for area setting and other inspection conditions when Execution Mode is set to "Width Measurement".

Setting an Inspection Area

Note

You cannot set a Mask Area in Connector checker.

1. Select "Area Setting" in "Connector (Gra. Edg.)" setting window.

2. Select "Area Setting".

"Area Setting" window is displayed.

- **3.** Move the area to inspecting area by operating the ENTER key and press the ENTER key to fix the position.
- **4.** Move the start point and fix it. Then, move the end point and fix it.

In the lower left on the screen, the coordinates of the start point and the end point of the area and size and the number of Gray Edge cells are displayed. Use them to make setting. (See the right table)

5. Set the size (W) of Gray Edge cells which detect edges in width measuring area.

Note

The widths in X and Y directions of a cell are defined as the figures shown on the right.

6. Tilt the ENTER key left/right to specify the number of cells, and press the ENTER key to fix it.

Setting Edge Conditions

Specify the condition of detecting edges and scanning.

1. Select "Inspection Condition".

2, Set "Detect Direction".

Set the direction in order to search edges from the side with fewer noises, either background or surface of an object.

Inside -> Outside (default):

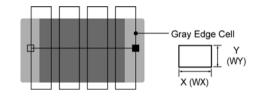
Searches edges from inside of cells to both ends. **Outside -> Inside:** Searches edges from both sides to the inside.

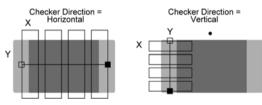
Refer to

For the information of the following conditions, refer to the chapter of Gray Edge checker (page 100).

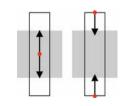
- Inspection Condition "Scan Method", "Edge Condition", "Detected Position"
- Search Method

	X (ENTER key, left/right)	Y (ENTER key, up/down)
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
Ν	Number of cells (Max. 100)	





Inside -> Outside



Outside -> Inside

Deciding Differential Threshold

Decide a threshold value of differential in detecting area. Only the areas with differential value which is higher than this threshold are subjected to detect.

The threshold can be set in two ways, common setting and individual setting. The common setting sets the same value for all Gray Edge cells and the individual setting sets separate values. Use the individual setting if pins have different brightness or only some of pins are dark due to lighting condition.

1. Select "Thresh.Adj.".

2. Press the TRIG key to execute a test.

The detected edge differentials are displayed. Use them to set the threshold.

3. To set threshold of Gray Edge cells individually, select "Yes" for "set Individually".

Select "No" not to employ Individual Setting.

4. Select the threshold setting table.

5. To employ the common setting, select the row of "Common" and enter a value.

To use the Individual setting, select Gray Edge cell number and enter a threshold.

Area Setting Inspection Condition	-	Set indiv			No	•	
Search Method		No. Common	50	111.0	50	111.1	1
Judgement Limits		0	50	0	50	0	ŝ
Threshold Adj.		1	50	0	50	0	
		2	50	0	50	0	
Judgement	NG						
Time(ms)	0.00						
Max. Pitch	0.000						
Min. Pitch	0.000						2

6. Press the TRIG key to execute a test.

Press the F1key to display the image and confirm that all parts are detected stably.

Setting Judgement Limits

Set a tolerance (maximum and minimum values) of the values of detected widths. If the detected widths are within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG". When judgements of all widths are "OK", judgement of the checker will be "OK".

1. Select "Judgement Limits".

2. Input the setting values for "Max. Judge. Pitch" and "Min. Judge. Pitch".

Even when using "Width Measurement" as the execution mode, these items are displayed as "Max. Judge. Pitch" and "Min. Judge. Pitch".

3. After inputting is completed, press the CANCEL key.

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image easily, set "Window Transparency (SETUP menu)" to a larger value. ("Changing Window Transparency (SETUP Menu)", page 320)

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

Note

Position adjustment is also executed at the same time if it is used.

Are	a Setting					_	
	ion Conditio	on		mment			
	rch Method			mera		0	
	ment Limits		Po:				No
	shold Adj.		Are	ea		_	Set
inre	sherd Adj.		-				
Judgement		N	16				
Time(ms)		0.0	0				
Max. Pitch		0.00	0				
Win, Pitch		0.00					
			-				
Average Pitch	ment	0.00	0				
Average Pitch Pitch Total Judge		0.00	-				
Average Pitch Pitch Total Judge		0.00	0				
Average Pitch Pitch Total Judge Distance Diff. To	otal Judg.	0.00 N	10 16 10	0144.0	XI	n	Diff.1
Average Pitch Pitch Total Judge Distance Diff. To Pitch Pitch Issin e 158.935 OK	otal Judg.	0.00 N 207.500	10 16 19 38_380	-163	×1 242.454	197.315	174
Average Pitch Pitch Total Judge Distance Diff. To Bitch Lister 0 158,805 OK 1 159,269 OK	otal Judg. 0.000 MG 0.005 NG 0.200 NG	0.00 N 207.500 337.500	10 16 38.380 38.046	-163 -167		197.315	174
Average Pitch Pitch Total Judge Distance Diff. To 9758,805 0K 1 159,269 0K	otal Judg.	0.00 N 207.500	10 16 19 38_380	-163		197.315	174
Average Pitch Pitch Total Judge Distance Diff. To Bitch Lister 0 158,805 OK 1 159,269 OK	otal Judg. 0.000 MG 0.005 NG 0.200 NG	0.00 N 207.500 337.500	10 16 38.380 38.046	-163 -167		197.315	174
Average Pitch Pitch Total Judge Distance Diff. To Bitch Lister 0 158,905 OK 1 159,269 OK	otal Judg. 0.000 MG 0.005 NG 0.200 NG	0.00 N 207.500 337.500	10 16 38.380 38.046	-163 -167		197.315	174

2. Check data of detected area list.

No.:	Gray Edge cell No.				
Ditah	Data of Ditab Can Float and Wig				

Pitch;	Data of Pitch, Gap, Float, and Width. (Regardless of execution modes, the name is fixed to "Pitch".)
Judgement:	Judgement of each pin (or width)
Distance Difference:	Distance Difference of "Float" (Available only in the case of Execution Mode = Float)
Judgement:	Judgement of Distance Difference of "Float" (Available only in the case of Execution Mode = Float)
X0, Y0, Diff.0:	Coordinates and differential value of edges detected with Area 0.
X1, Y1, Diff.1:	Coordinates and differential value of edges detected with Area 1.

Note

- When Calibration is employed, the data is displayed after calibration.
- When highlighting each No., Gray Edge cells displayed on the screen window turn to pink.

Registering Inspection Results in Numerical Calculation

(This is supported in Ver.1.30 or later.)

The detected coordinate and differential value of cells and judgement can be registered into Numerical Calculation from the checker setting window. Although you can register them also in Numerical Calculation setting window, information of many cells can be registered efficiently with less operation from the checker setting window.

Data that can be registered into Numerical Calculation from Connecter (Gray Edge) setting window

- Pitch
- Pitch Judgement
- Distance Difference
- Distance Difference Judgement
- X coordinate 0
- Y coordinate 0
- Differential value 0
- X coordinate 1
- Y coordinate 1
- Differential value 1

The setting procedure is the same as Connector (Binary Window) and Connector (Gray Window). Refer to page 138 for details.

Registering into Data R/W

(This is supported in Ver.1.30 or later.)

The detected pitch, distance difference, and judgement limits of cells and judgement can be registered into Data R/W from the checker setting window. Although you can register them also in Data R/W setting window, information of many cells can be registered efficiently with less operation from the checker setting window.

Data that can be registered into Data R/W from Connecter (Gray Edge) setting window

- Result No.: Cell No. of the first cell to register
- Maximum: Max. Judge. Pitch
- Minimum: Min. Judge. Pitch
- Max. Dist. Differ.: Max. Distance Difference
- Min. Dist. Differ.: Min. Distance Difference
- Pitch
- Pitch Judgement
- Distance Difference
- Distance Difference Judgement
- X coordinate 0
- Y coordinate 0
- Differential value 0
- X coordinate 1
- Y coordinate 1
- Differential value 1

The setting procedure is the same as Connector (Binary Window) and Connector (Gray Window). Refer to page 139 for details.

4.7.14 Smart Edge (Circle)

(Available from Ver.1.6)

What is Smart Edge (Circle)?

Smart Edge (Circle) is a function to output the center point, radius or diameter of a round object by detecting edges of the object with a number of cells. It is suitable for the detection of a missing edge and burr of a round object, angle of a convex (or concave) part, the inspection of circularity and the calculation of the angle of the diameter position of an ellipse. For a ring-shaped object, detecting the outer and inner circles both enables the detection of the difference between the centers of the two circles or the ring width.

The central coordinate or radius of a circle can be also detected when a whole object cannot be captured or for the angle of a chamfered object.

Inspection example

t	θ + θ + +	
Detection of radius, diameter	Detection of angles of measured maximum and minimum values. Capturing part of a c detect the	center points of
Detect Mode		Output Data
Measure Radius	Detects the radius from the center point of a detected virtual circle to the edge. This mode is effective to detect a missing edge and burr, and the position and angle of a projection as the left figure. Circularity inspection is also performable based on a radius value. Detects the diameter based on the edge coordinates of a circle detected with two	 Virtual circle (Centeral coordinate, Radius) Radius, Diameter or Width, and the maximum, minimum, average and standard deviation Circularity Maximum angle, minimum angle (Radius, Diameter or Width) Detected data of each cell Radius, Diameter or Width Deviation(Detect Mode: Measure Radius only), Coordinate,
MAX. MIN.	opposite cells . Circularity inspection is also performable based on a radius value.	Differential Used edge count, Unused edge count
Measure Width	Inspects ring-shaped objects. Measures the difference between the edges of outer and inner circles, and outputs it as "Width". This mode is suitable for inspecting the misalignment of center of concentric circle as the central coordinates of two circles are detected. Circularity inspection is also performable based on a radius value.	

Specifying Checker No.

- 1. [Select "Smart Edge (Circle)" in "Checker Type".
- 2. Select the checker No. list and specify a checker number to set.
- 3. Press the ENTER key to determine the checker No.

"Smart Edge (Circle)" setting window appears. The gray image is displayed on the screen window.

Selecting	a Camera	
oolooting	a camora	

Select a camera image to set "Smart Edge (Circle)" checker.

- 1. Select "Area Setting" in "Smart Edge (Circle)" setting window.
- 2. Select a camera No. in "Camera".

The image of the selected camera is displayed.

▶ Note

Select a displayed image type (Live/Memory and Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

Area Settin

Virtual Circle Detect Condi.

Edge Detect Condition Judgement Limits Capera

Area

Selecting Position Adjustment

Position Adjustment is helpful when the position of an inspection object may shift largely or an angle can be detected in advance for an ellipse object.

Select a Position Adjustment checker that has been already set. Refer to page 185 for details of position adjustment.

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

The list of position adjustment is displayed.

Note

If a position adjustment checker is not created, "Position Adj." cannot be selected.

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

Note

When selecting a checker number for Position/Rotation Adjustment or Rotation Adjustment, the criterion values for maximum and minimum angles or the label for the horizontal axis of the graph vary depending on the setting of "Base Angle". Refer to page 165for details.

OPERATION ENVIRO	NMENT TYPE	INSPECTION
Position Adj.	Area S	ize Adj.
Checker Type		
Smart Edge(Circ	le)	-
Block No.		
Checker No.	0	
000		-
001		
002		_

Sat

Chapter 4 3BSetting Inspection Conditions

Selecting a Preprocess Group

Set a preprocess filter to apply on an image captured by a camera as necessary.

1. Select "Virtual Circle Detect Condition" > "Preprocess".

"Preprocess" window is displayed.

2. Select a Preprocess group (A to E) in "Preprocess".

Note

For details of preprocess, refer to page PAGEREF.

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

Return to "Virtual Circle Detect Condition" setting window. The selected preprocess group is displayed.

Execution Sequence of Smart Edge (Circle)

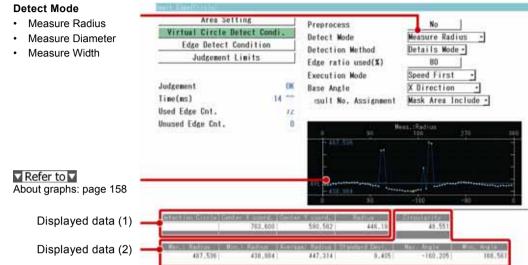
Process sequence		Related parameters
Detection of edges of circle		Area Setting (p.160)Edge Detect Condition (p.162)
Detection of virtual circle	Calculates the central coordinate and radius of virtual circle.	 Detection Method ¬ Edge ratio used ⊢ (p.163) Execution Mode
Detection of radius, diameter or width	Detects according to Detect Mode.	Detect Mode (p.156)
Detection of each data (see the right column) and circularity of radius, diameter or width.	Max. value, min. value, average value, standard deviation, angle of max./min. value	Denoising (p.167)Base Angle (p.165)
Judgement	Each judgement condition	 Judgement Limits: Each Max., Min. values (p.169)

Setting Detect Mode

1. Select "Virtual Circle Detect Condition" > "Detect Mode".

2. Select a desired Detect Mode from the list.

Depending on the selected Detect Mode, detected data items to be displayed at the bottom of the screen vary.



About Data to be displayed

			Detect Mode				
			Measure Radius	Measure Diameter	Measure Width		
(1)	Virtual circle	a)	Center coordinate (X, Y)		Center coordinate (X, Y) of inner circle Center coordinate (X, Y) of outer circle		
			Rac	lius	Radius of inner circle Radius of outer circle		
(2)	Measure	b)	Max. radius	Max. diameter	Max. width		
	-ment		Min. radius	Min. diameter	Min. width		
	value		Average radius	Avereage diameter	Average width		
		c)	(Radius) Standard deviation	(Diameter) Standard deviation	(Width) Standard deviation		
		d)	Circu	larity	Circularity of inner circle Circularity of outer circle		
		e)	Max. radius angle	Max. diameter angle	Max. width angle		
			Min. radius angle	Min. diameter angle	Min. width angle		

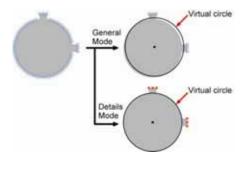
a) Virtual circle

Virtual circle is a true circle(*) that is calculated with the coordinate values of the edges of an object detected by each cell.

Two detection methods are available. "General Mode" which uses the coordinate values of all detected edges and "Details Mode" which does not use the coordinate values of convex or concave of an object for calculating the virtual circle.

Note

*) When Calibration is employed, virtual circle (true circle) is detected with the values after calibration. When Factor X and Factor Y are different, it is displayed as an ellipse according to the ratio. (Because the image displayed on the screen is the state before calibration.)



b) Maximum, minimum and average of measurement values

Calculates the radius, diameter or width using the edges detected by each cell. Then, calculates the maximum, minimum and average values for the remaining data except the data judged as noises.

The criterion to judge data as noises is decided by "Denoising" function.

As the graph displayed on the screen (described below) shows the maximum and minimum values before denoising, the values of the graph may be different from the output values.

Refer to

About Denoising function: Page 167

c) Standard deviation

It is the value that the variation in values of radius, diameter or width is quantified. It is calculated by the formula mentioned on the right.

This formula is for the case of "Detect mode: Measure Radius".

For the case of "Measure Diameter" or "Measure Width", replace the "Radius" in the right formula with "Diameter" or "Width".

The larger value indicates the greater variation.

No. of data ("Used edge count")
Note

Sum of ("Measurement: Radius" of each cell - "Average: Radius")²

The calculation method for "Standard Deviation" used for Denoising function is different.

d) Circularity

Detects the difference between the maximum radius and minimum radius as circularity.

When Detect Mode is "Measure Diameter" or "Measure Width", circularity is also calculated by detecting the radius, maximum radius and minimum radius.

(However, when Detect Mode is "Measure Diameter" or "Measure Width", the maximum radius and minimum radius are not displayed on the screen.)

e) Maximum angle and Minimum angle

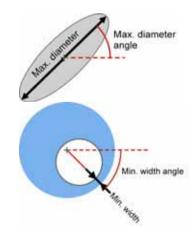
Angle between the base angle and the position of the maximum/minimum value of radius, diameter or width.

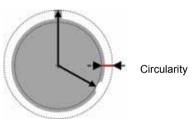
Note

The base angle (Dotted line position in the right figure) used for calculating angles is selectable. Refer to page 165 for details.

Example) Max. diameter angle

Min. width angle





About Graphs and Cell results to be displayed

Measurement values of each cell obtained from test results are displayed as graphs in Smart Edge (Circle). The graph shows the status of edge detection for each cell or whether they are within edge threshold as marks. It is also possible to shows a list of the status of edge detection or detection data for all cells.

 (1) Meas.: Radius 270 360 (2) 494.064 (2) (3) (3) (3) (3) (3) (3) (3) (3) (3) (3	About	graph				
(1) Graph type It shows a graph of radius data when Detect Mode is "Measure Radius". It shows a graph of diameter data when selecting "Measure Diameter", and a graph of width data when selecting "Measure Width". (2) Maximum value The maximum and minimum values of radius. This is the value of radius (diameter/width) that is calculated based on the coordinate of edge detected by each cell before applying various parameters such as Judgement Limits. It may be different from the maximum measurement or minimum measurement displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed form the start angle in order. (4) Angle label 0 to 360 degree of "Measure Radius" and "Measure Rudius" and "Measure Planeter". (5) Result of each cell It shows detected positions of each cell. It also shows detection results or maximum and minimum measurement otking (6) Mark Color Description Cell result list (*) Display of judgement field (7) Reat Edge: Und	(4)	1	(1)	Meas.:Radiu 180	s 270	360
0 -180 -90 0 (1) Graph type It shows a graph of radius data when Detect Mode is "Measure Radius". It shows a graph of diameter data when selecting "Measure Diameter", and a graph of width data when selecting "Measure Width". (2) Maximum value The maximum and minimum values of radius. This is the value of radius (diameter/width) that is calculated based on the coordinate of edge detected by each cell before applying various parameters such as Judgement Limits. It may be different from the maximum measurement or minimum measurement displayed at the bottom of the screen is the value after applying the denoising function.) (4) Angle label 0 to 360 degree for "Measure Radius" and "Measure Width". 0 to 180 degree for "Measure Diameter". (5) Result of each cell It shows detected positions of each cell. It also shows detection results or maximum and minimum measurement values as marks. (4) Angle label It shows detected positions of each cell. It also shows detection results or maximum and minimum measurement values as marks. (5) Result of each cell It shows detected positions of each cell. It also shows detection results or maximum and minimum measurement of V/NG (4) Yellow green Min. Measurement OK/NG (5) Result of each cell It shows detected positions of each cell. It also shows detection results or maximum and minimum measurement of V/NG (5) Result of each cell	AVE	- 494.064 (2)		(5)	····	
(1) Graph type It shows a graph of radius data when Detect Mode is "Measure Radius". It shows a graph of diameter data when selecting "Measure Diameter", and a graph of width data when selecting "Measure Width". (2) Maximum value When threshold has been set in Edge Detect Condition, a graph of differential is shown. (3) Minimum value The maximum and minimum values of radius. This is the value of radius (diameter/width) that is calculated based on the coordinate of edge detected by each cell before applying various parameters such as Judgement Limits. It may be different from the maximum measurement or minimum measurement displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen. (Because the data displayed from the start angle in order. (4) Angle label 0 to 360 degree and the lower label varies depending on the start angle, end angle, setting value of "Base Angle" and adjustment angle for	(3) 368.680 ×	Ī			
 shows a graph of diameter data when selecting "Measure Diameter", and a graph of width data when selecting "Measure Width". When threshold has been set in Edge Detect Condition, a graph of differential is shown. (2) Maximum value (3) Minimum value (4) Angle label (4) Angle label (5) Result of each cell (5) Result of each cell (6) Result of each cell (7) Result of each cell (8) Minimum and minimum measurement values as marks. (9) Maximum and minimum measurement values as marks. (1) Maximum and minimum measurement values as marks. (2) Maximum and minimum measurement or minimum measurement displayed at the bottom of the screen is the value after applying the denoising function.) (4) Angle label (5) Result of each cell (6) Result of each cell (7) Result of each cell (8) Mark Color (9) Description (9) Cell result list (*) (1) Display of judgement field (1) Yellow green (2) Maximum and minimum measurement (2) Maximum and minimum measurement (2) Maximum and minimum measurement (3) Minimum value 		o 90)	-180	-90	Ó
 (2) Maximum value (3) Minimum value (3) Minimum value (3) Minimum value (4) Angle label (4) Angle label (5) Result of each cell (5) Result of each cell (6) Result of each cell (7) Result of each cell (8) Result of each cell (9) Result of each cell (1) Result of each cell (1) Result of each cell (2) Result of each cell (3) Result of each cell (4) Result of each cell (5) Result of each cell (6) Result of each cell (7) Result of each cell (8) Result of each cell (9) Result of each cell (1) Result of each cell (1) Result of each cell (2) Yellow green (3) Max. Measurement (4) Max. Measurement (5) Result of each cell (6) Result of each cell (7) Result of each cell (8) Result of each cell (9) Result of each cell (1) Result of each cell (2) Yellow green (3) Max. Measurement (4) Max. Measurement (5) Result of each cell (6) Result of each cell (7) Result of each cell (8) Result of each cell (9) Result of each cell (1) Result of each cell (2) Result of each cell (3) Result of each cell (4) Result Color (6) Result of each cell (7) Result of each cell (8) Result of each cell (9) Result of each cell (1) Result of each cell (2) Result of each cell (3) Result of each cell (4) Result Color (5) Result of each cell (6) Result of each cell (7) Result of each cell (7) Result of each cell (8) Result of each cell (9) R	(1)	Graph type	shows a	graph of diame	ter data when selectir	ng "Measure Diameter", and a
 (3) Minimum value (diameter/width) that is calculated based on the coordinate of edge detected by each cell before applying various parameters such as Judgement Limits. It may be different from the maximum measurement or minimum measurement displayed at the bottom of the screen. (Because the data displayed at the bottom of the screen is the value after applying the denoising function.) (4) Angle label O to 360 degree for "Measure Radius" and "Measure Width". O to 180 degree for "Measure Diameter". The positions and results of edges detected by each cell are displayed from the start angle in order. The position at 0 degree and the lower label varies depending on the start angle, end angle, setting value of "Base Angle" and adjustment angle for Position/Rotation Adjustment. (5) Result of each cell It shows detected positions of each cell. It also shows detection results or maximum and minimum measurement values as marks. Mark Color Description Cell result list (*) Display of judgement field Yellow green Min. Measurement OK/NG Reed Edge: Undetected Undetected X Blue Excluded edge by Excluded denoising 				reshold has bee	en set in Edge Detect	Condition, a graph of differential is
 "Measure Diameter". The positions and results of edges detected by each cell are displayed from the start angle in order. The position at 0 degree and the lower label varies depending on the start angle, end angle, setting value of "Base Angle" and adjustment angle for Position/Rotation Adjustment. (5) Result of each cell It shows detected positions of each cell. It also shows detection results or maximum and minimum measurement values as marks. Mark Color Description Cell result list (*) Display of judgement field Yellow green Min. Measurement OK/NG Green Max. Measurement OK/NG Red Edge: Undetected Undetected Blue Excluded edge by Excluded 			(diamete each cel be differe displaye	r/width) that is o l before applying ent from the ma d at the bottom	calculated based on th g various parameters ximum measurement of the screen. (Becau	ne coordinate of edge detected by such as Judgement Limits. It may or minimum measurement se the data displayed at the
start angle in order. The position at 0 degree and the lower label varies depending on the start angle, end angle, setting value of "Base Angle" and adjustment angle for Position/Rotation Adjustment. (5) Result of each cell It shows detected positions of each cell. It also shows detection results or maximum and minimum measurement values as marks. Mark Color Description Cell result list (*) Display of judgement field Yellow green Min. Measurement OK/NG Green X Red Edge: Undetected Yellow detected Undetected X Blue Excluded edge by denoising	(4)	Angle label			asure Radius" and "M	easure Width". 0 to 180 degree for
(5) Result of each cell It shows detected positions of each cell. It also shows detection results or maximum and minimum measurement values as marks. Mark Color Description Cell result list (*) Display of judgement field • Yellow green Min. Measurement OK/NG • Green Max. Measurement OK/NG × Red Edge: Undetected Undetected × Blue Excluded edge by denoising Excluded					s of edges detected b	y each cell are displayed from the
maximum and minimum measurement values as marks. Mark Color Description Cell result list (*) Display of judgement field Yellow green Max. Measurement OK/NG Red Edge: Undetected Undetected X Blue Excluded edge by denoising Excluded 			end ang	e, setting value	of "Base Angle" and a	
Yellow green Min. Measurement OK/NG Green Max. Measurement OK/NG Red Edge: Undetected Undetected Blue Excluded edge by denoising Excluded	(5)	Result of each cell				as marks.
Green Max. Measurement OK/NG × Red Edge: Undetected Undetected × Blue Excluded edge by denoising Excluded			Mark	Color	Description	
× Red Edge: Undetected Undetected × Blue Excluded edge by denoising Excluded			•	Yellow green	Min. Measurement	OK/NG
× Blue Excluded edge by Excluded denoising				Green	Max. Measurement	OK/NG
denoising			×	Red	Edge: Undetected	Undetected
			×	Blue		
Light blue Judgment: OK OK			•	Light blue	Judgment: OK	ОК
Red Judgement: NG NG			•	Red	Judgement: NG	NG

*) Next page

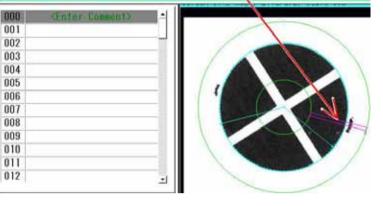
Checking result and data of each cell

Press the FUNC key and select "Cell Result" from the pop-up-menu.

Cell number, judgement, measurement values, deviation, coordinate and differential are listed for all the set cells. The selected cell is displayed in pink on the screen window.

Tilt the ENTER key up/down to display the data of the desired cell.

No.	Judge.	Mean,:Radius De	vistion	X0	Y0	Diff.0	Xt
0	OK	331,888	-3.330	852.717	467.441	-103	
1	0K	331,823	-3.396	852.202	484.867	-97	
2	OK	332.084	-3,134	851,099	502.277	-97	
3	Excluded	360.376	25.157	876.765	524.007	-34	
4	Excluded	364.376	29.158	877.228	543.451	-90	
5	Excluded	366.486	31,267	874,700	562,608	-107	



Note

- In the case of Width Measurement, both data of outer and inner circles is displayed.
- Tilt the SHIFT and ENTER keys to change the page.

Judgement

Four types of characters are displayed in "Judge." field after the test depending on the edge detection result of cells or judgement result.

÷					
	"Judge." field	Edge Detection	Edge coordinate was used for calculating	Measurement value (radius, diameter or width) is within	Mark in graph
			measurement value.	the max. and min. values of Judgement Limits.	0
1	OK	0	0	0	•
		(Detected)		(Judgement: OK)	(Light blue)
2	NG	0	0	×	♦ (Red)
		(Detected)		(Judgement: NG)	
3	Excluded	0	×		× (Blue)
		(Detected)	(Excluded by "Denoising")		
4	Undetected	×			× (Red)
		(Undetected)			

Deviation

This value is the difference between the radius (Measurement value) and the radius of virtual circle. It is displayed only when Detect Mode is set to "Measure Radius".

Displaying only the cells of a specific judgement result

It is possible to display only the cell data of a specific result such as the cells judged as NG or the NG and excluded cells.

Press the FUNC key when displaying the cell result list and select the type of the cells to be displayed from the pop-up menu.

The selected result type is checked, and only the cells of the checked type are displayed in the list.

Selecting again deletes the check marks and restores the display.

It is possible to select not only one type but also several types.

For example, when NG cells, undetected cells and excluded cells are all checked, the cells other than the cells judged as OK are displayed.

Display Undetected Checkers Only: Display Excluded Checkers Only:		Display	NG checkers only
Display Excluded Checkers Only:	splay Excluded Checkers Only:	→Bisplay	Undetected Checkers Only:
		Display	Excluded Checkers Only:
	V		

		12111-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1		
J	Undetected	0,000	0.000	8,000
- 4	Undetected	0.000	0.000	0.000
22	Undetected	0.000	0.000	0,000
39	Undetected	0,000	0.000	0,000
40	Undetected	0.000	0,000	0,000
57	Undetected	0,000	0.000	0.000

Setting Inspection Area

Set the position and size of the area and the size of cells to detect edges of a circle by the cells.

1. Select "Area Setting" in "Smart Edge (Circle)" setting window.

2. Select "Area Setting".

"Area Setting" window is displayed. A cell to detect the edge of an object circularly arranged is displayed on the screen window.

3. Select "Change".

4. Move the entire area by operating the ENTER key and set the center of the circle (CPX, CPY).

5. Set the size of the area.

The area size is expressed by radius (RX, RY). To change Width-X, tilt the Enter key left/right, to change Width-Y, tilt it up/down.

6. Set the size of the cell (WX, WY).

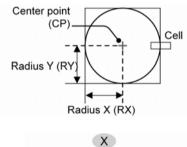
To change Width-X, tilt the Enter key left/right, to change Width-Y, tilt it up/down.

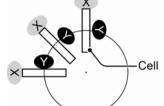
The cell scans from the outside to inside of the circle or from the inside to outside. This scan direction is Width-Y.

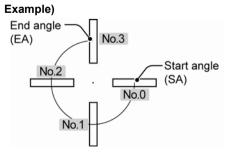
7. Tilt the ENTER key left/right to set a start angle (SAX)and an end angle (EAX).

When Detect Mode is "Measure Diameter", an end angle cannot be specified as it is not possible to measure only a part of the circle.

The sell at the start angle is set to No.0 and cell numbers are assigned to the end angle.







pitch) in 0.1 degree (*1).

When it is set to 10.0 (Default), 36 cells are arranged at every 10 degree for measuring whole circumference.

Set it to a smaller value to arrange more cells.

When a negative value is specified, cell numbers are assigned from the start cell counterclockwise.

Note

If the number of cells increases and they overlaps each other, only two cells are displayed from the start angle.

*1) In Diameter measurement mode, the number of cells must be always even. Therefore, it may not be specified by 0.1 degree.

	X (Left/right key of the keypad)	Y (Up/down key of the keypad)	
СР	X coordinate of the center of the circle	Y coordinate of the center of the circle	
R	Radius of the circle X	Radius of the circle Y	
W	Width-X of cell	Width-Y of cell	
SA	Start Angle		
EA	End Angle		
AP	Cell pitch (+/-90, exc	ept 0)	

* Tilting the arrow keys (left/right/up/down) pressing the SHIFT key enables to specify SA, EA and AP by 0.1 degree.

* In Diameter measurement mode, there is no EA: End angle.

9. After setting the cell pitch is completed, press the CANCEL key.

How to exclude from inspection (Mask area)

Mask areas, where checker does no inspection, can be set in an inspection area. Set a start point and an end point of a cell to be excluded from inspection. The number of mask areas is not limited. Follow the same steps used for "Flow Detection" checker.

Refer to Page 130

Assignment of cell numbers

Cell numbers are assigned to the arranged cells from the start angle. When a mask area has been set, it is also possible not to assign a cell number to the mask area (to skip the cell in the mask area).

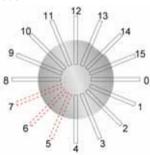
1. Select "Virtual Circle Detect Condition".

2. Select either "Mask Area Include" or "Mask Area Exclude" in "Result No. Assignment".

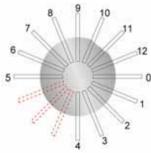
Mask Area Include (Default): Assign cell numbers to the cells masked. Mask Area Exclude: Not assign cell numbers to the cells masked.

The right figure shows an example of the difference in the results of cell number assignment when the lower-left three cells (dotted line) are masked.

Mask Area Include



Mask Area Exclude



Edge Detect Condition

Set conditions of detecting edges of an object.

1 Select "Edge Detect Condition".

The list of the conditions for detecting edges and the graph is displayed.

When Detect Mode is "Measure Width", two sets of conditions are provided. Setting these conditions enables the 2 edges of the outer circle and inner circle to be detected with different conditions.

2. Set "Scan Direction".

In. -> Out.:

Scans from the center of the circle to the outside. **Out. -> In.:** Scans from the outside of the circle to the center.

Note

In the case of Width Measurement

Edges of the outer circle and inner circle are detected with one cell.

Inside	Outside	Scan Method		
In> Out.	Out> In.	Scans the inner edges from the center of the circle to the outside, and scans the outer edges from the outside to the center. At this time, if the outer edge is detected at the position closer to the center than the inner edge, the edges are undetected.		-
ln>	· Out.	Scans the edges of the inner circle, and starts the scan of the edges of the outer circle from that position.		-
Out.	-> In.	Scans the edges of the outer circle, and starts the scan of the edges of the inner circle from that position.	-	
Out> In.	In> Out.	Scans the edges of the inner circle from the center of the cell, and starts the scan of the edges of the outer circle from that position.		

3. Set "Scan Method", "Edge Condition", "Edge Threshold" and "Detect Position".

These edge detect conditions are the same as Gray Edge checker. Refer to page 100.

Scan Method: Projection / Single Edge Condition: Light -> Dark/ Dark-> Light/ Both Edge threshold: 50 (Default) Detect Position: Front/Peak/Rear

The following items are available only when selecting "Single". Filter, Width, Average Range

4. Press the TRIG key to run a test and confirm if the edges of the circle are detected.

Scan Direction	Out> In.
Scan Method	Projection
Edge Condition	Both
Edge Threshold	50
Detect Position	Front
Filter	3
Width	5
Average Range	5



How to read a graph when setting a threshold

Pointing the cursor to "Edge Threshold" displays the graph of differentials of edges.

Decide the appropriate threshold referring to the detection result and differential of each cell in "Cell Result" and this graph.

0	90	Differential 180	270	360
-255	12.43			-
÷				
0 **		** * ** *		
Ó	90	-180	-90	Ó

Vertical axis:	It indicates differential. When Edge Condition is "Both", it is -255 to 255. When "Light->Dark", 0 to -255. When "Dark->Light", 0 to 255.
Red line:	It indicates threshold. When "Edge Condition" is set to "Dark->Light", the edges with the differentials over the red line that is drawn above Differential 0 are detected. When "Edge Condition" is set to "Light->Dark", the edges with the differentials below the red line that is drawn under Differential 0 are detected. When "Edge Condition" is set to "Both", the two lines are displayed.
Light blue line:	It indicates the average of differential. When Edge Condition is "Both", the both averages of the detected edges for "Light->Dark" and edges for "Dark->Light" are displayed.

Refer to

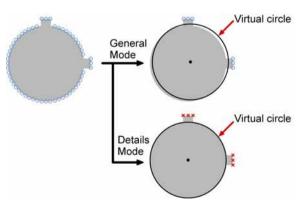
Refer to "About Graph" (p.158) for the details of marks and items other than those above.

Setting Virtual Circle Detect Condition

Set the method for detecting a virtual circle. Set "Detection Method", "Edge ratio used" and "Execution Mode".

Select "Virtual Circle Detect Condition" ".
 > "Detection Method".

"Detection Method" is a parameter to decide whether or not to use all the edge coordinates detected by each cell for calculating a virtual circle.



General Mode:

Detects a virtual circle using all edge coordinates. However, as the figure on the right, if the edge coordinates of projections are also used for detecting a virtual circle, the center of the virtual circle may shift.

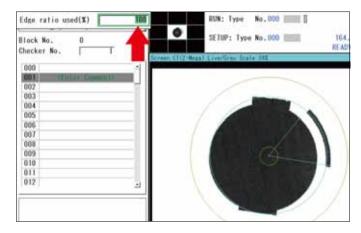
Details Mode (Default):

When an object has projections or concave surface, using this mode enables those edge coordinates not to use for calculating a virtual circle.

First, detects a virtual circle using all the edge coordinates, and then detects the final virtual circle only using the edge coordinates in "Edge ratio used" from those with a smaller error for the first virtual circle. Select "Details Mode" to set "Edge ratio used".

2. Select "Edge ratio used(%)".]

The menu for setting "Edge ratio used" appears in the upper left of the screen. The screen window can be checked. Default: 80 (%)



When "Edge ratio used" is 100, all the detected edges are indicated with " \bigcirc "(light blue). It shows that they are used for detecting the virtual circle. Decrease the value of Edge ratio used and run the test. The mark for the edges unused for the virtual circle changes to " \times " (red), and the line showing the virtual circle comes closer to the circumference. After determining the value, press the CANCEL key.

Edge ratio used(%)



Edge ratio used(%)



3. Select "Execution Mode".

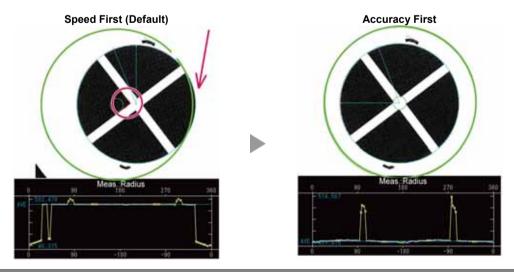
[Default: Speed First]

This parameter is effective when a part of a circle is out of the inspection area due to the position shift of the object.

If a part of the circle is out of the inspection area, the number of detected edge coordinates may reduce or a different spot from the edge of the target circle may be detected. As a result, the correct virtual circle may not be detected or the center of the detected virtual circle may not be correctly detected.

In such case, set the mode to "Accuracy First". The inspection area will be adjusted to the central coordinate of a virtual circle after the detection, and the virtual circle will be detected again. In other words, the position adjustment is performed by the checker itself.

However, the number of detection of virtual circle in "Accuracy First" mode is more than "Speed First" mode, and so the inspection time is longer.



Setting Base Angle

Select a base angle from the following three types for detecting the angles of the maximum and minimum values of radius, diameter or width. This setting affects the display of the lower horizontal axis of the graph that is displayed on the setting window.

1. Select "Virtual Circle Detect Condition" > "Base Angle".

2. Select from "X Direction". "Rotation Adjustment Angle" or "Start Angle".

X Direction (Default):

Outputs an angle using the right side of X axis as 0 degree. An angle is expressed in -180 to +180. It is not affected by the "Start Angle" specified in Area Setting or the adjustment angle in "Position Adjustment".

The lower horizontal axis of the graph is indicated from the value that is Start angle + Adjustment angle.

Rotation Adjustment Angle:

Outputs an angle using Rotation adjustment angle as a base. An angle is expressed in -180 to +180. The lower horizontal axis of the graph is indicated from Start angle.

Start Angle:

Detects an angle using "Start Angle" specified in the area as 0 degree. An angle is expressed in 0 to 360. If the number for Position/Rotation Adjustment or Rotation Adjustment checker is specified for "Position Adjustment" in Area Setting, the start angle after rotation adjustment is 0 degree.

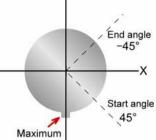
Note

Example) When Start angle is 45 degree and Adjustment angle is 30 degree, 75 degree is used as a base angle as the start angle is located at the position of 75 degree. The lower horizontal axis of the graph is always indicated from 0 degree.

Output exampel of angle

Condition

Start Angle: 45 degree End Angle: -45 degree Max. value (Max. angle): Projection



Detection angle		
-	Position/Rotation Adjustment, Rotation Adju	ustment
	No	Yes: Adjustment angle = 30 degree
X Direction	120 degree Detects from the right side of X axis to the maximum position.	120 degree Detects from the right side of X axis (before adjustment) to the maximum position.
Rotation Adjustment Angle		90 degree Detects from the right side of X axis (after adjustment) to the maximum position.
Start Angle	75 degree Detects from start angle to the maximum position.	45 degree Detects from start angle (after adjustment) to the maximum position

Setting Judgement Condition

Perform judgement for the following four conditions respectively. When all the conditions are met, the judgement result of the checker will be OK.

- Measurement: Radius, Measurement: Diameter, Measurement: Width
- Standard deviation (Standard deviation calculated from the result of measurement)
- Circularity
- Unused Edge Count

Setting Denoising function About Denoising function

Measurement values are calculated using the edges detected by each cell. However, if cells detect projections, concaves on the surface of the object or noises existing around it as edges, using this function enables those edges not to be used for calculating measurement values. This is "Denoising Function".

Only the edges within a distance or standard deviation specified based on the radius of a virtual circle are used for the calculation of measurement values.

About Unused Edge Count

In Denoising function, edges excluded from edges to be used for calculation and cells which cannot detect edges are called "unused edge". Edges used for calculating measurement values are called "used edge". The number of each edge is displayed in the left of the screen together with the judgement result of checker.

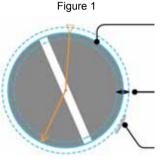
- 1. Select "Judgement Limits" > "Denoising".
- 2. Use either "Distance" or "Std. Devi." for performing "Denoising".

Distance:

Uses the edges within the distance specified in "Denoising" based on the radius of a virtual circle for the calculation of measurement values. (Area within the dotted line in Figure 1)

Standard Deviation:

Calculates the standard deviation from the radius of a virtual circle and the edge coordinates detected by each cell, and uses the edges within the value calculated by the formula mentioned on the right. (Area within the dotted line in Figure 1)



Virtual circle

Range of edge positions used for calculation measurement values

Example of edges excluded by Denoising function.

Denoising	No		
Benoising Range	No -		
	Na	Minimum	Judge.
Meas.: Radiu:	Distance	0.000	OK
Standard Devi	Std. Devi.	0.000	OK
Circularity	100.000	0.000	OK
Unused Edge Cnt.	3597		OK

"Radius of virtual circle +/- Standard deviation * Denoising range"

The "Standard deviation" used here is calculated based on the radius of a virtual circle. It is different from the "Standard Deviation" displayed on the screen (that is a criterion for judgement).

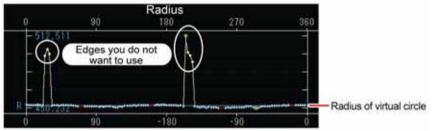
3. Set "Denoising Range".

Set the denoising range checking the graph or the result of each cell (Cell Result).

Refer to

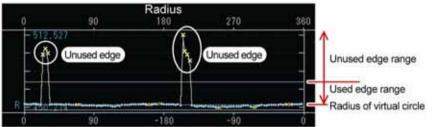
Refer to page 159 for details of Cell Result.

The figure below shows an example that Denoising is not used. Multiple edges in the two areas are targeted for measurement.



Using Denoising function displays a line to divide the range of unused edges from the range of used edges as below.

Enter a value in Denoising Range and press the ENTER key to move this line. Check the graph and make the setting to let the target edges in the range of unused edges.



Setting the denoising range to a larger value expands "Used edge range".

Note

The "x" mark (red) in the graph indicates the cell that detects no edge.

Although it is displayed in the used edge range, it is counted as an unused edge.

Setting Judgement Limits

Judgement L	inits			YORKS DEPARTMENT	The local distribution of the local distribu	IN THE PERSON
Judgement Time(ms) Used Edge Cnt.	0K 96	Stan C	s.: Radius dard Devi. ircularity Edge Cnt.	Maximum 350.000 20.000 100.000 3597	4111000 310.000 0.000 0.000	OK
Unused Edge Cnt.	24	0	90	Meas.:Radius 180	270	360
		AVE	90		-80	
Detection Dircle Cente	r X courd. Senti 816.852	614.268	Radius 332.12	- fireularats		
Max.: Radium Min. 333,322	327,489	331.27	Standard Devi 1,87	the second se	Min. An 924	rle 32.953

1. Select the table of maximum/minimum values in "Judgement Limits" setting window.

2. Specify the maximum and minimum measurement values of radius (diameter/width).

As the maximum and minimum measurement values are displayed at the bottom of the screen, make the setting checking it.

In addition, red lines indicating the maximum and minimum values are displayed in the graph. Confirm them and set.

3. Specify the maximum and minimum values of standard deviation and circularity.

As the current value of each condition is displayed at the bottom of the screen, make the setting checking it.

4. Specify the maximum value for "Unused Edge Count".

The current value of the unused edge count (test result) is displayed on the left of the screen. Confirm it and set.

The default for the maximum number of settable cells is 3597.

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image or checker pattern easily, set "Window Transparency (SETUP menu)" to a larger value. ("Change Window Transparency (SETUP Menu)", page 320)

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

Note

Position adjustment and area size adjustment are also executed if they have been set.

2. Check data of detected area list.

Check the graph, data of virtual circle, measurement data and judgement result to be displayed on the screen.

Error messages when running a test

If Smart Edge (Circle) is not performed properly when running a test, error numbers and messages are displayed in the checker list.

Error No.	Message	Cause
0040	Virtual circle cannot be calculated.	 When the number of detected edges is 2 or less: When the center of virtual circle is not within the range of -9,999.999 to +9,999.999. When all the detected edges are located on the same line:
0041	Edge required for measurement cannot be detected.	 When edge count is 0 after denoising: When no combination of edges to be paired cannot be detected when Detect Mode is Diameter measurement or Width measurement:

(Available from Ver.2.0)

What is Smart Edge (Line)?

Smart Edge (Line) is a function to calculate an approximate line using the coordinate values detected with a number of cells.

Detecting the line of the edge face enables the detection of the angle of the object even if the object has a rough face.

The mode for measuring the width of the object is also available.

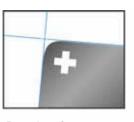
Inspection example

Detect Mode: Measure Deviation, Measure Distance

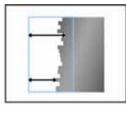


- Detection of the position of a projection
- Angle of an object

Output Data



Detection of a corner (Combination of Smart Edge (Line) and Geometry Calculation)



Distance difference from Base Position (Measure Distance)

Detect Mode: Measure Width

- Width measurement
- Detection of the max. and min. values, and output of the position

D

, pp. ccc	 Coordinates (Start point, End point) Angle Line element (a, b, c) Linearity
(Deviation, Distance, Width)	 Max. measurement, Position of max. measurement Min. measurement, Position of min. measurement Average Measurement Standard Deviation
Each cell	 Coordinate of edge, Differential, Measurement, Judgement

Used edge count, Unused edge count

Specifying Checker No.

- 1. [Select "Smart Edge (Line)" in "Checker Type".
- 2. Select the checker No. list and specify a checker number to set.
- **3.** Press the ENTER key to determine the checker No.

"Smart Edge (Line)" setting window appears. The gray image is displayed on the screen window.

Position	n Adj.	Area	Size	Adj.
Checker I	ype			
Smart Edg	e(Line)			-
Block No.	0	Ř		
Checker N	lo. [0	
000	<enter< td=""><td>Commen</td><td>t≻</td><td>1</td></enter<>	Commen	t≻	1
001				
001				

<

Selecting a Camera

Select a camera image to set "Smart Edge (Line)" checker.

- **1.** Select "Area Setting" in "Smart Edge (Line)" setting window.
- 2. Select a camera No. in "Camera".

The image of the selected camera is displayed.

Note

Select a displayed image type (Live/Memory and Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

Selecting Position Adjustment

Position Adjustment is helpful when position of an inspection object may move largely. Select a Position Adjustment checker that has been already set. Refer to page 185 for details of position adjustment.

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

The list of position adjustment is displayed.

Note

If a position adjustment checker is not created, "Position Adj." cannot be selected.

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

Note

When selecting a checker number for Position/Rotation Adjustment or Rotation Adjustment, the base angle vary depending on the setting of "Base Angle".

Base Angle: Refer to page 181.

Selecting a Preprocess Group

Set a preprocess filter to apply on an image captured by a camera as necessary.

1. Select "Approximate Line Detect Condition" > "Preprocess".

"Preprocess" window is displayed.

2. Select a Preprocess group (A to E) in "Preprocess".

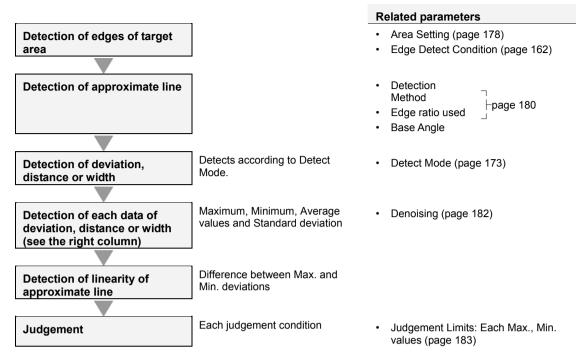
```
Note
For details of preprocess, refer to page 71.
```

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

Return to "Approximate Line Detect Condition" setting window. The selected preprocess group is displayed.

Area Setting	Connent		-
Approximate Line Detect Condition	Camera	10	-
Edge Detect Condition	Position Adjustment	0	
Judgement Limits	Area	Ĩ	
	Area Size Adjustment	2	

Execution Sequence of Smart Edge (Line)



Setting Detect Mode

Smart Edge (Line) detects the edge of the end face of an object, and detects the coordinate values, angle and linearity of the approximate line to be detected from the coordinate value. In addition, the following measurements are performed in each inspection mode.

Measure Deviation

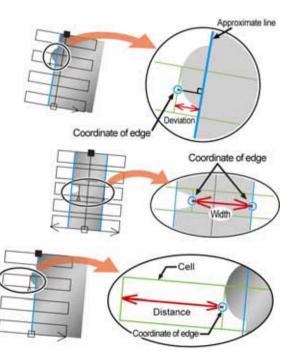
Measures the edge detected in each cell and and the length of a perpendicular to the approximate line through the edge (distance between the edge and the approximate line). This is "Deviation".

Measure Distance

Measures the distance between the start point of scan in each cell and the detected edge.

Measure Width

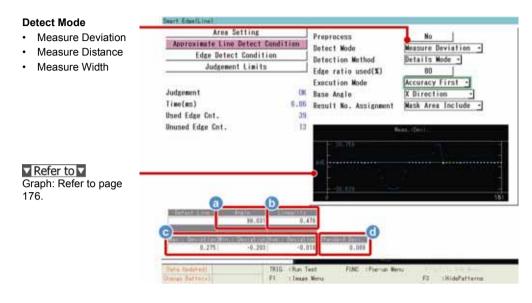
Detects the distance between the two edges detected in one cell as width.



1. Select "Approximate Line Detect Condition" > "Detect Mode".

2. Select a desired Detect Mode from the list.

Depending on the selected Detect Mode, detected data items to be displayed at the bottom of the screen vary.



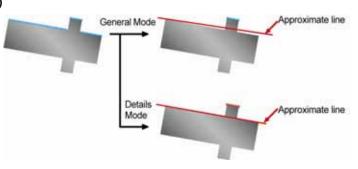
About Data to be displayed

	ta to be alsplayed		
	Measure Deviation	Measure Distance	Measure Width
(a)	Angle of approximat	e line	Angles of approximate lines 0 and 1
(b)	Linearity of approxin	nate Line	Linearity of approximate lines 0 and 1
(c)	Standard deviation of deviations	Standard deviation of distance	Standard deviation of width
(d)	Max. deviation	Max. distance	Max. width
	Min. deviation	Min. distance	Min. width
	Average deviation	Average distance	Average width

About Detected Line (Approximate Line)

It is a line that is calculated with the coordinate values of the edges of an object detected by each cell.

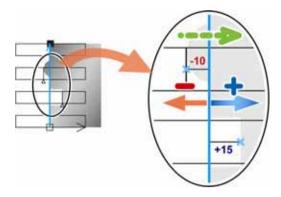
Two detection methods are available. "General Mode" which uses the coordinate values of all detected edges and "Details Mode" which does not use the coordinate values of convex or concave of an object for calculating the line.



About Positive and Negative of Deviation Data

The deviation data detected when Detect Mode is "Measure Deviation" is positive or negative depending on the scan direction (of the cell). When the scan direction (upper dashed arrow) is from left to right, the right area across the approximate line is positive and left area is negative as the right figure

When the scan direction is the other way, the positive and negative areas are also inverted.



What are Maximum, Minimum and Average Measurement Values?

Calculates the deviation, distance or width using the edges detected by each cell. Then, calculates the maximum, minimum and average values for the remaining data except the data judged as noises.

The criterion to judge data as noises is decided by "Denoising" function.

As the graph displayed on the screen (described below) shows the maximum and minimum values before denoising, the values of the graph may be different from the output values.

Refer to About Denoising function: page 182

What is Standard Deviation?

It is the value that the variation in values of deviation, distance or width is quantified. It is calculated by the formula mentioned on the right.

The larger value indicates the greater variation.

The right formula is for the case of "Detect mode: Measure Distance". For the case of "Measure Deviation" or "Measure Width", replace the "Distance" in the right formula with "Deviation" or "Width".
 Sum of ("Measurement: Distance" of each cell - "Average: Distance")2

 No. of data ("Used edge count")

Note

The calculation method for "Standard Deviation" used for Denoising function is different.

What is Linearity?

Linearity is the difference between the maximum and minimum values of the deviation for an approximate line.

In case of the "Measure Distance" mode and "Measure Width" mode, linearity is also calculated in the same method as the "Measure Deviation" mode.



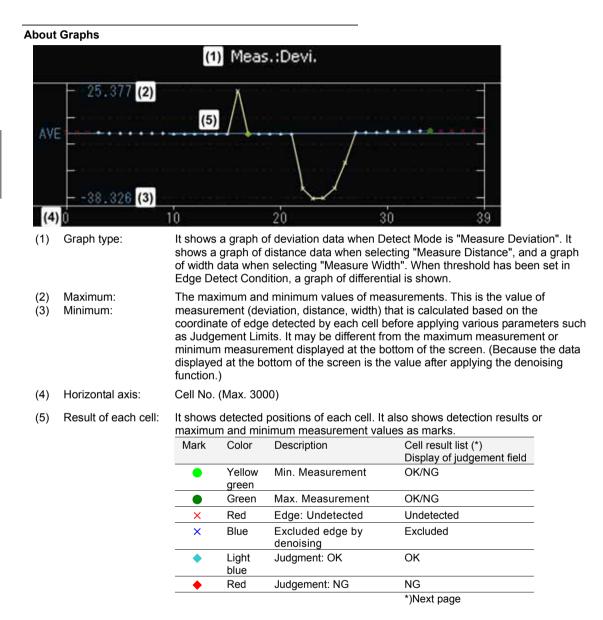
Linearity

Approximate line

About Graphs and Cell results to be displayed

Measurement values of each cell obtained from test results are displayed as graphs in Smart Edge (Line). The graph shows the status of edge detection for each cell or whether they are within edge threshold as marks.

It is also possible to show a list of the status of edge detection or detection data for all cells.



Checking result and data of each cell

Press the FUNC key and select "Cell Result" from the pop-up menu.

Cell number, judgement, measurement values, coordinate and differential are listed for all the set cells. The selected cell is displayed in pink on the screen window.

Tilt the ENTER key up/down to display the data of the desired cell.

Note

- In case of the "Measure Width" mode, two sets of data are displayed for one cell as two approximate lines are detected.
- Tilt the SHIFT and ENTER keys to change the page.

	75 MB	Control of the state		Course and the lot	COLUMN D		No. 1 March 1	DOM: N
-15-	Undefected	0,609;	8,000	4,000	41		****	
18	Excluded	+23,881	181.813	132,013	- 341	+++1	.++++	-1643
17	Excluded	-17,893	88.222	141.613	-71.1			
14	Excluded.	-30.401	84,138	151,489	- 44		++++	
1.0	Englanded	-00,467	122.548	101.7221	. 44			
- 26	Excluded -	129.658	42,000	171,3001	80		-++++	41444
10 C								
82 84 85								
84 85 86 87					4			
64 85 86 87 88					4			
84			5		4			

Judgement

Four types of characters are displayed in "Judge." field after the test depending on the edge detection result of cells or judgement result.

	Judgement field	Edge Detection	Edge coordinate was used for calculating measurement value.	Measurement value is within the max. and min. values of Judgement Limits	Mark in graph
1	OK	O (Detected)	0	⊖ (Judgement: OK)	(Light blue)
2	NG	⊖ (Detected)	0	× (Judgement: NG)	◆ (Red)
3	Excluded	O (Detected)	imes (Excluded by "Denoising")		× (Blue)
4	Undetected	imes (Undetected)			× (Red)

Displaying only the cells of a specific judgement result

It is possible to display only the cell data of a specific result such as the cells judged as NG or the NG and excluded cells.

Press the FUNC key when displaying the cell result list and select the type of the cells to be displayed from the pop-up menu.

The selected result type is checked, and only the cells of the checked type are displayed in the list. Selecting again deletes the check marks and restores the display.

It is possible to select not only one type but also several types.

For example, when NG cells, undetected cells and excluded cells are all checked, the cells other than the cells judged as OK are displayed.

 Display Undetected Cells Display Excluded Cells 	Display	NG Cells
Display Excluded Cells	✓Display	Undetected Cells
	Display	Excluded Cells

160-	Judge .	Hess::Devi.	X0	10	0144_0
0	Undetected	0.000	0.000	0.000	0
1	Undetected	0.000	0.000	0.000	.0
17	Undetected	0.000	0.000	0,000	0
24	Undetected	0.000	0.000	0,000	0

Setting Inspection Area

Set the position and size of the area and the size of cells to detect edges of the object by the cells.

- 1. Select "Area Setting" in "Smart Edge (Line)" setting window.
- 2. Select "Area Setting" > "Change".
- 3. Move the whole area by operating the ENTER key and press the ENTER key.

4 Specify "Start point (ST)" and "End point (ED)".

The start point is on the left and the end point is on the right in the default condition.

Set the start point and end point along the edges to be detected.

When the edges to be detected are located vertically, set the start point at the bottom and the end point at the top. The cell at the start point is set to No.0 and cell numbers increase to the end point. Note that the scan direction of the cells vary depending on the positions of start and end points. The scan direction is set in "Edge Detect Condition".

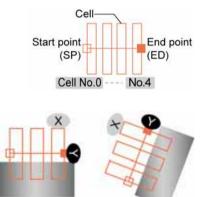
5. Set the size of the cell (WX, WY).

To change Width-X, tilt the Enter key left/right, to change Width-Y, tilt it up/down.

The width parallel to the start and end points is Width-X, and the right-angled direction is Width-Y.

6. Tilt the ENTER key left/right to specify the number of cells (N), and press the ENTER key to fix it.

Set the cells with no space between them from the start point to the end point. The part with a space between cells cannot be inspected.



	X (Left/right key of the keypad)	Y (Up/down key of the keypad)
ST	X coordinate of the start point	Y coordinate of the start point
ED	X coordinate of the end point	Y coordinate of the end point
W	Width-X of cell	Width-Y of cell
Ν	Number of cells (Max	x. 3000)

Note

If the number of cells increases and they overlaps each other, only two cells are displayed from the start point.

If the cells are fully or partly covered with other cells, the scans are repeated in those areas. Although the inspection is conducted thoroughly, note that the processing time takes longer as the number of cells increases.

7. After setting the number of cells is completed, press the CANCEL key.

How to exclude from inspection (Mask area)

Mask areas, where checker does no inspection, can be set in an inspection area. Set the first cell and end cell to be excluded from inspection. The number of mask areas is not limited. Follow the same steps used for "Flow Detection" checker.

Refer to page 130

Assignment of cell numbers

Cell numbers are assigned to the arranged cells from the start point. When a mask area has been set, it is also possible not to assign a cell number to the mask area (to skip the cell in the mask area).

- 1. Select "Approximate Line Detect Condition".
- 2. Select either "Mask Area Include" or "Mask Area Exclude" in "Result No. Assianment".

Mask Area Include (Default): Assign cell numbers to the cells masked. Mask Area Exclude: Not assign cell numbers to the cells masked.

The right figure shows an example of the difference in the results of cell number assignment when the three cells (dotted line) are masked.

Edge Detect Condition

Set conditions of detecting edges of an object.

1. Select "Edge Detect Condition".

The list of the conditions for detecting edges and the graph is displayed. When Detect Mode is "Measure Width", two sets of conditions (Condition 0 and Condition 1) are provided. Setting these conditions enables the two edges to be detected with different conditions to detect the width. The edges of Line 0 are detected with Condition 0 and the edges of Line 1 is detected with Condition 1.

2. Set "Scan Direction".

[->]: If the start point is regarded as the position at six o'clock, it scans in the direction of three o'clock from nine o'clock.

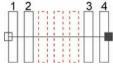
[<-]: If the start point is regarded as the position at six o'clock, it scans in the direction of nine o'clock from three o'clock.

Selecting the scan direction displays the guide indicating the relation between the start and end points in the inspection area and the selected direction on the screen.

Mask Area Include

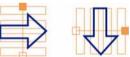


Mask Area Exclude



	Condition 0
Scan Direction	->
Scan Method	Projection
Edge Condition	Both
Edge Threshold	50
Detect Position	Front
Filter	3
Width	5
Average Range	5

When selecting -> (Right-pointing arrow)



When selecting <-(Left-pointing arrow)



Note

When Detect Mode is "Measure Width", two edges are detected with one cell.

The following is the example that the start point of the area is regarded as the position at six o'clock.

Condition 0	Condition 1	Scan Method	
->	->	Condition 0 and 1 scans edges in the same direction. Edges are scanned in the direction of three o'clock from nine o'clock with Condition 0. Then, edges are scanned with Condition 1 from the edge detection point of Condition 0.	
<-	<-	Condition 0 and 1 scans edges in the same direction. Edges are scanned in the direction of nine o'clock from three o'clock with Condition 0. Then, edges are scanned with Condition 1 from the edge detection point of Condition 0.	
->	<-	Condition 0 and 1 scans edges in opposite directions. Edges are scanned in the direction of three o'clock from nine o'clock with Condition 0, and in the direction of nine o'clock from three o'clock with Condition 1.	
<-	~	Condition 0 and 1 scans edges in opposite directions. Edges are scanned in the direction of nine o'clock from the center of a cell. Then, edges are scanned with Condition 1 in the direction of three o'clock from the edge detection point of Condition 0.	

3. Set "Scan Method", "Edge Condition", "Edge Threshold" and "Detect Position".

These edge detect conditions are the same as Gray Edge checker. Refer to page 100.

[Scan Method]: Projection / Single [Edge Condition]: Both / Light -> Dark / Dark-> Light [Edge Threshold]: Default: 50 [Detect Position]: Front / Peak / Rear [Filter], [Width], [Average Range] (Only when selecting "Single".)

4. Press the TRIG key to run a test and confirm if the edges to detect the approximate line are detected.

How to read graphs when setting thresholds

It is the same as Smart Edge (Circle). Refer to page 158. However, the horizontal axis of the graph for Smart Edge (Line) is cell numbers.

Setting Approximate Line Detect Condition

Set the method for detecting an approximate line. Set "Detection Method", "Edge ratio used" and "Execution Mode".

1. Select "Approximate Line Detect Condition" > "Detection Method".

This is a parameter to decide whether or not to use all the edge coordinates detected by each cell for calculating an approximate line.

General Mode:

Detects an approximate line using all edge coordinates.

However, if there is a projection or concave in the detected area, the approximate line may shift as the edge coordinates in those parts are also used for the detection.

Details Mode (Default):

When an object has projections or concave surface, using this mode enables those edge coordinates not to use for calculating an approximate line. First, detects an approximate line using all the edge coordinates, and then detects the final approximate line only using the edge coordinates in "Edge ratio used" from those with a smaller error for the first approximate line.

Select "Details Mode" to set "Edge ratio used".

2. Select "Edge ratio used(%)".

The menu for setting "Edge ratio used" appears in the upper left of the screen. The screen window can be checked. The "o" mark indicates used edges and the "x" mark indicates unused edges. Set the value checking the screen. Default: 80 (%)

3. Select "Execution Mode".

Default: "Speed First"

When selecting "Accuracy First", the inspection area is tilted to be at right angles to the detected approximate line after the detection, and the approximate line is detected again. Compared to "Speed First", detecting edges more accurately calculates an approximate line with less error. However, the inspection time in "Accuracy First" is longer than the one in "Speed First".

(dge ratio used(X)

The second

hecker

003 004 005

006

010

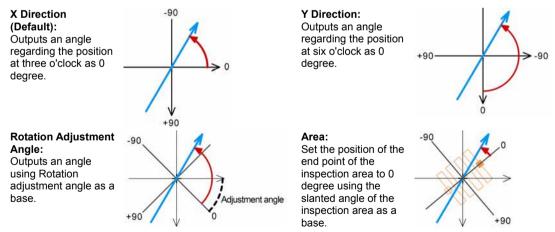
011

Setting Base Angle

Select a base angle from the following four types for detecting the angle of the approximate line.

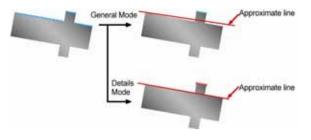
1. Select "Approximate Line Detect Condition" > "Base Angle".

2. Select from "X Direction", "Y Direction", "Rotation Adjustment Angle" or "Area".



Note

- The bold line (blue) is the approximate line.
- The above figures show the examples when Calibration Scale is not used or when Calibration Scale is used and "Rightward Downward" is selected for Coordinate Axis (positive direction). Changing the setting of Coordinate Axis may change the value of the detected angle.



No. 002 111

ST ATTY

UN; Iver

STIRE Take No. 1012

Setting Judgement Condition

Perform judgement for the following four conditions respectively. When all the conditions are met, the judgement result of the checker will be OK.

- Measurement: Deviation, Measurement: Distance or Measurement: Width
- Standard deviation (Standard deviation calculated from the result of measurement)
- Linearity
- Unused Edge Count

Setting Denoising function

About Denoising function

Measurement values are calculated using the edges detected by each cell. However, if cells detect projections, concaves on the surface of the object or noises existing around it as edges, using this function enables those edges not to be used for calculating measurement values. This is "Denoising Function".

Only the edges within a distance or standard deviation specified based on an approximate line are used for the calculation of measurement values.

About Unused Edge Count

In Denoising function, edges excluded from edges to be used for calculation and cells which cannot detect edges are called "unused edge", and edges used for calculating measurement values are called "used edge". The number of each edge is displayed in the left of the screen together with the judgement result of checker.

1. Select "Judgement Limits" > "Denoising".

2. Use either "Distance" or "Std. Devi." for performing "Denoising".

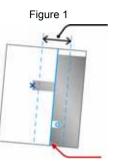
Distance:

Use the edges within the distance specified in "Denoising" based on an approximate line for the calculation of measurement values. (Area within the dotted line in Figure 1)

Standard Deviation:

Calculates the standard deviation from an approximate line and the edge coordinates detected by each cell, and uses the edges within the value calculated by the formula mentioned on the right.

(Area within the dotted line in Figure 1)



Range of edge positions used for calculation measurement values

Approximate line

Denoising	Distance		
Denoising Range	4.000		
	Maximum	Minimum	Judge.
Meas.:Deviation	5.000	-5.000	OK
Standard Devi.	10.000	0.000	OK
Linearity	100.000	0.000	OK
Unused Edge Cnt.	2998		OK

"Position of approximate line +/- Standard deviation * Denoising range"

The "Standard deviation" used here is calculated based on each coordinate value of an approximate line.

It is different from the "Standard Deviation" displayed on the screen (that is a criterion for judgement).

3. Set "Denoising Range".

Set the denoising range checking the graph or the result of each cell (Cell Result).

Refer to

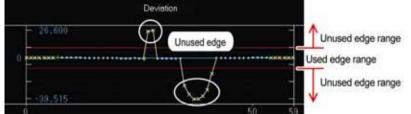
Refer to page 176 for details of Cell Result.

The figure below shows an example that Denoising is not used. Multiple edges in the two areas are targeted for measurement.



Using Denoising function displays lines above and below the approximate line which divides the range of unused edges from the range of used edges.

Changing the value of the denoising range makes the space between the lines wider or narrower. Check the graph and make the setting to let the target edges in the range of unused edges.



Setting the denoising range to a larger value expands "Used edge range".

Note

- The "x" mark (red) in the graph indicates the cell that detects no edge. Although it is displayed in the used edge range, it is counted as an unused edge.
- The graph of "Deviation" is always displayed here regardless of the inspection mode.

Setting Judgement Limits

 Select the table of maximum/minimum values in "Judgement Limits" setting window.

2. Specify the maximum and minimum measurement values of deviation (distance/width).

As the maximum and minimum measurement values are displayed at the bottom of the screen, make the setting checking it. In addition, red lines indicating the maximum and minimum values are displayed in the graph. Confirm them and set.

lwort Edge(Line)	
Area Setting	
Approximate Line Detect Condition	Bistance F
Edge Detect Condition	Belief Filmer Ballett
Jodgement Limits	
Judgement OK Time(m) 2.55	Rest Ultimat Ultimat <thultimat< th=""> <thultimat< th=""> <thulti< th=""></thulti<></thultimat<></thultimat<>
Used Edge Cnt. 33	2998 (M
Boused Edge Cot. 13	Nana Devis
88,022 8,33	
National Contraction of the Contraction of the Local Contraction of the	Concession of the local division of the loca

3. Specify the maximum and minimum values of standard deviation and linearity.

As the current value of each condition is displayed at the bottom of the screen, make the setting checking it.

4. Specify the maximum value for "Unused Edge Count".

Default: 2998

The current value of the unused edge count (test result) is displayed on the left of the screen. Confirm it and set.

Running a Test and Confirming Result

Confirm if the current settings perform an inspection properly. To observe the image or checker pattern easily, set "Window Transparency (SETUP menu)" to a larger value. ("Change Window Transparency (SETUP Menu)", page 320)

1. Press the TRIG key.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

Note

Position adjustment and area size adjustment are also executed if they have been set.

2. Check data of detected area list.

Check the graph, data of approximate line, measurement data and judgement result to be displayed on the screen.

Error messages when running a test

If Smart Edge (Line) is not performed properly when running a test, error numbers and messages are displayed in the checker list.

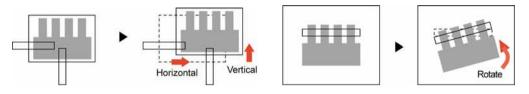
Error No.	Message	Cause
E0040	The approximate line cannot be calculated.	When the detected edge count is less than 2
E0041	Edge required for measurement cannot be detected.	 When all edges are excluded with the denoising function When there is no cell that two cells are detected in Width measurement mode

4.8.1 What Is Position Adjustment?

If positions of checker areas are fixed, inspections cannot be executed properly when an object moved only a short distance.

Position Adjustment allows inspecting properly even if an object is displaced, by detecting the current position of the object and reflecting its shift amount from the base position to checkers.

You can set up to 1000 position adjustment checkers per type (when 10 blocks are used).



PV500 has multiple types of position adjustments to detect the position and the rotation angle of an object.

Position Adjustment (Horizontal/vertical shift amount)

After each checker detected the position of the object, Position Adjustment calculates the misalignment between the object and the base position. To detect an object, select from the following six types.

Binary Edge / Gray Edge / Feature Extraction / Matching / Smart Edge (Circle) / Smart Edge (Line)

Position Rotation Adjustment (Horizontal/vertical position and angle shift amount)

Position/Rotation Adjustment detects position (coordinates) and angle of an object using checkers and calculates the misalignment from the base position and rotating angle from the base angle.

To detect an object, select from the following five types.

Feature Extraction (Principal axis angle) / Matching (360-dgree) / Feature Extraction (2 checkers) / Matching (2 checkers) / Smart Edge (Line)

Rotation Adjustment (rotated amount), Position Adjustment (horizontal/vertical shift amount)

Rotation Adjustment detects the angle of an object using checkers and calculates the rotating angle from the base angle.

To detect an object, select from the following six types.

Binary Edge (Horizontal) / Binary Edge (Vertical) / Gray Edge (Horizontal) / Gray Edge (Vertical) / Smart Edge (Line) (Horizontal) / Smart Edge (Line) (Vertical)

Note

Note that the checker cannot be adjusted when camera numbers of referred position adjustment and the following checker are different depending on the combination of the camera numbers. Refer to page 194 for details.

Position Adjustment

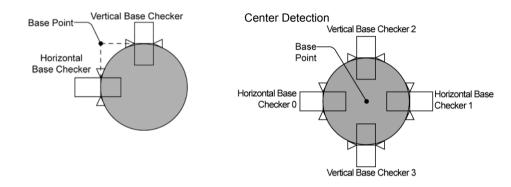
Binary Edge and Gray Edge

These checkers detect in the same method of Binary Edge checker and Gray Edge checker. The X/Y coordinates of the detected edge is considered as a base position.

They also have the Center detection function which decides a base position by calculating the middle of the detected two points both in horizontal and vertical directions.

Note

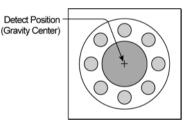
Only one direction either horizontal or vertical can be set.



Feature Extraction

This checker detects the gravity center of an object in the same method of Feature Extraction checker.

It considers the detected coordinates of the gravity center as a base position.



Matching

This checker detects an object in the same method of Smart Matching checker.

The output point of the detected object will be considered as the base position.

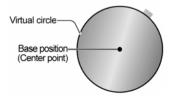


Smart Edge (Circle)

This checker detects a virtual circle in the same method of "Detect Mode: Radius" for Smart Edge (Circle).

The coordinate of the center of the detected virtual circle will be considered as the base position.

If a whole circumference cannot be captured, or for a rounded angle, the position detection is possible.



Smart Edge (Line)

This checker detects an object in the same method of Smart Edge (Line)

When the horizontal base checker and vertical base checker are both set, the intersection point of two approximate lines will be considered as the base position.

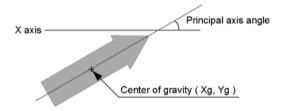
When only the horizontal base checker or vertical base checker is set, the intersection point of the approximate line and the line passes through the center of the inspection area will be considered as the base position.

Base Position (Intersection point of two lines) Approximate line Line passing through the center Base Position (Intersection point through the center Base Position

Position/Rotation Adjustment

Feature Extraction (Principal Axis Angle)

This checker detects the gravity center and the principal axis angle of an object in the same method of Feature Extraction checker. It considers the detected coordinates of the gravity center and the angle as a base position and base angle respectively. The range of a detected angle is +/- 90 degrees.



Matching 360-degree

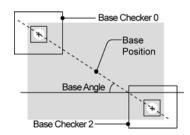
This checker detects the position of an object (output point coordinates) and the rotation angle in the same method of Smart Matching. It considers the detected coordinates and the angle as a base position and base angle respectively.

Note

Subtraction function of Matching checker is not available.

Feature Extraction (2 checkers) and Matching (2 checkers)

It considers an angle which are formed by X axis and a line between two gravity centers detected by two Feature Extractions or between two output points detected by two Smart Matchings as a base angle. And also it considers the middle point of the line as a base position.



Detect Position

(Output Point)

Angle

Smart Edge (Line)

This checker detects an object in the same method of Smart Edge (Line) The intersection point of two approximate lines detected with two base checkers is considered as the base position, and the angle of the median on two approximate lines is considered as the base angle.

Base Position (Intersection point of two lines) Approximate line Median

Base Checker 2

Point 2

Point 2

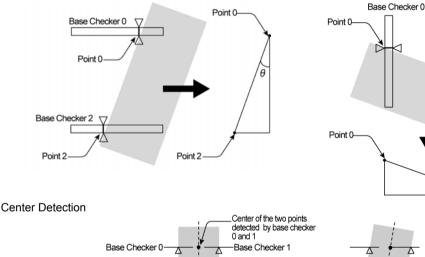
Rotation Adjustment

Binary Edge (Horizontal) / Binary Edge (Vertical), Gray Edge (Horizontal) / Gray Edge (Vertical)

These checkers detect two points in the same method of Binary Edge checker or Gray Edge checker, and calculates an object gradient.

Binary Edge (Horizontal) and Gray Edge (Horizontal) scan horizontally to detect edges. Binary Edge (Vertical) and Gray Edge (Vertical) scan vertically to detect edges.

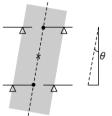
These checkers can obtain a middle point of two points (center detection) other than edges of an object as a base position.





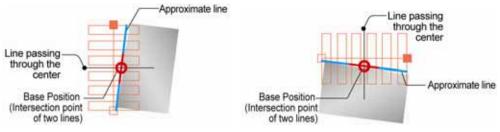
Center of the two points detected by base checker Base Checker 0 Base Checker 1 Base Checker 2 Base Checker 3 Center of the two points detected by base checker 3 Center of the two points detected by base checker 3 Center of the two points detected by base checker 3

2 and 3



Smart Edge (Line) (Horizontal), Smart Edge (Line) (Vertical)

The angle of the approximate line detected in the same method of Smart Edge (Line) is considered as the base angle. The base coordinate is the intersection point of the line passing through the center of the inspection area and the approximate line.



4.8.3 Setting a Position Adjustment

Selecting a number and a type of Position Adjustment

- **1.** Select "INSPECTION" > "Position Adj.".
- 2. Select the checker No. list and specify a Position Adjustment checker number to set.
- **3.** Move the cursor onto a type of Position Adjustment to create.

The list of detection methods available in the selected Position Adjustment is displayed.

4. Tilt the ENTER key right and then up/down to select a detection method.

The setting window of selected Position Adjustment is displayed.

Selecting a Camera

Select a camera image to set Position Adjustment.

1. Select "Checker Settings" in "Pos. Adj." setting window.

2. Select a camera No. in "Camera".

The image of the selected camera is displayed.

Note

Select a displayed image type (Live/Memory and Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

ENT TYPE INSPECTION	DN
Area Size Adj.	
0	ŀ
	┝
	L
	E

Position Adj. A	rea Size Adj.	Checker		Slice	Level
Block No. 0			RUN:	Type	No. 00
Checker No.	0			D. T	N- 00
000	4		3610	IP: Type	NO.UL
001		Screen COllogra		a Maria Ra	
002		Docreen Corcoled	ςα) μι	vergray 20	a10 10
003					
004					
005	Positi			ry Edge	
005			Gray		
007	Rotati	ion Adjustment +	Feat	ure Extrac	tion
0.02			-4100		



Creating a Base Checker

1. Select "Base Setting" in "Checker Settings" setting window.

Now, it is ready for base checker setting.

2. Select a base checker to set.

The setting window of selected base checker is displayed.

3. Set necessary items.

The setting procedure is the same as the other checkers. For more details, refer to the chapter of description of each checker.

Note

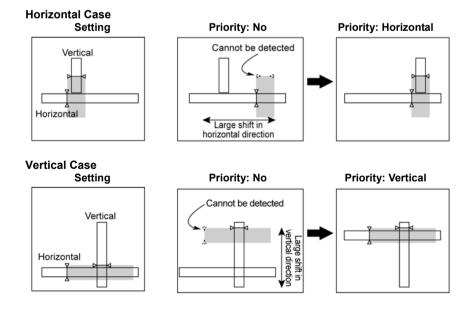
Some items displayed in checkers are not displayed in Position Adjustment. Nondisplayed items cannot be set in Position Adjustment.

4. Press the TRIG key to execute a test.

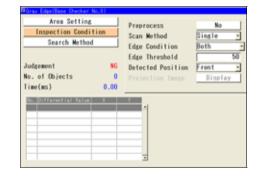
Only the currently setting base checker can be tested. Confirm a test result in the same way of normal checkers.

About Priority

The Priority function is effective if an object moves largely either vertically or horizontally. When the object moves largely in the horizontal direction, set to "Horizontal". When it moves largely in the vertical direction, set to "Vertical".







When adjusting position by detecting the center

1. Select "Base Setting" in "Checker Settings" setting window.

Now, it is ready for base checker setting. At this moment, "Detect Center" cannot be selected.

2. Select base checkers to detect the center (Horizontal base checker 0 and Vertical base checker 2).

The setting window of the selected base checker is displayed.

- **3.** Set an area and a condition for the base checker.
- **4.** Press the CANCEL key to go back to the condition setting window.

Now, "Detect Center" of the set base checker can be selected.

Example: When setting horizontal base checker No.0, "Detect Center of Base0, 1" will be activated.

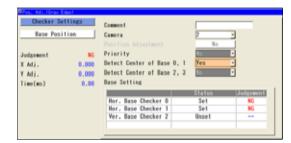
5. Select "Yes" for "Detect Center of Base 0, 1".

In the Base Setting field, Checker1 (or Checker3) is created. The created base checker has the same area and conditions of the base checker set in the step 3.

- 6. Select the created base checker.
- 7. Move the area of the base checker and change the conditions as necessary.
- 8. After setting is completed, press the CANCEL key.

The procedure after this is the same as when detecting no center.





Checker Se Base Posi		Comment Camera Position Adjustment Priority	2 No	
X Adj. V Adj.	0.000	Detect Center of Base 0, 1 Detect Center of Base 2, 3 Base Setting		9
lime(ms)	0.00	ease serring	Status	Judgement
		Hor, Base Checker 0	Set	NG
		Hor. Base Checker 1	Set	NG
		Ver. Base Checker 2	Unce t	

Deleting a Base Checker

With Position Adjustment - Binary Edge/ Gray Edge/ Smart Edge (Line), adjusting only either of horizontally or vertically can be performed. To delete (restore to be unset) the created horizontal base checker or vertical base checker, operate from the pop-up menu.

1. Move the cursor onto the set base checker to delete.

2. Press the FUNC key.

The pop-up menu appears.

3. Select "Delete".

When the dialog message appears, select "YES".

 Original State
 Consent

 Judgment
 Y. Adj.

 Y. Adj.
 0.70

 Time(m)
 0.7

 Base Settina
 0.1

 Base Settina
 0.1

The selected base checker is deleted and "Status" field changes to "Unset".

Registering Base Position

Register the current object position as a base position.

Note

- When the displayed image is a live image, Position Adjustment scans a newly captured image and the detected position and angle are registered as a base. When displaying a memory image, it scans the currently displayed image and the detected position and angle are registered as a base.
- Displaying a message other than "Register a Base Position," in the message display area indicates that the checker could not detect an object in a base checker test. Change the setting of a base checker with NG display in the judgement field.

Position Adjustment - Binary Edge, Gray Edge, Smart Edge (Circle), Smart Edge (Line), Position Rotation Adjustment -Smart Edge (Line) and Rotation Adjustment

- 1. Select "Base Position".
- 2. Select "Register".
- **3.** When the dialog message appears, select "YES".

Correctly registering a base position displays values in the list of Adjustment Amount, Current Position, Base Position, and Base Checker.

Note

If a base position cannot be registered, return to the Condition setting window and reconsider the settings of the base checker judged as NG.



Checker Se	ttings	Base Position	Re	gister	
Base Posi	tion		X	Y	Theta
		Adjustment Amount	0.000	0.000	0.000
Judgement	NG	Current Position	68.089	131.357	0.000
X Adi.	0.000	Base Pesition	68.089	131.357	0.000
Y Adj.	0.000	Base Checker			
Theta Adj.	0.000		X	Y	
Time(ms)	0.00	Checker 0	68.089	248.500	
		Checker 2	319,500	131.357	

Position Adjustment - Feature Extraction, Matching and Pos/Rot Adjustment (Except Position Rotation Adjustment - Smart Edge (Line))

1. Select "Base Position".

2. Select "Register".

The window to select an object to use in Position Adjustment from the detected objects appears. Even if only one result is detected, this window is displayed.

Note

If nothing in the list, no object can be detected. Adjust the conditions.

3. Select the list.

4. Select a number of detect position to use Position Adjustment.

Adjust the inspection condition and sorting order so that the selected detection object always is the same number.

The selected detection object is displayed in red on the screen window.

5. Press the Cancel key.

- 6. Select "Base Position".
- 7. When the dialog message appears, select "YES".

Correctly registering a base position displays values in the list of Adjustment Amount, Current Position, Base Position, and Base Checker.

Checker Settings Register Base Position **Base Position** Adjustment Amount Current Position Base Position Judgement X Adj. 0.000 V.ML. 0.000 Base Checker Time(ms) 0.00 heta 0.000 0.000 Checker 0 0.000

No. Area Grav.X Grav.Y Principal Axis Angle

Checker 0

Select Detect Position of Base O

Register Base

0.000

PPee, Adj. (Feature Extraction				
Checker Settings	Base Position	Register		
Base Position		X	Y	Theta
	Adjustment Amount	0.000	0.000	0.000
Judgement N	Current Position	163.095	247.516	0.000
X Adj. 0.000	Base Position	163.095	247.516	0.000
Y Adj. 0.000 Time(ms) 0.00	DADE PHONEL			
(ins) 0.00		X	Ŷ	Theta
	Checker 0	163.095	247.516	0.000

4.8.4 Applying Position Adjustment to Checkers

Which Position Adjustment is applied to checkers must be determined because multiple Position Adjustments can be registered for a Type. To do so, select a Position Adjustment in Area Setting window of each checker. An area of Position Adjustment checkers also can be adjusted by Position Adjustment. The procedure below uses Position Adjustment checker to describe, however, the procedure for other checkers is the same.

1. Select a Position Adjustment checker.

2. Select "Checker Settings".

When target checker is other than position adjustment, select "Set" of "Area Setting".

3. Select "Position Adjustment".

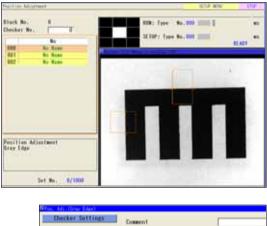
The list of Position Adjustments that have been set is displayed.

As selecting a number with the cursor, the Position Adjustment area of the number is displayed in orange on the screen window. Observe it to select.

4. Select a Position Adjustment No. to refer the adjustment amount.

The selected type No. is displayed in the "Position Adjustment" field. To cancel applying a position adjustment, select "No" in the top of the list.

Pos. Adj. (Grav Edge)		
Checker Settings	Comment	
Base Position	Camera	2
	Position Adjustment	No
Judgemen t NG	Priority	So -



Checker Settings	Comment	
Base Position	Camera	2
	Position Adjustment	No.000
Judgement N	Priority	No.

Note

* About selectable position adjustment

When target checker is Position Adjustment

The number of Position Adjustment checkers must be lower than the number of the currently setting Position Adjustment.

If the currently setting Position Adjustment is No.9 with camera No.0, only the set Position Adjustment checkers of No.0 to 8 with camera setting of No. 0 and 1 are displayed.

Position Adjustment and checkers with different camera number setting

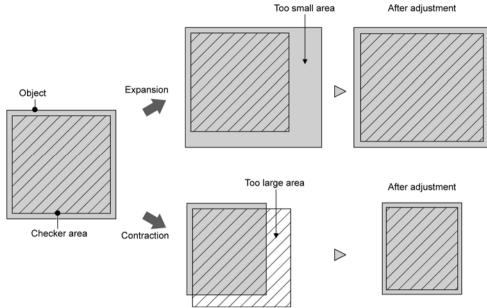
When more than one camera is used, the Position Adjustment with camera setting of No,0 or 1 cannot adjust the checkers with camera setting of No.2 and 3, and vice versa.

Position Adjustments unselectable for adjusting checkers are not displayed in Step 3 above.

	Camera No.	of Position Adj	ustment availa	ble to adjust
	0	1	2	3
0	Yes	Yes	No	No
1	Yes	Yes	No	No
2	No	No	Yes	Yes
3	No	No	Yes	Yes
		0 0 Yes 1 Yes 2 No	0 1 0 Yes Yes 1 Yes Yes 2 No No	Yes Yes No 2 No No Yes

Yes: Selectable, No: Not selectable

This function expands or contracts the inspection area or mask area to fit a variable-sized object. The function detects the part which signifies an object size, such as edges of the object or register marks, and expands or contracts a checker area based on the coordinates of the part.



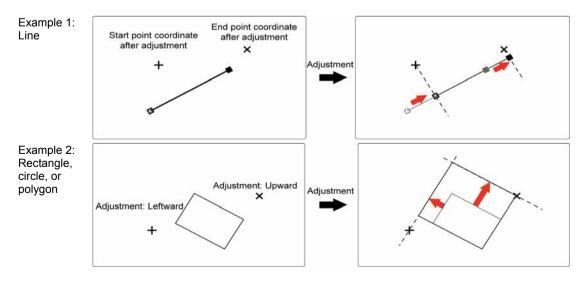
Note

Area Size Adjustment is not available for some checkers. In the checkers which can use Area Size Adjustment, "Area Size Adj." is displayed in the setting window.

Available:	Line, Binary Window, Gray Window, Binary Edge, Gray Edge, Feature Extraction, Flaw Detection, Connector (Binary Window), Connector (Gray Window), Smart Edge (Circle), Smart Edge (Line)
Not available:	Smart Matching, Connector (Gray Edge), Position Adjustment, Area Size Adjustment

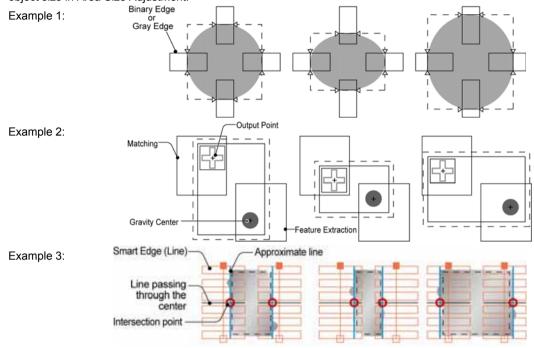
In the Case of Diagonal Inspection Area

When applying Area Size Adjustment on a diagonal inspection area, the function expands or contracts the area without changing the angle.



Detecting a Object Size

Binary Edge, Gray Edge, Feature Extraction, Smart Matching and Smart Edge (Line) can be set to detect an object size in Area Size Adjustment.



Note

If Area Size Adjustment detects multiple parts, the coordinates of No.0 is used to adjust the area. When there is a possible to detect multiple parts, sort them so that the desired part is always No.0.

Creating a Area Size Adjustment Checker

Although Area Size Adjustment provides No.0 to 999 per type (if the number of used block is 10), the setting limit is 1000 checkers combined with Position Adjustment.

- 1. Select "INSPECTION" > "Area Size Adj.".
- 2. Select the checker No. list and specify a checker (Area Size Adjustment) number to set.

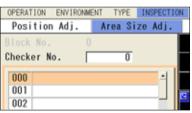
3. Select a type of Area Size Adjustment to create.

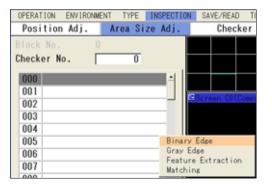
The setting window of the selected Area Size Adjustment is displayed.

Refer to

The procedure after here is the same as the checker of the type that you select to create an Area Size Adjustment. Refer to the following page for details.

- Binary Edge: page96
- Gray Edge: page 100
- Feature Extraction: page 105.
- Matching: page 111.
- Smart Edge (Line): page 171





Using Area Size Adjustment for Checkers

Multiple Area Size Adjustment checkers can be set. Select an Area Size Adjustment checker to use its coordinates to adjust the checker size.

Note

After using Area Size Adjustment, the area frame (checker pattern) is displayed in the adjusted size. However, the positions of the start point (ST) and end point (ED) that are displayed by selecting "Area Setting" > "Change" are on the coordinates before the area size adjustment is made.

- 1. Select a checker to adjust the size.
- 2. Select "Area Setting".
- 3. Select the table of "Area Size Adjustment".
- 4. Select a point which you want to adjust, start point, end point, up, down, left or right.

The list of Area Size Adjustments that have been set is displayed. As selecting a number with the cursor, the Area Size Adjustment area of the number is displayed in orange on the screen window. Observe it to select.

5. Select an Area Size Adjustment checker.

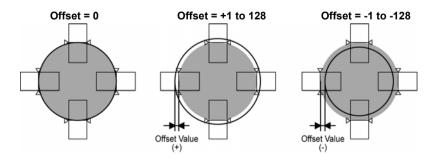
> The screen returns to Area Setting of the checker and the selected number of Area Size Adjustment is displayed.

Repeat the procedure and select Area Size Adjustment checkers as necessary. (You can also set just a single part such as only start point.)

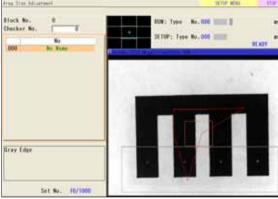
6. Specify the offset value as necessary.

About Offset Value

Offset Value is to create an area outside (side of larger area) or inside (side of smaller area) of the coordinates of an edge, a gravity center, or an output point detected by Area Size Adjustment checker. You can specify different values for each of up, down, left and right.











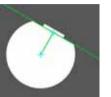
4.10.1 What is Geometry Calculation?

Geometry Calculation is a function that calculates the distance between two points, intersection point of two lines and median using the data detected with each checker. With this function, only specifying the result detected by a checker enables to execute calculation without setting any operation expression.

Inspection examples



Measurement of C-cut size



Measurement of distance between D-cut point and center



Measurement of approximate circle with multiple points

Note

The figures drawn in the image examples in this chapter includes the images drawn with the "Character/Figure Drawing" function.

Types of Geometry Calculation

The following seven types of geometry calculations are available.

Type of calculation	ation		Output Data
Distance Point-Point	¢ + 0	Detects the distance between two points , the line connecting two points and its median.	 Distance between two points Coordinate X and Y of median Line angle Line element (a, b, c)
Intersecting Point	\mathbf{X}	Detects the intersecting point and the angle of two lines	Coordinate X and Y of Intersecting pointIntersecting angle of two lines
Median		Detects the intersecting angle of two lines and the median (bisector) of the angle.	 Intersecting angle of two lines Median angle Median element (a, b, c)
Distance Point-Line	the o	Detects the intersecting point of a perpendicular to a line through a point, and the length of the perpendicular.	 Pedal X and Y Length of perpendicular (Distance between point and line) Perpendicular angle Perpendicular element (a, b, c)
Approximate Line	0000	Detects the approximate line from multiple coordinate values.	 Approximate line angle Approximate line element (a, b, c) Standard deviation
Approximate Circle	+	Detects the approximate circle from multiple coordinate values.	 Center X and Y of approximate circle Radius of approximate circle Standard deviation
Approximate Ellipse		Detects the approximate ellipse from multiple coordinate values.	 Center X and Y of approximate ellipse Major and minor axes of approximate circle Angle of approximate circle (Major axis gradient) Standard deviation

Selecting a Checker No. and a Type of Detect Mode

- 1. Select "INSPECTION" > "Geometry Calc.".
- 2. Select the checker No. list and specify a checker number to set.
- 3. Move the cursor onto a type of Geometry Calculation to create.

The setting window of the selected type is displayed.

Selecting a Camera

Select a camera image to set "Geometry Calculation".

1. Select a camera No. in "Camera" in the setting window of "Geometry Calculation".

The image of the selected camera is displayed.

Note

Select a displayed image type (Live/Memory and Gray/Binary) or magnification in "Image Menu" opened by pressing the F1 key.

010

Setting a Reference

Specify the created checker to detect "Point" or "Line" which are necessary for Geometry Calculation.

1. Select "Reference".

The items such as points or lines which are required for the selected type of Geometry Calculation are listed.

Items to be specified vary depending on geometry calculations. Refer to the next page for how to set an area.

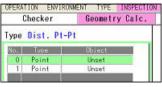
Detect mode	Input item	
Distance Point-Point	Point 0, Point 1	
Intersecting Point	Line 0, Line 1	
Median of Two Lines	_	
Distance Point-Line	Point 0, Line 1	
Approximate Line	Point 0 to Point 9	2 points or more
Approximate Circle	or	3 points or more
Approximate Ellipse	All points	6 points or more

Type Dist. Pt-Pt Comment Camera 10 • References **Judgement Limits**

OPERATION ENVIRONMENT TYPE INSPECTION

Geometry Calc.

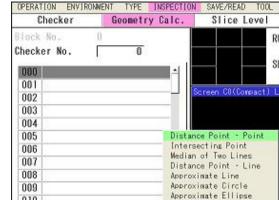
Checker



Note

- Only the checkers set with the same camera can be referred.
- The procedure for setting "Distance Point-Line" is the same as those for setting "Point" in "Distance Point-Point" and "Line" in "Intersecting Point".

OPERATION ENVIR	ONMENT TYPE INSPECTION
Checker	Geometry Calc.
Type Dist, Pt-	-Pt
Type Di <mark>st. Pt</mark> - Comment	-Pt



For Distance Point - Point

In this section, for the object detected in Feature Extraction No.0, enter the detected zeroth coordinate in Point 0, and enter the detected first coordinate in Point 1.

In Feature Extraction, it has been set to sort the objects in descending order of area and detect the circle of the largest area zerothly.

1 Select No.0: Point from the list.

The list of checkers which can be input is displayed. Unset checkers are shown in gray and cannot be selected. For details of selectable checkers, see page 203.

2. Select "FEC: Feature Extraction" from the list.

The list of Feature Extraction checkers is displayed.

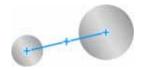
3. Select Checker No. 000.

The list of result types is displayed.

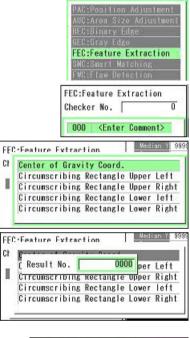
4. Select "Center of Gravity Coord." and specify Result No. 0000.

The selected data is displayed in a symbol for No.0: Point in the list.

5. Set the second point (No.1: Point) in the same steps.







1

Cł

I

	Checker	Geometry Calc.
ype	Dist. Pt	I-Pt
No.	Type	Object
No.	Type Point	Object FEC000.0000

For Intersecting Point

"Intersecting Point" is used to calculate the intersecting point using the lines detected by Smart Edge (Line) and Geometry Calculation.

When using the lines detected by Geometry Calculation, only smaller numbers than the number of the currently setting Geometry Calculation can be specified.

Note

The procedure for setting "Reference" of Median of Two Lines is the same as the one for Intersecting Point.

The following is an example when setting Smart Edge (Line) to No. 0 and Geometry Calculation to No. 1.

1. Select No.0: Line from the list.

The list of checkers which can be input is displayed. If there is no checker that can be specified, checkers are shown in gray and cannot be selected. For details of selectable checkers, see page 203.

2. Select "SEL: Smart Edge (Line)" from the list.

The list of result types is displayed.

3. Select "Line0 Element" or "Line1 Element".

The selected data is displayed in a symbol for No.0: Line in the list.

4. Select No.1: Line.

5. Select "GGC: Geometry Calculation" from the list.

The list of the geometry calculations set to the numbers smaller than the number of the currently setting checker is displayed.

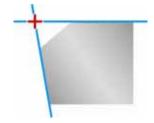
6. Select the geometry calculation you want to use.

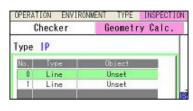
Geometry calculations to calculate lines are the following 4 types.

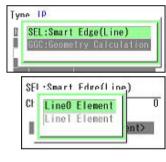
- Distance Point Point
- Median of Two Lines
- Distance Point-Line
- Approximate Line

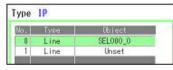
When selecting a geometry calculation other than the above, the intersecting point of two lines cannot be calculated.

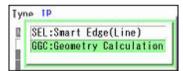
When selecting Geometry Calculation No., the type is displayed in the message field below the list. Check it.

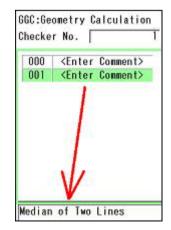












For Approximate Circle

Selecting "All Points" enables to set multiple points detected by one checker in block.

In this section, enter all the coordinate positions of the object detected by Smart Edge (Line) in the point 0.

Note

The procedures for setting "Reference" of Approximate Line and Approximate Ellipse are the same as that of Approximate Circle.

1. Select No.0: Point from the list, and select "All Points".

The list of checkers which can be input is displayed. For details of selectable checkers, see page 203. Unset checkers are shown in gray and cannot be selected.

Note

The procedure for setting "Reference" when selecting "Point" is the same as that of Distance Point - Point.

2. Select "SEL: Smart Edge (Line)" from the list.

The list of Smart Edge (Line) checker is displayed.

3. Select Checker No. 000.

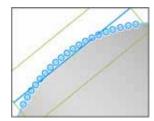
The list of result types is displayed.

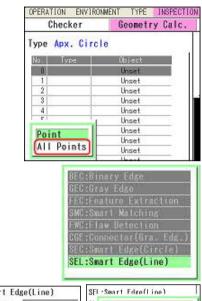
4. Select "Cell Individual Result0".

The selected data is displayed in a symbol for No.0 in the list.

Set as necessary after No.1.

"All Points" and "Point" can be mixed (e.g. set No.0 to "All Points" and set No.1 to "Point").





Checker No. 0	CH	Contractory of the local division of the loc			
		Cell	Individual Individual	Result0	
000 <enter comment=""></enter>	I	locut	murvrusar	acaurti	

Checker	Geometry Ca
Type Apx. Circ	le
No. Туре	Object
0 All Points	SEL000_0
	Unset
2	Unset
3	Unset
4	Unset
5	Unset
6	Unset
1	Unset
8	Unset
9	Unset

Note

When points which can not be detected by the specified "Target" checker for some reason as below exist, the approximate circle, approximate ellipse and approximate line will be calculated with the coordinate values of the detected points only.

- When the specified checker did not detect edges or objects
- When the cell individual result of the specified Smart Edge (Circle) or Smart Edge (Line) was excluded by the denoising function.

However, the calculation cannot be executed when the number of detected points is less than each minimum number of points for Approximate Circle, Approximate Ellipse and Approximate Line.

List of Settable Items for Each Object

	Point	All Points	Line
PAC: Position Adjustment	O Base Position Coord. Detect Position Coord. Base Coord. (Detect Coord. of Base Checker)	×	×
AUC: Area Size Adjustment	Ο	×	×
BEC: Binary Edge	0	0	×
GEC: Gray Edge	0	0	×
FEC: Feature Extraction	O Center of Gravity Coord. Circumscribing Rectangle Coord. (Upper left, Upper right, Lower left, Lower right)	O (Center of Gravity Coord.)	×
SMC: Smart Matching	0	0	×
FWC: Flaw Detection	0	0	×
CGE: Connector (Gray Edge)	O Area 0 Area 1 (*a	0	×
SEC: Smart Edge (Circle)	O Center Coord. 0 Center Coord. 1 (*b Cell Individual Result 0 Cell Individual Result 1 (*c	O Cell Individual Result 0 Cell Individual Result 1 (*c	×
SEL: Smart Edge (Line)	O Max. Measurement Coord. Min. Measurement Coord. Line0 Start Coord. Line0 End Coord. Line1 Start Coord. (*b Line1 End Coord. (*b Cell Individual Result 0 Cell Individual Result 1 (*b	O Cell Individual Result 0 Cell Individual Result 1 (*b	O Line0 Element Line1 Element (*b
GGC: Geometry Calculation	○ (*d	×	⊖ (*d (*e

*a) When selecting "Gap", "Float" or "Width Measurement" in Execution Mode

*b) When selecting "Measure Width" in Detect Mode

*c) When selecting "Measure Width" or "Measure Diameter" in Detect Mode

*d) Available only for the geometry calculations of the smaller numbers than the currently setting geometry calculation

*e) Normally operation can be performed only with the following types which calculate line elements (abc): Distance Point - Point / Median of Tow Lines / Distance Point - Line / Approximate Line

Note

The checker with a camera number different from that selected for the setting geometry calculation cannot be specified.

Setting Measurement Condition

Measurement conditions vary depending on the type of geometry calculation.

Detect mode	Measurement condition	
Distance Point-Point	Line Display:	Segment / Half line0 / Half line1 / Wall-to-wall
	Angle Range:	0<->360 / -180<->180
	Direction:	ST -> ED / ED -> ST / Down / Left / Up / Right
Intersecting Point	Intersecting Angle:	Acute Angle / CW / CCW
Median of Two Lines	Angle Range:	0<->360 / -180<-> 180
	Direction:	Vector Sum / Down / Left / Up / Right
	Intersecting Angle:	Acute Angle / CW / CCW
Distance Point-Line	Line Display:	Segment / Half line0 / Half line1 / Wall-to-wall
	Angle Range:	0<->360 / -180<-> 180
	Direction:	OT0 -> IP / IP -> PT0 / Down / Left / Up / Right
Approximate Line	Angle Range:	0<->360 / -180<-> 180
	Direction:	Down / Left / Up / Right
Approximate Circle	None	
Approximate Ellipse	Angle Range:	0<->360 / -180<-> 180
	Direction:	Down / Left / Up / Right

About Measurement Conditions

Line Display

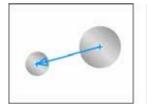
Select the display method of the detected line.

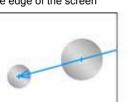
The following figures show the examples of "Distance Point-Point". The large circle is the start point (Reference No. 0) and the small circle is the end point (Reference No. 1).

Segment

Draw between No.0 and No.1

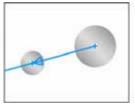
Half line 0 Draw between No.0 and the edge of the screen





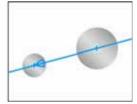


Draw between No.1 and the edge of the screen



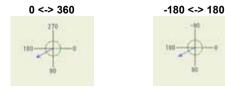
Wall-to-wall

Draw between the both edges of the screen



Angle Range

Specify 0 to 360 degree or -180 to 180 degree to output the angle data to be detected. The position at three o'clock is 0 degree.

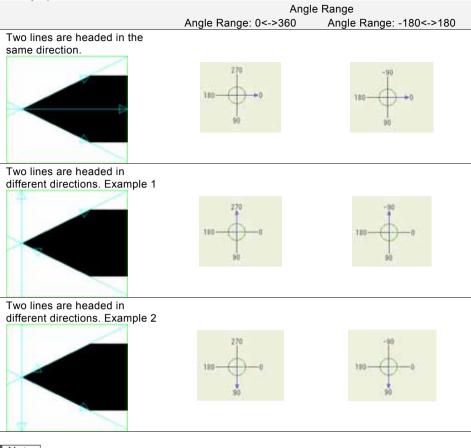


Direction

Detected angles vary depending on the specified direction and the setting value of "Angle Range".

xample) For	Distance Point - Point		
Direction	Appearance of Direction	Angle Range and	d Detect Angle
		Angle Range: 0<->360	Angle Range: -180<->180
ST -> ED		Range: 0 - 359.999 Result: 160	Range: -179.999 - 180 Result: 160
ED -> ST		Range: 0 - 359.999 Result: 340	Range: -179.999 - 180 Result: -20
Down		Range: 0 - 179.999 Result: 160	Range: 0 - 179.999 Result: 160
Left		Range: 90 - 269.999 Result: 160	Range: 90 - 180, -90.001179.999 Result: 160
Up		Range: 180 - 359.999 Result: 340	Range: 0179.999 Result: -20
Right		Range: 0 - 89.999, 270 - 359.999 Result: 340	Range: 0 - 89.999 and -0.00190 Result: -20

Example) When Median of Two Lines - Direction = Vector Sum



Note

- In case of Median of Two Lines, the direction of measure median varies depending on the direction of two lines.
- The concepts of Down, Left, Up and Right for Median of Two Lines are the same as those for Distance Point - Point.
- About Direction of Lines

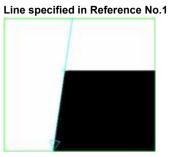
The direction of the line detected by Smart Edge (Line) is that of the Start point (ST) -> End point (ED) of the area setting.

The direction of the line detected by Approximate Line of Geometry Calculation is as set in "Direction".

Intersecting Angle

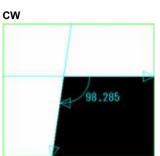
Specify one of the three methods to detect the angle between two intersecting lines.

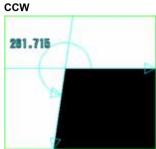
Line specified in Reference No.0



Acute Angle



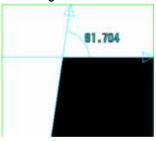


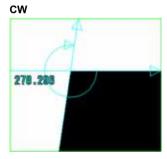


In case of CW or CCW, the start position is the line specified in Reference No.0.

When the direction of a line changes, the detected angular positions differ between CW and CCW. The following is the case that the direction of line in Reference No.1 is reversed.

Acute Angle





CCW 81.704

Note

The intersecting angle and median is output as below when two lines are not intersected.

	When two lines are headed in the same direction	When two lines are headed in different directions
Intersecting Angle	0 degree	180 degree
Median	It is calculated with the same direction and angle as the two lines.	A line passing through the center of the image is calculated, which is the angle of Line No.0 + 90 degrees.

Setting Judgement Condition

Measurement conditions vary depending on the type of geometry calculation.

Detect mode	Judgement limits	Input range
Distance Point-Point	Median X, Median Y	-99999999.999 to 99999999.999
	Distance	0 to 9999999999999
	Line Angle	0 to 359.999(When Angle Range is 0<->360) -179.999 to 180.000 (When Angle Range is -180<->180)
Intersecting Point	IP X, IP Y	-99999999.999 to 99999999.999
	Angle	0 to 359.999
Median of Two Lines	Angle	0 to 359.999
	Line Angle	0 to 359.999 (When Angle Range is 0<->360) -179.999 to 180.000 (When Angle Range is -180<->180)
Distance Point-Line	Pedal X, Pedal Y	-99999999.999 to 99999999.999
	Distance	0 to 99999999.999
	Pedal Angle	0 to 359.999 (When Angle Range is 0<->360) -179.999 to 180.000 (When Angle Range is -180<->180)
Approximate Line	Line Angle	0 to 359.999 (When Angle Range is 0<->360) -179.999 to 180.000 (When Angle Range is -180<->180)
	Standard Deviation	0 to 99999999.999
Approximate Circle	Center X, Center Y	-99999999.999 to 99999999.999
	Radius	0 to 99999999.999
	Standard Deviation	0 to 9999999999999
Approximate Ellipse	Center X, Center Y	-99999999.999 to 99999999.999
	Major Axis	0 to 99999999.999
	Minor Axis	0 to 99999999.999
	Major Axis Gradient	0 to 359.999 (When Angle Range is 0<->360) -179.999 to 180.000 (When Angle Range is -180<->180)
	Standard Deviation	0 to 9999999999999

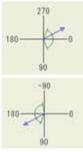
Maximum and Minimum Values of Line Angle

As for Line Angle, the maximum value can be set to a smaller value than the minimum value (Max. value < Min. value). Set the values checking the guide display.

In the example on the right, it will be judged as OK if the detected angle is in the range of "290 to 70 degrees".

In the example on the right, it will be judged as OK if the detected angle is in the range of "110 to -110 degrees".

2	Maximum	Minimum
Median X	999999999,999	-999999999.999
Median Y	999999999.999	-999999999.999
Distance	99999999.999	0.000
		000 000
Line Ang.	70.000	290.000
Line Ang.	70.000 Maximum	Xinimum
Line Ang. Median X		
	Maximum	Minimum
Median X	Maximum 999999999.999	Minimum -999999999.999



Error Messages when performing Geometry Calculation

If Geometry Calculation is not performed properly, error numbers and messages are displayed in the checker list.

Error No.	Message	Cause					
E0070	Unset item found.	When a check	When a checker to be used is not specified.				
E0071	No ref. checker result.	When the spe lines.	cified checker did not detect edges, objects or				
Error No.	Message	Туре	Cause				
E0072	Could not normally calculate.	Distance Point-Point	When two points are in the same position				
		Intersecting Point	 When two lines are parallel and not intersected 				
			When the intersection point is out of the range of +/-9999				
		Approximate Line	When the input point is less than 2When all the input points are in the same position				
		Approximate Circle	 When the input point is less than 3 When the input points are located on a line When the center of the approximate circle is out of the range of +/-9999 				
	Approxima Ellipse	Approximate Ellipse	 When the input point is less than 6 When the input points are located on a line When the center of the approximate ellipse is out of the range of +/-9999 When the ellipse cannot be calculated (due to the positions of the input points) 				

4.11 Calculation of Detected Data (Numerical Calculation)

This function calculates using the data detected by checkers and outputs the data to the external devices. Up to 1000 expressions (when 10 blocks are used) can be set for each product type.

Note

- PV500 can handle the values from -2147483648.000 to + 2147483647.000, which are -(2³¹) to (2³¹-1), during calculation. When a calculating value exceeds the range, it is considered as an error (ER) and an error signal (ERROR0) is output. In that case, the calculation result is output as "0".
- The setting limit is the maximum of 1000 expressions per product type combined with expressions of Numerical Calculation. (After creating 1000 expressions of Numerical Calculation, you cannot create a judgement expression any more.)
- In Connector (Binary Window), Connector (Gray Window), and Connector (Gray Edge), you can
 register some types of data into a Data R/W sheet from the setting windows. Refer to the description of
 each checker for details.
- When the judgement of the numerical calculation registered in a numerical expression is error (ER), it is referred as "0" in the expression.

Example) When CA000 is error

No.		Expression	Result
CA001	=	CA000	0
CA002	=	CA000 + 500	500

4.11.1 Setting a Calculation

Creating a Calculation

Select "INSPECTION" > "Num. Calcu." from the menu bar.

"Numerical Calculation" list is displayed. Next to the calculation number, the beginning part of an expression is displayed. Tilting the ENTER key right in the list to display the next page shows 63 characters of expression and comment.

2. Select a numerical calculation list and a number to set.

The screen of numerical calculation setting is displayed.

OPERATION ENVIRONMENT TYPE INCP	ECTION SAVE/REA	0 3000,		SETUP NENU	5109-
Area Size Adj. Checker	Slice	Level	Preprocess	Num. Calco	u. 00
Block No. D					
Checker No. 0					
No. Expression	Result	Judge.	Max.	Min.	Output 3
CAC000 FEC000_AREA.0003	0.000	ER	0.000	0.000	Tes
CAC001Brise1					
CAC002 Unset					
CAC003 Unset					
CAC004 Brise t					
CAC005 Unset					
CAC006 Unset					
CAC007 Brise t					
CAC008 Unset					
CAC009 Brise t					
CACO 10 MAX(CAC002_VALUE,2)	0.000	ER	0.000	0.000	Tes
CAC011Unset					
CAC012 Unset					
CAC013 Broset					
CAC014 Unset					
CAC015 Unset					
CAC016 Unset					
CAC017Unset					

3. Select the numerical calculation input field and press the ENTER key again.

The list of items that can be registered in a calculation is displayed.

Checker:	Select this to enter the inspection data or the statistics data of checkers including position adjustment and area size adjustment.
Numerical Calculation:	Select this to enter the result of numerical calculation or the statistics data of them.
Judgement:	Select this to enter the result of judgement or the statistics data of them.
Constant:	Select this to enter a fixed value. Values that can be input are +/- 9999999.999.
System Register:	Select this to enter the System Registers No.0 to 7 specified in the environment setting.
Scan Count:	Select this to enter the scan count after startup or type switching.
Operators and Functions:	Select this to enter an operator or a function. Refer to the section of Operators and Functions, page 222 for details.

Note

Scan Count is reset to "0" by turning on the power, switching type, and resetting statistics data.

4. Enter an operation expression.

Up to 16 items and 560* characters can be set.

If you selected a wrong item, delete it with the F2 key and reregister the expression.

Note

Moving the cursor onto an item displays the information of the item in the expression explanation field.

*) The products before ver.1.1 limit the number of characters to 256.

5. Enter a comment with the software keyboard as necessary.

6. Press the CANCEL key again.

When the dialog message appears, select "YES".

"Yes": Registers the expression.

"No": Returns to the status before inputting the expression.

"Cancel": Cancels registering the expression and come back to status to edit.

Note

If the expression is incorrect such as wrong grammar or unspecified data which is necessary for the function, selecting "Yes" cannot execute the registration and a message is displayed in the bottom field. The cursor is moved to the wrong item. Correct it.

7. Press the TRIG key to run a test and confirm the result as necessary.

OPERATION ENVIRONMENT TYPE			SETUP MONU	510
Area Size Adj. Che	cker Slice Level	Preprocess	Num. Calcu.	
Numerical Calculation	CAC001			
Common t				
Expression				
GEC000_X.001-BEC000_X.0	90			ſ
Function Description				
	Maximum		0.000	
	Minimum		0.000	
	Output	Yes	-	
	Result.			
	Judgement			
Expression Description				
Gray Edge No.000 X Object No.001				

Input Example: Entering a Result of a Checker

For this example, enter the object area detected thirdly by Feature Extraction No.0. Depending on the type of checker, selectable data varies.

1. In the list of items that can be entered in expression, select "Checker" > "FEC(Feature Extraction)".

The list of Feature Extraction checkers is displayed.

2. Select checker No. 000.

The list of result types is displayed.

Note

For some checkers, the list of result types is displayed on multiple pages. Tilt the ENTER key left or light to change the page.

3. Select "Area", the data to enter.

The window to set a result No. is displayed. Among multiple detected objects, use the object No. numbered with Feature Extraction checker to specify.

4. Select "0003".

Note

If specifying the number exceeding the number of detected objects, the input value will be "0".

5. Select "Result".

The code indicating "the object area detected thirdly by Feature Extraction No.0" is displayed in the expression field.

Highlighting a code displays the meaning of it in the Expression Description field in the bottom of the screen.



Result Type Judgement Inspection Time No. of Objects Area

Gravity X

	Result/Statistics	
	Result	3
	Result	
NEELATION	ENVIRONMENT TWO DESCRIPTION CAN	(a)

Numerical Calculation CACOO2 Comment Factorsion FECODO_AREA.0003 Function Description Na Nu Nu Nu Nu Nu Nu Nu Nu Nu Nu Nu Nu Nu	PERATION ENVIRONMENT TYPE	INCRECITION	SAVE/RE
Comment Expression FEC000_AREA.0003 Function Description Nu Uk	Area Size Adj. Ch	ecker	Slice
Expression FECCOD_AREA.0003 Function Description Ma Mi Ok Rk Ju	Numerical Calculation	CACOB2	
FECODO_AREA.0003 Function Description Ma Mi Oc Re Ju	Comment	1	
Function Description Mi Di Di Ju	Expression		
Hu Mi Ot Ri Ji	FEC000_AREA.0003		
Hu Mi Ot Ri Ji			
Hu Mi Ot Ri Ji			
Hu Mi Ot Ri Ji			
Mi Do Ro Ju	Function Description		
Ov Re Ju			1000
Re			Mir
Ja			Out
Ja			
			Res
Expression Description			Juc
Expression Description			1
	Expression Description	1911 - 1	
	when onlice working		
Area Object No.003			_

Inputting Functions

After selecting a type of function, highlighting a code shows the description of the function in the field under the expression field. Refer to it to enter an expression.

Express	on		
SORT()			
Function	Description		
	Description		
SORT			
	s the square	root of	the
SORT(V	al value.		
ounit(vi	ilde /		

Copying an Set Expression

- Select "INSPECTION" > "Num. Calcu." from the menu bar.
 "Numerical Calculation" window is displayed.
- 2. Select a numerical calculation list in the setting window and move the cursor onto the expression No. to copy.
- **3.** Press the FUNC key and select "Copy" from the displayed menu.

PERATION IN THE	and the second s	IN BAVE/FEAD		ALC: NOT THE REAL OF
Area Size Che	cker	Slice I	evel	Preprocess
Corv				
Deleta Io.	<u>.</u>			
No. Expression	-	Intern International		Regiment
CAC000 FEC000_AREA.0003		0.000	NG	0.00
CAC001 GEC000_X.001-GEC0	01_	0.000	NG	0.00
CACOD2 Unset				
CAC003 linse t				
CAC004 Unset				
CAC005 Unset				
CACOD6 Unset				
C4C007 linset				

- 4. Move the cursor onto the destination expression No.
- 5. Press the FUNC key and select "Paste" from the displayed menu.

Copying is executed.



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

Replacing an Item

This function replaces a part of an expression with another item to use.

- **1**, Move the cursor onto the item to replace.
- 2. Press the F1 key: Replace Items.

In a similar way to creating an expression, an item select window is displayed.

3. Select an item.

It is replaced with the selected item.

OPERATION ENGROMENT TYPE INSPECT	IN LAIE/FEAD TAOL		IETUP MENU	\$108
Area Size Adj. Dhecker	Slice Level	Preprocess	Num. Calcu.	••
Numerical Calculation CACOOI Comment				
GEC000_X.001-GEC001_X.000				
Function Description				
	Maximum		0.000	
	Minimum		0.000	
	Output	Yes	1	
	Resul t		0.006	
	Judgement		8 6	
Expression Description				
Gray Edge No.001 X Object No.000			1	
Data Undated)	titus Test PINC 1 Herilace Itees F2	Delete Fi	Delete All	ĩ

Deleting an Item

A part of or an entire operation expression can be deleted.

- **1.** Select an expression in the numerical calculation setting window.
- 2. To delete just an item, move the cursor onto the item and press the F2: Delete key. The item is deleted.
- **3.** To delete an entire expression, press the F3: Delete All key.

As the confirming message appears, selecting "YES" deletes all items registered in the expression.

Printing . Partness of Two	200.000.000		217.69	100
Ares Size Adj. Checker	Strice Level	Preprocess	COMMON Dellaw	
Aumorical Calculation. CAUND	1			
Comment				
Laprension				
SECOND_X_NULL_RECOVI_#_NON				4
The second secon				
				1
function Description				-1
Tang Tiles Barney Options	1 Maximum	-	1.00	
	Rintene.		8,365	
	default.	Sec	-	
		-	1.000	
	Result	-		
	Julgrant,		10 C	
Expression Description				
liver Lige No. (0)				-
X Object Br. 200				
			_	
New York Carl 1	and the second second second	State State	P. LOUIS CO. N. P. LEWIS	1
and the second se	Deles Nee: 17.	Deleter 1	Plante Million	

Setting Judgement Limits

Set a tolerance (maximum and minimum values) of the calculated result. If the value is within the tolerance, the object will be judged as "OK", if it is out of it, the object will be judged as "NG". If any judgement is not necessary, there is no need to set.

- **1.** In numerical expression setting window, select "Maximum" and enter a value.
- 2. In numerical expression setting window, select "Minimum" and enter a value.
- **3.** Press the TRIG key to execute a test and confirm the judgement.

Note

Maximum/Minimum values can be input in the previous window, in the list of numerical calculations.

Expression		
GEC000_X.001-GEC001_X.000		
Function Description		
	Maximum	0.000
	Minimum	0.000
	Output	Yes •
	Result	0.000
	Judgement	NG
Expression Description		
Gray Edge No.001 X Object No.000		

Setting an Output Condition

Select whether or not to output calculation results to the external devices for each expression. Default setting is set to output.

Note

In addition to the setting for each expression, setting from "ENVIRONMENT" > "Input/Output" outputs numerical calculation results to the external devices.

1. Select "Output" in the numerical calculation setting window.

2. To output it, select "Yes". Select "No" not to output.

Note

Output conditions can be input in the previous window, in the list of numerical calculations.

Expression		
6EC000_X.001-6EC001_X.000		
Function Description		
	Maximum	0.000
	Minimum	0.000
	Output	Yes 🔹
	Result	0.000
	Judgement	NG
Expression Description		
Gray Edge No.001 X Object No.000		

The data described below is that can be used in numerical calculation. The symbols in parentheses are displayed in operation expressions.

Inspection data that can be registered in Numerical Calculation

Note

Depending on type of result data, selectable statistics data varies when selecting "Statistics".

Statistics: Type 1

Scan Count	(@TIME)	OK count	(@OK)	NG count	(@NG)
Statistics: Type	2				
Minimum value	(@MIN)	Min. OK Judge.	(@OKMIN)	Min. NG Judge.	(@NGMIN)
Maximum value	(@MAX)	Max. OK Judge.	(@OKMAX)	Max. NG Judge.	(@NGMAX)
Average	(@AV)	OK average	(@OKAV)	NG average	(@NGAV)
Range	(@RG)	OK range	(@OKRG)	NG range	(@NGRG)
Variance	(@DV)	OK Variance	(@OKDV)	NG Variance	(@NGDV)

Checker

ltem	Result No.	Result Type	Statistics type	Output Value	, etc	
Position Adjustment		Judgement (JUDGE)	1	OK=1, NG=0		
(PAC) No.0-999		Inspection Time (TIME)		2		
		Base Position X (BPOSX)		2		
		Base Position Y (BPOSY)		2		
		Base Position Theta (BAN	G)	2		
		X Adjustment Amount (AJ)	K)	2		
		Y Adjustment Amount (AJ)	Y)	2		
		Theta Adjustment Amount	(AJANG)	2		
		Detect Position X		2		
		Detect Position Y		2		
		Theta(ANG)		2		
		Judgement of Base Checker (BJUDGE)	No.0-3	1	OK=1, NG=0	Base=Base checker
		Base Inspection Time (BTIME)	No.0-3	2		
		Base X-Coordinate (BX)	No.0-3	2		
		Base Y-Coordinate (Y)	No.0-3	2		
		Base Projection X (BPX)	No.0-3	2		
		Base Projection Y (BPX)	No.0-3	2		
Area Size Adjustment		Judgement (JUDGE)		1	OK=1, NG=0	
(AUC) No.0-999		Inspection Time (TIME)		2		
		X coordinate (X)		2		
		Y coordinate (Y)		2		
		Projection distance of X (F	ΥX)	2		
		Projection distance of Y (PY)		2		
Line (LIC) No.0-999		Judgement (JUDGE)		1	OK=1, NG=0	
		Inspection Time (TIME)		2		
		Pixel judgement (DJ)		1	OK=1, NG=0	
		Objects judgement (LJ)		1	OK=1, NG=0	
		No. of Pixels (DCNT)		2	0 - 125938	
		No. of Objects (DCNT)		2	0 - 41979	
Binary Window(BWC)		Judgement (JUDGE)		1	OK=1, NG=0	
No.0-999		Inspection Time (TIME)		2		
		Area (AREA)		2	0 - 1920000	

Item Result R No.		Result Type	Statistics type	Output Value, etc
Gray Window(GWC)		Judgement (JUDGE)	1	OK=1, NG=0
No.0-999		Inspection Time (TIME)	2	
		Gray Average (AVE)	2	0 - 255
Binary Edge(BEC) No.0-999		Judgement (JUDGE)	1	OK=1, NG=0
		Inspection Time (TIME)	2	
		No. of Objects (COUNT)	2	0 - 256
	0-255	X coordinate (X)	2	
		Y coordinate (Y)	2	
		Detected color (COLOR)	2	"White > Black"=0, "Black > White"=1
		Projection distance of X (PX)	2	
		Projection distance of Y (PY)	2	
Gray Edge(GEC)		Judgement (JUDGE)	1	OK=1, NG=0
No.0-999		Inspection Time (TIME)	2	
		No. of Objects (COUNT)	2	0 - 256
	0-255	X coordinate (X)	2	
		Y coordinate (Y)	2	
		Differential Value (DEF)	2	0 - 255
		Projection distance of X (PX)	2	
		Projection distance of Y (PY)	2	
Feature Extraction		Judgement (JUDGE)	1	OK=1, NG=0
(FEC) No.0-999		Inspection Time (TIME)	2	
Common Result:		No. of Objects (COUNT)	2	0 - 10000
Individual Result1	0-9999	Area (AREA)	2	0 - 1920000
1/2 page		X coordinate of gravity center (X)	2	
		Y coordinate of gravity center (Y)	2	
		Projection width (PW)	2	
		Projection height (PH)	2	
		Perimeter (PLEN)	2	
		Principal axis angle (ANG)	2	-89.9 - +90.0, -180.0
		Projection distance of X (PX)	2	
		Projection distance of Y (PY)	2	
Individual Result2: 2/2 page	-	X coordinate of the upper left point of circumscribing rectangle (LUX)	2	
		Y coordinate of the upper left point of circumscribing rectangle (LUY)	2	
		X coordinate of the upper right point of circumscribing rectangle (RUX)	2	
		Y coordinate of the upper right point of circumscribing rectangle (RUY)	2	
		X coordinate of the lower left point of circumscribing rectangle (LDX)	2	
		Y coordinate of the lower left point of circumscribing rectangle (LDY) X coordinate of the lower right point	2	
		of circumscribing rectangle (RDX) Y coordinate of the lower right point	2	
		of circumscribing rectangle (RDY)	۷	

Item	Result No.			Output Value, etc
Smart		Judgement (JUDGE)	1	OK=1, NG=0
Matching(SMC) No.0-999		Inspection Time (TIME)	2	
10.0-333		No. of Objects (COUNT)	2	0 - 255
	0-255	Detect Template No. (TEMP)	2	
		Correlation (COR)	2	
		X coordinate (X)	2	
		Y coordinate (Y)	2	
		Angle (ANG)	2	-179.999 -180.000
		Pixels of Max. Subtracted Object (AREA)	2	
		No. of Subtracted Objects (LCNT)	2	0 -128
		Projection distance of X (PX)	2	
		Projection distance of Y (PY)	2	
	0-5	No. of objects (interim) (SCNT)	2	0 -256
		Correlation value (interim) (SS)	2	0.001 -1.000
law		Judgement (JUDGE)	1	OK=1, NG=0
Detection(FWC) No.0-999		Inspection Time (TIME)	2	
10.0-333		No. of objects (COUNT)	2	0 -512
	0-511	Flaw size (SIZE)	2	1 - 3600
		First Cell of Flaw. (FCELL)	2	
		X coordinate (X)	2	
		Y coordinate (Y)	2	
		Projection distance of X (PX)	2	
		Projection distance of Y (PY)	2	
onnector - Binary		Judgement (JUDGE)	1	OK=1, NG=0
Vindow(CBW) lo.0-999		Inspection Time (TIME)	2	
10.0-333		No. of Cells(CELL)	2	3 - 100
	0-99	Area (AREA)	2	
		Individual judgement (PJ)	1	OK=1, NG=0
Connector Gray		Judgement (JUDGE)	1	OK=1, NG=0
Vindow (CGW) lo.0-999		Inspection Time (TIME)	2	
10.0-333		No. of Cells(CELL)	2	3 - 100
	0-99	Gray Average (AVE)	2	0 -255
		Individual judgement (PJ)	1	OK=1, NG=0
connector Gray		Judgement (JUDGE)	1	OK=1, NG=0
Edge (CGE) Io.0-999		Pitch total judgement (PTJG)	1	OK=1, NG=0
Common Result: 1/2 page		Distance difference total judgement (UPJG)	1	OK=1, NG=0
		Inspection time (TIME)	2	
		No. of Cells(CELL)	2	3 - 100
		Max. Pitch (PMAX)	2	
		Min. Pitch (PMIN)	2	
		Average Pitch (PAVE)	2	

Item	Result No.	Result Type	Statistics type	Output Value, etc
Individual Result: 2/2	0-99	Pitch Individual Judgement (JG)	1	OK=1, NG=0
page		Distance difference individual judgement (UJG)	1	OK=1, NG=0
		Pitch (PT)	2	
		Distance difference (UPT)	2	
		Edge X coordinate 0 of area 0 (X1)	2	
		Edge Y coordinate 0 of area 0 (Y1)	2	
		Edge differential 0 of area 0 (D1)	2	0 -255
		Edge X coordinate 1 of area 1 (X2)	2	
		Edge Y coordinate 1 of area 1 (Y2)	2	
		Edge differential 1 of area 1 (D2)	2	0 -255
Smart Edge (Circle)		Max. Measurement value (LMAX)	2	Measurement value =
(SEC) No.0-999 Detected Result:		Min. Measurement value (LMIN)	2	Radius, Diameter or Width
1/3 page		Average Measurement (LAVE)	2	
		Standard Deviation (STD)	2	
		Max. Angle (AMAX)	2	
		Min. Angle (AMIN)	2	
		Center X 0 (CX0)	2	
		Center Y 0 (CY0)	2	
		Radius 0 (R0)	2	
		Circularity 0 (CIR0)	2	
		Center X 1 (CX1)	2	Each data of outer detected
		Center Y 1 (CY1)	2	 circle when selecting Detect Mode: Width
		Radius 1 (R1)	2	
		Circularity 1 (CIR1)	2	
Common Result:	-	Judgement (JUDGE)	1	OK=1, NG=0
2/3 page		Measurement Judgement (LJUDGE)	1	
		Standard Devation Judgement (SJUDGE)	1	
		Circularity Judgement (CJUDGE)	1	
		Unused Edge Count Judgement (NJUDGE)	1	
		Inspection Time (TIME)	2	
		Used Edge Count (FCNT)	2	
		Unused Edge Count (NCNT)	2	
		No. of Cells (CELL)	2	0-3599
Individual Result: 3/3 page	0-3599	Individual Judgement (IJUDGE)	1	OK=1, NG=0
		Measurement value (LEN)	2	
		Deviation (DEV)	2	
		X 0 (X0)	2	
		Y 0 (Y0)	2	
		Differential 0 (D0)	2	0 -255

ltem	Result No.	Result Type	Statistics type	Output Value, etc
		X 1 (X1) *1)	2	
		Y 1 (Y1) *1)	2	
		Differential 1 (D1) *1)	2	
		Judgement Code (STAT)	2	0-4 *2)
Smart Edge (Line)		Max. Measurement value (LMAX)	2	
(SEL) No.0-999		Min. Measurement value (LMIN)	2	_
Common Result: 1/3		Average Measurement (LAVE)	2	=
page		Standard Deviation (STD)	2	=
		Max. Measurement X (XMAX)	2	=
		Max. Measurement Y (YMAX)	2	=
		Min. Measurement X (XMIN)	2	=
		Min. Measurement Y (YMIN)	2	=
		Judgement (JUDGE)	1	OK=1, NG=0
		Measurement Judgement (LJUDGE)	1	
		Standard Devation Judgement (SJUDGE)	1	_
		Linearity Judgement (JUDGE)	1	
		Unused Edge Count Judgement (NJUDGE)	1	_
		Inspection Time (TIME)	2	_
		Used Edge Count (FCNT)	2	_
		Unused Edge Count (NCNT)	2	
		No. of Cells (CELL)	2	
Detected Result: 2/3		Line 0 Start Coordinate X (SX0)	2	
page		Line 0 Start Coordinate Y (SY0)	2	
		Line 0 End Coordinate X (EX0)	2	_
		Line 0 End Coordinate Y (EY0)	2	_
		Line 0 Element a (EA0)	2	_
		Line 0 Element b (EB0)	2	_
		Line 0 Element c (EC0)	2	_
		Line 0 Angle (ANG0)	2	_
		Linearity 0 (LI0)	2	_
		Line 1 Start Coordinate X (SX1)	2	Approximate line data tha
		Line 1 Start Coordinate Y (SY1)	2	 is detected based on the edges detected with the
		Line 1 End Coordinate X (EX1)	2	condition 1 when selecting
		Line 1 End Coordinate Y (EY1)	2	Width for Detect Mode
		Line 1 Element a (EA1)	2	_
		Line 1 Element b (EB1)	2	_
		Line 1 Element c (EC1)	2	_
		Line 1 Angle (ANG1)	2	_
		Linearity 1 (LI1)	2	_

*1)

When Execution Mode = Width: Outer edge data When Execution Mode = Diameter: Edge data of the opposite cell to Result No. cell.

- *2) 0:
- Cell that detected edges and Individual Judgement NG cell Cell that detected edges and Individual Judgement OK cell Cell that detected edges and denoising 1:
 - 2:
 - Cell that detected no edge 3:
 - 4: Masked cell

Item	Result No.	Result Type	Statistics type	Output Value, etc
Individual Result: 3/3 page	0-2999	Individual Judgement (IJUDGE)	1	OK=1, NG=0
		Measurement value (LEN)	2	
		X 0 (X0)	2	_
		Y 0 (Y0)	2	_
		Differential 0 (D0)	2	0 -255
		X 1 (X1)	2	Data of the edges detected
		Y 1 (Y1)	2	 with the condition 1 when selecting Width for Detect
		Differential 1 (D1)	2	Mode
		Judgement Code (STAT)	2	0-4 *1)

Cell that detected edges and denoising Cell that detected no edge 3: Masked cell 4:

*1)

0: 1:

2:

Geometry Calculation

Detected result data varies depending on the type of geometry calculation. Refer to Geometry Calculation: page 198 for details.

Cell that detected edges and Individual Judgement NG cell Cell that detected edges and Individual Judgement OK cell

Item	Result No.	Result Type	Statistics type	Output Value, etc
Geometry		X coordinate (X)	2	
Calculation (GGC) No.0-999		Y coordinate (Y)	2	=
Result: 1/2 page		Standard Deviation (STD)	2	=
		Angle (ANG)	2	=
		Line Parameter A (LINEA)	2	=
		Line Parameter B (LINEB)	2	=
		Line Parameter C (LINEC)	2	_
		Distance (DIST)	2	=
		Intersecting Angle (CANG)	2	0 - 360
		Radius (R)	2	
		Major Axis (LA)	2	_
		Minor Axis (SA)	2	_
		Inspection Time (TIME)	2	
Judgement: 2/2	-	Judgement (JUDGE)	1	OK=1, NG=0
page		X Judgement (XJUDGE)	1	_
		Y Judgement (YJUDGE)	1	_
		Standard Deviation Judgement (SJUDGE)	1	_
		Angle Judgement (AJUDGE)	1	
		Distance Judgement (DJUDGE)	1	_
		Intersecting Angle Judgement (CAJUDGE)	1	_
		Radius Judgement (RJUDGE)	1	_
		Major Axis Judgement (LAJUDGE)	1	_
		Minor Axis Judgement (SAJUDGE)	1	

Numerical calculation

ltem		No.	Result Type	Statistics type	Output Value, etc
Numerical	CAC Numerical	0-999 *1)	Judgement (JUDGE)	1	OK=1, NG=01
Calculation	Calculation		Result (VALUE)	2	
	OCA Numerical	0-999	Judgement (JUDGE)	1	OK=1, NG=0
	Calculation (Previous Result)		Result (VALUE)	2	

*1) Only smaller No. than the currently setting numerical calculation No. is settable.

Judgement

ltem		No.	Result Type	Statistics type	Output Value, etc
Judgement	JRC Judgement (Internal)	0-999	Judgement (JUDGE)	1	Only statistics
	JDC Judgement (External)				

Constant/ System Register/Scan Count

Item	Result	Statistics type	Output Value, etc
System Value (SYS)	Number of Scans (COUNT)	No	0 - 2147483647
System Register	SYS:REG0 to SYS:REG7	No	-9999999.999 - 9999999.999
Constant	Input value: -99999999.999 to 9999999.999	No	

Operators

+	Addition	
-	Subtraction	
*	Multiplication	
1	Division	If denominator becomes "0", the calculation will be terminated and an error signal (ERROR1) will be output.
(,)	Parenthesis	Up to three parentheses can be used successionally. You cannot use four or more of them successionally. Correct: (((A+B)-C+D)+E), Wrong: ((((A+B)-C+D)+E)+F)

Arithmetical Function

MOD (S0, S1)	Remainder when S0 is divided by S1	e.g.) MOD (9,4) = 1
POW (S0, S1)	Value of S0 multiplied by S1.	e.g.) POW (3, 2) = 9
LOG10 (S)	Common logarithm of S	e.g.) LOG10 (100) = 2
SQRT (S)	Square root of S	e.g.) SQRT (144) = 12
ABS (S)	Absolute value of S	e.g.) ABS (-255) = 255
PI	Pi (fixed value)	PI = 3.142
INT (S)	Integer portion of S	e.g.) INT (-1.8) = -1
ROUND (S)	Round S to a whole number	e.g.) ROUND (1.485) = 1
FLOOR (S)	Round S down to a whole number	e.g.) FLOOR (1.485) = 1
CEIL (S)	Round S up to a whole number	e.g.) CEIL (-1.3) = -1

Difference among INT, ROUND, FLOOR and CEIL

S	INT (S)	ROUND (S)	FLOOR (S)	CEIL (S)
1.5	1	2	1	2
1.4	1	1	1	2
-1.4	-1	-1	-2	-1
-1.5	-1	-2	-2	-1

Statistical Function

MAX(C,S)	Maximum value from S-number of results of numerical calculation No.C	Example) In the case of
MIN(C,S)	Minimum value from S-number of results of numerical calculation No.C	- CA000=10 CA001=5.8 CA002=3
AVE(C,S)	Average of S-number of results of numerical calculation No.C	- MAX(0, 3) = 10 MIN(0, 3) = 3
SUM(C,S)	Sum of S-number of results of numerical calculation No.C	AVE(0, 3) = 6.267 SUM (0, 3) = 18.8
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).	SORT(0, 3, 1, 0)=3 The 0-th (smallest) value of the ascendingly sorted results of numerical calculation No.0 to 2.

Trigonometrical Function

с	(x1,y1) (θ = degree) • SIND(θ) = $\frac{b}{c}$ • COSD(θ) = $\frac{a}{c}$	
(x0,y0) a	• $TAND(\theta) = \frac{b}{a}$	
SIN(Radian)	Sine of angle DR (radian)	e.g.) b = SIN (Radian) * c
COS(Radian)	Cosine of angle DR (radian)	e.g.) a = COS (Radian) * c
TAN(Radian)	Tangent of angle DR (radian)	e.g.) a / b = TAN (Radian)
ASIN(S)	Arcsine of angle DR (radian)	e.g.) Radian = ASIN (b / c)
ACOS(S)	Arccosine of angle DR (radian)	e.g.) Radian = ACOS (a / c)
ATAN(S)	Arctangent of angle DR (radian)	e.g.) Radian = ATAN (b / a)
SIND(Degree)	Sine of angle D	e.g.) b = SIND (Degree) * c
COSD(Degree)	Cosine of angle D	e.g.) a = COSD(Degree) * c
TAND(Degree)	Tangent of angle D	e.g.) a/b = TAND(Degree)
ASIND(S)	Arcsine of angle D	e.g.) Degree = ASIND(b / c)
ACOSD(S)	Arccosine of S	e.g.) Degree = ACOSD (a / c)
ATAND(S)	Arctangent of S	e.g.) Degree = ATAND (b / a)
RAD(Degree)	Radian of angle D	e.g.) RAD(45) = 45 / 360 x 2π= 0.785
DEG(Radian)	Angle of radian R	e.g.) DEG(0.785) = 45

Geometric Function

MIDDLEX(X0,Y0,X1,Y1) MIDDLEY(X0,Y0,X1,Y1)	Coordinate X and Y of the middle point of Y1)	f two points Q0 (X0, Y0) and Q1 (X1,			
CPOINTX (a0,b0,c0,a1,b1,c1) CPOINTY (a0,b0,c0,a1,b1,c1)	Coordinate X and Y of the intersection of two lines L0 (a0x+b0y+c0=0) and L1 (a1x+b1y+c1=0) If two lines are parallel, the judgement will be "ERR".				
ELINEPA (x0,y0,x1,y1) ELINEPB (x0,y0,x1,y1) ELINEPC (x0,y0,x1,y1)	Element a, b and c of a line L (ax+by+c=0) which connects two points (x0,y0) and (x1,y1).	(x0,y0) (x0,y0) (x0,y0) (x1,y1) (x1,y1) (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".	L0 (a0x+b0y+c0=0) DR(radian) L1 (a1x+b1y+c1=0)			
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	L (ax+by+c=0)			
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)	Q1 L (ax+by+c=0)			

CIRCLEX (x0,y0,x1,y1,x2,y2) CIRCLEY (x0,y0,x1,y1,x2,y2) CIRCLER (x0,y0,x1,y1,x2,y2)	Coordinate X and Y of the center and radius (in pixels) of a circle through three points, (x0,y0), (x1,y1) and (x2,y2)	(x0,y0) (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 square Element a, b and c of a regression line (ax calculation No.C0 as the top of X, calculati S-number of calculation data as continuous calculated by LINELSA, LINELSB, and LIN If it cannot be calculated, the judgement wi	+by+c) when regarding numerical on No.C1 as the top of Y, and s data. Element a, b, and c are ELSC respectively.
	Example) Regression line of five points (X0 CAC000 = X0 CAC001 = X1 CAC002 = X2 CAC003 = X3 CAC004 = X4 CAC005 = Y0 CAC006 = Y1 CAC007 = Y2 CAC008 = Y3 CAC009 = Y4 CAC010 = LINELSA(0, 5, 5) CAC011 = LINELSB(0, 5, 5) CAC012 = LINELSC(0, 5, 5)	 Y0) to (X4, Y4) Register the points in a calculation so that their coordinates X and Y are continuous. To obtain element a. To obtain element b. To obtain element c.

Comparison Function

EQ (S0, S1)	Returns "1" when S0 = S1, otherwise "0".	e.g.) EQ (85, 85) = 1
NEQ (S0, S1)	Returns "1" when S0 \neq S1, otherwise "0".	e.g.) NEQ (85, 85) = 0
LT (S0, S1)	Returns "1" when S0 < S1, otherwise "0".	e.g.) LT (85, 85) = 0
LEQ (S0, S1)	Returns "1" when $S0 \le S1$, otherwise "0".	e.g.) LEQ (85, 85) = 1
GT (S0, S1)	Returns "1" when S0 > S1, otherwise "0".	e.g.) GT (215, 85) = 1
GEQ (S0, S1)	Returns "1" when S0 \geq S1, otherwise "0".	e.g.) GEQ (215, 85) = 1

4.12 Totally Judging Results of Checkers (Judgement)

PV has a function that totally judges on the judgements of checkers and numerical calculations. Although 1000 Judgements are provided, No.0 to 999 (when 10 blocks are used), you can set maximum of 1000 expressions per type combining with numerical calculations.

Judgement can be displayed on the screen and output to the external devices. In addition, images can be saved according to the judgement and the images can be output to the external devices.

Note

When the execution mode is set to "Automatic Switch", the judgement is a branch condition. Refer to Chapter 4.4.3 (page 66) about the setting procedure of branch conditions.

4.12.1 Setting Judgement Conditions

Creating a Calculation

1. Select "INSPECTION" > "Judgement" from the menu bar.

"Judgement" window is displayed. Note If [Judgement] is not displayed after selecting [INSPECTION], tilt the ENTER key to the right to show the hidden menus.

Yellow arrows shown in the submenu row indicates that the menu is hidden.

OPERATION ENVIRONMENT	TYPE INSPECTION	SILVE/READ TO	L.	16	UP MONU	\$70P
Checker S	lice Level	Preprocess	Num.	Calcu.	Judgement	• •
Block No. Type Checker No.	JOC(Externa JOC(Interna JOC(Externa					
No.	Ex	pression		Jud	e Commen	1
JDC000 Deset						
J0C001 Unset						
J0C002 Unset						
JBC003 Brise t JBC004 Brise t					_	
JDC004 Drise t						
JDC005 Unset					_	
JDC007 Unset					_	
ancon i buser						
Condition Set Branch Condition	Set Set					
	Condition	Checker No.	Result	De	scription	
Total Judge. Save Img Memory Image Dutput	No No No		No No		JRC/JOC at NG JRC/JDC at NG	,

2. Select a type of Judgement to set by [Type].

The list of the judgements that you selected is displayed.

Judgement has two types as below. Select them in accordance with your purpose.

JDC (External): The judgement result can be output to the external device.

JRC (Internal): The judgement results cannot be output to the external device. The other conditions are the same as that of JDC (External). Use JRC when computing a judgement which is not necessary to be output to the external device. Example: As a precalculation of JDC (External) As a condition to save images or to output images.

3. Select a calculation list and a judgement number to set.

The screen of numerical calculation setting is displayed.

4. Select the numerical calculation input field and press the ENTER key again.

The list of items that can be registered in a calculation is displayed.

Checker:	Select this to input judgements of checkers including Position Adjustment and Area Size Adjustment.
Operator:	Select this to input operators such as "AND" and "OR" to judge results totally.
Numerical Calculation:	Select this to input a judgement of a numerical calculation.
Judgement JRC:	Select this to input a judgement of JRC (Internal). (When you have set a judgement of JRC, you can select only JRC with smaller number than currently setting JRC.)
Judgement JDC:	Select this to input judgement of JDC (External) with smaller number than currently setting judgement number. (When you have set a judgement of JRC, you cannot select JDC.)

5. Enter an operation expression.

Up to 16 items and 560 characters* can be set.

If you selected a wrong item, delete it with the F2 key and reregister the expression.

Note

Moving the cursor onto an item displays the information of the item in the expression explanation field.

*) The products before ver.1.1 limit the number of characters to 256.

6. Enter a comment with the software keyboard as necessary.

PERATION ENVIRON		INSPECTION	SAVE/READ	100,			SETUP MENU		STOP
Checker	Slice	Level	Preproc	455	Nun.	Calcu.	Judg	ement	00
Judgement No.		JRCOOD							
Comment									
Expression									
SMC000_JUDGE -	CACODO_JUD	ICE.							1
					Judges	een t	[
Expression De Smart Matchin Judgement									

7. After inputting is completed, press the CANCEL key.

8. Press the Cancel key again.

When the dialog message appears, select "YES". "Yes": Registers the expression. "No": Returns to the status before inputting the expression. "Cancel": Cancels registering the expression and come back to status to edit. Note Note When an expression is incorrect such as a grammatical error, even if you select [Yes], a message appears and registration cannot be executed. Correct the expression in the case.

9. Press the TRIG key to run a test and confirm the updated judgement as necessary.

Input Example: Entering a Judgement of a Checker

For this example, we enter the judgement of Position Adjustment No.0. Depending on the type of checker, selectable data varies.

 In the list of items that can be entered in an expression, select "Checker" > "PAC(Position Adjustment)".

The list of position adjustment is displayed.

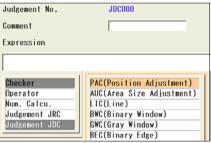
2. Select checker No. 000.

The list of result types is displayed.

3. Select "Judgement".

The code indicating the judgement of Position Adjustment No.0 is displayed in the expression field.

Highlighting a code displays the meaning of it in the bottom field of the screen.



ULKUI	No.
000	
001	Independent Topos
002	Judgement Type
003	
004	Judgement
005	Judgement
006	Base Judgement
007	
800	
009	

Copying an Expression

- Select "INSPECTION" > "Judgement" from the menu bar.
 "Judgement" window is displayed.
- 2. Specify a type of judgement in the Judgement window.
- **3.** Select a calculation list and a judgement number to copy.
- **4.** Press the FUNC key and select "Copy" from the displayed menu.
- 5. Move the cursor onto the destination judgement No.
- 6. Press the FUNC key and select "Paste" from the displayed menu.

Copying is executed.

Note

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

OPERATION DWURDMENT	TYPE INSPECTION SAVE/READ TOO	L .	SCOP MON	STOP
- Circlen	Slice Level Preprocess	Num. Calcu.	Judgement	0.0
Coav				
Paste - Delete	CHART AND A COMPANY			
•	(DDC(External) -			
Checker No.	0			
No.	Expression		Judge Comm	nt
JECODO PACODO_JUDG	£		NG	
JDC001 Undert				
JDC002 Unset				
JDC003 Unset				
JDC004 Unise t				
JDC005 Unset				
JDC006 Unset				

Replacing a Item

This function replaces a part of an expression with another item to use.

1. Move the cursor onto the item to replace.

2. Press the F1 key: Replace Items.

In a similar way to creating an expression, an item select window is displayed.

3. Select an item.

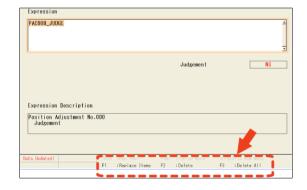
It is replaced with the selected item.

Deleting Operation Expressions and Items

A part of or an entire operation expression can be deleted.

- **1.** Move the cursor onto the deleting item.
- **2.** To delete just an item, move the cursor onto the item and press the F2: Delete key. The item is deleted.
- **3.** To delete an entire expression, press the F3: Delete All key.

As the confirming message appears, selecting "YES" deletes all items registered in the expression.



Data That Can Be Used in Judgement

The data described below is that can be used in judgement expression. The symbols in parentheses are displayed in operation expressions.

Item					Condition for OK judgement
Judge (JUDC					The specified object or edge is detected.
Base (BJUE	Judgement DGE)	Position Adjustment: • Binary Edge • Gray Edge	 Position Adjustment: Feature Extraction Matching Smart Edge (Circle) Position Rotation Adjustment: Feature Extraction (Principal Axis Angle) 360-degree Matching 	Position Rotation Adjustment • Feature Extraction (2 checkers) • Matching (2 checkers) Rotation Adjustment all	
	No.0 (0)	Horizontal Base Checker 0	Base Checker 0	Base Checker 0	The base checkers can detect the
	No.1 (1)	Horizontal Base Checker 1 (Center Detection)		Base Checker 1 (Center Detection)	specified object or edge.
	No.2 (2)	Vertical Base Checker 2		Base Checker 2	
	No.3 (3)	Vertical Base Checker 3 (Center Detection)		Base Checker 3 (Center Detection)	

Others

Item		Condition for OK judgement	
Checker - Area Size Adjustment (AUC) No.0-999	Judgement (JUDGE)	The specified object or edge is detected.	
Checker - Line (LIC) No.0-999	Judgement (JUDGE)	Pixel judgement and Object judgement are both OK.	
	Pixel judgement (DJUDGE)	The number of pixels is within the Judgement limits.	
	Object judgement (LJUDGE)	The number of objects is within the Judgement limits.	
Checker - Binary Window(BWC) No.0-999	Judgement (JUDGE)	Area value is within the OK Judgement limits.	
Checker- Gray Window(GWC) No.0-999	Judgement (JUDGE)	Gray Average is within the OK Judgement limits.	
Checker - Binary Edge(BEC) No.0-999	Judgement (JUDGE)	The number of detected edges is within the Judgement limits.	
Checker - Gray Edge(GEC) No.0-999	Judgement (JUDGE)		
Checker- Feature Extraction (FEC) No.0-999	Judgement (JUDGE)	The number of detected objects is within the OK Judgement limits.	
Checker - Smart Matching(SMC) No.0-999	Judgement (JUDGE)	The number of detected objects at the last phase is equal to the maximum limitation of the number of detected objects that was set at the last phase of the sequence.	
Checker - Flaw Detection(FWC) No.0-999	Judgement (JUDGE)	The number of detected flaws is within the OK Judgement limits.	
Checker - Connector -	Judgement (JUDGE)		
Binary Window(CBW) No.0-999	Individual Judgement(PJUDGE) No.0-99		

Item		Condition for OK judgement
Checker - Connector Gray Window (CGW) No.0-999	Judgement (JUDGE)	
Window (CGW) No.0-399	Individual Judgement(PJUDGE) No.0-99	
Checker - Connector Gray Edge (CGE) No.0-999	Judgement (JUDGE)	Pitch Total Judgement and Distance Difference Total Judgement are both OK.
	Pitch total judgement (PTJUDGE)	Pitch Judgements are all OK.
	Distance Difference Total Judgement (UTJUDGE)	Distance Difference Judgements are all OK.
	Pitch Judgement(PJUDGE) No.0-99 (Judgement of each pitch)	The detected pitches are within the Judgement limits of pitches.
	Distance Difference Judgement(UJUDGE) No.0-99 (Judgement of each distance difference)	The detected distance difference is within the Judgement limits of distance difference.
Smart Edge (Circle) (SEC) No.0-999	Judgement (JUDGE)	The judgements of Measurement Value, Standard Deviation, Circularity and Unused Edge Count are all OK.
	Measurement Judgement (LJUDGE)	Measurement Value*1) is within the range of the maximum/minimum limitations.
	Standard Devation Judgement (SJUDGE)	Standard Deviation is within the range of the maximum/minimum limitations.
	Circularity Judgement (CJUDGE)	Circularity is within the range of the maximum/minimum limitations.
	Unused Edge Count Judgement (FJUDGE)	Unused Edge Count is within the range of the maximum/minimum limitations.
	Individual Judgement (IJUDGE) No.0-3599	The result of the cell with the specified No. is OK (Undetected, excluded and NG cells are NG.)
Smart Edge (Line) (SEL) No.0-999	Judgement (JUDGE)	The judgements of Measurement Value, Standard Deviation, Linearity and Unused Edge Count are all OK.
	Measurement Judgement (LJUDGE)	Measurement Value*2) is within the range of the maximum/minimum limitations.
	Standard Devation Judgement (SJUDGE)	Standard Deviation is within the range of the maximum/minimum limitations.
	Linearity Judgement (JUDGE)	Linearity is within the range of the maximum/minimum limitations.
	Unused Edge Count Judgement (FJUDGE)	Unused Edge Count is within the range of the maximum/minimum limitations.
	Individual Judgement (IJUDGE) No.0-3599	The result of the cell with the specified No. is OK (Undetected, excluded and NG cells are NG.)
Geometry Calculation (GGC) No.0-999	Judgement (JUDGE)	All the judgements for the items set in Judgemen Limits are OK.
	X Judgement (XJUDGE)	IP X or Center X is within the range of the maximum/minimum limitations.
	Y Judgement (YJUDGE)	IP Y or Center Y is within the range of the maximum/minimum limitations.
	Standard Deviation Judgement (SJUDGE)	Standard Deviation is within the range of the maximum/minimum limitations.
	Angle Judgement (AJUDGE)	Line Angle is within the range of the maximum/minimum limitations.
	Distance Judgement (DJUDGE)	Distance is within the range of the maximum/minimum limitations.

*1) Measurement Value = Radius, Diameter or Width (decided according to the setting value of Detect Mode)
*2) Measurement Value = Deviation, Distance or Width (decided according to the setting value of Detect Mode)

Item		Condition for OK judgement
Geometry Calculation (GGC) No.0-999	Intersecting Angle Judgement (CAJUDGE)	Intersecting Angle is within the range of the maximum/minimum limitations.
	Radius Judgement (RJUDGE)	Radius is within the range of the maximum/minimum limitations.
	Major Axis Judgement (LAJUDGE)	Major Axis of Ellipse is within the range of the maximum/minimum limitations.
	Minor Axis Judgement (SAJUDGE)	Minor Axis of Ellipse is within the range of the maximum/minimum limitations.
Numerical Calculation (CAC/OCA)	CAC Numerical Calculation (JUDGE) No.0-999	Calculation result is within the Judgement limits.
	OCA Numerical Calculation Previous Result (JUDGE) No.0-999	-
Judgement (JRC/JDC)	JUC Judgement (JUDGE) No.0-999	Judgement formula returns true.
	JDC Judgement (JUDGE) No.0-999	-

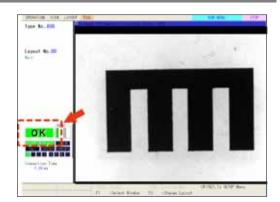
About Operators

Use operators to judge results of multiple checkers or numerical calculations.

+: Logical sum	Example: JD01=A+B			
Returns "OK (1)", if the result of either A or B is OK (1).	А	В	JD01	
Returns OR (1), if the result of either A of B is OR (1).	OK (1) OK (1)	OK (1)	
	OK (1) NG (0)	OK (1)	
	NG (0	D) OK (1)	OK (1)	
	NG (0	0) NG (0)	NG (0)	
*: Logical product	Example:	JD01=A*B		
Returns "OK (1)", if the results of both A and B are OK (1).	А	В	JD01	
Returns $OR(1)$, if the results of both A and B are $OR(1)$.	OK (1) OK (1)	OK (1)	
	OK (1) NG (0)	NG (0)	
	NG (0	D) OK (1)	NG (0)	
	NG (0)) NG (0)	NG (0)	
#: Exclusive OR	Example:	JD01 = A # B		
Returns "OK (1)", if the results differ between A and B.	A	В	JD01	
	OK (1) OK (1)	NG (0)	
	OK (1) NG (0)	OK (1)	
	NG (0	D) OK (1)	OK (1)	
	NG (0	D) NG (0)	NG (0)	
/: Negation	Example:	JD01=/A		
Reverses a judgement.	А	/	JD01	_
, ,	OK (1) Reversed	NG (0)	_
Do not put a symbol "/" before the multiple contents in parentheses. Wrong: JD01=/(A+B) Correct: JD01=/A+/B	<u>NG (0</u>)) Reversed	OK (1)	_
(: Left parenthesis	•	e contents in par	entheses by	
): Right parenthesis	priority.			

4.12.2 Total Judgement

Total Judgement is a judgement displayed in the status display area in RUN menu or SETUP menu. It can be output to the external devices solely. One of judgements per type can be registered as a Total Judgement. In User-Defined mode or Automatic Switch mode, a judgement can be registered as a Total Judgement for each block.



Selecting Total Judgement Expression

For "Execute All" execution mode

 Select "Condition" in judgement output setting window.
 "Condition" setting window is displayed.

Checker	Slice Level	Ргертосеза	Num.	Calcu.	Judgment.	
	Condition	STATISTICS.			COLUMN A COLUMN	
Total Judge.	100	000	- 84		Statistics of the	_
ave ing memory	No	STREET.	No.	Save	JRC/JDC at NG	
Inner Intrott	80		80	Output	JRC/JOC at MS	

2. Select "Condition" column of Total Judge.

Select a judgement type to register as a Total Judgement. [NO]: No Total Judgement [JRC]: Use a JRC(Internal) as a Total Judgement [JDC]: Use a JDC(External) as a Total Judgement

3. Select "Checker No." column and set a judgement number.

The result of the Total Judgement is displayed in the "Result" column.

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

Now you completed registering.

For "Automatic Switch" or "User-Defined" execution mode

1. Select "Condition" in judgement output setting window.

"Condition" setting window is displayed.

 Select "Total Judge." in the item selecting field on the upper left.
 The list of the Total Judgement by blocks is displayed.

Checker	Slice Leve	I Preproc	:055	Num.
fotal Judge.	-			
	Condition	Checker No.	Resul t	
Block0	JDC	000	NG	_
Block1	No			
Block2	No			
Block3	No			

3. Select "Condition" column of the block No. to set in the list and select a judgement type.

For details, refer to the procedure of "Execute All" execution mode.

- 4. Select "Checker No." column and set a judgement number.
- 5. After setting is completed, press the CANCEL key.

4.12.3 Selecting an Image Output Condition

Inspected images can be saved in the image memory of PV500 and output to the external devices when the judgement of the judging checker is "NG" during an inspection. Select a judging checker to be a condition to output images.

Note

This setting is available only when the condition of "Image Output" (or "Save Image Memory") is set to "NG judgement". These conditions can be set from "Input/Output" of "ENVIRONMENT".

Selecting a Condition Expression of Inspection Image Output/ Save in the Image Memory

For "Execute All" execution mode

1. Select "Condition" in judgement output setting window.

"Condition" setting window is displayed.

2. Select "Condition" column of Save Img. Memory or Image Output.

Condition	Charlent Nes	Broutt	Besci
100	000		
No			Save JRC
No.	And the second s	No	. Dutput JR
No	-		
No	1		
No Condition	151		100
THE .			
	JDC No No No No Condition	JDC 000 No No No Condition	JDC 000 EF No

Select a judgement type to register.

[No]: Images are not output or saved

[No Condition]: Not selecting a condition and output or save all images* [JRC]: Use a JRC(Internal) as a condition to image output/save [JDC]: Use a JDC(External) as a condition to image output/save

Note

*Select "No Condition" to temporarily output/save all images regardless of a judgement condition when the image output condition is set to "NG Judgement" which is in the window of "Input/Output" of "ENVIRONMENT".

When the other conditions are selected than "NG Judgement", the setting of Judgement window is invalid.

3. Select "Checker No." column and enter a judgement number.

The status of Image Output (or Save Image Memory) is displayed in the "Result" column. "No" indicates that image output/save is not executed because the condition is not fulfilled.

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

Now you completed registering.

For "Automatic Switch" or "User-Defined" execution mode

1. Select "Condition" in judgement output setting window.

"Condition" setting window is displayed.

2. Select "Image Output" (or "Save Image Memory") in the item selecting field on the upper left.

The list of the Save Image Memory or Image Output by blocks is displayed.

3. Select "Condition" column of the block No. to set in the list and select a judgement type.

For details, refer to the procedure of "Execute All" execution mode.

4. Select "Checker No." column and set a judgement number.

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

Now you completed registering.

Note

In case of automatic switch, as for the inspection image output and image memory save, only the setting for the block finally executed is enabled.

For example, if executing the operation in the order of block No. 0 \rightarrow block No.1 when the conditions for the inspection image output have been set for the block No. 0 only, the inspection image is not output as the conditions for the inspection image output have not been set for the block No. 1 finally executed.



4.13.1 What is Character/Figure Drawing?

Character/Figure Drawing is the function to draw figures or characters, and display them on the screen window.

The drawable figures are Line, Cross, Rectangle, Slanted rectangle, Ellipse and Character. For some shapes, an arrowhead can be added or figure can be filled.

As the function(*1) that refers the values detected by each checker is provided, not only drawing a figure of a fixed size at a fixed position but also changing the size or position depending on the inspection result is possible. The values of the data detected by each checker or judgement result (OK/NG) can be also displayed as well as a fixed text.

The color is selectable from eleven colors (Preset colors: 10, Optional color: 1). There is the function to switch the display color according to the judgement results of each checker.

Up to ten figures can be registered for one character/figure drawing.

► Note

- *1) Only the checkers set with the same camera can be referred.
- If the execution mode is "User-defined" or "Automatic Switch" when running a test in RUN Menu, the figure in the block that is not executed is not displayed. (Using the Marker function (page 289) displays a figure on the screen window of the specified camera regardless of the execution block.)
- Five kinds of figures and characters are collectively called "Figure" in this manual.

Ellipse

Examples of Figures

Cross

Line (Straight line)



Set the intersection

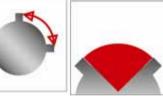
of a cross. The line

length can be

specified.



Set a start point and an end point. A half line can be displayed.

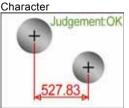


Set the center, width and height. Specifying the start and end angles enables to draw an arc or sector.

Rectangle, Slanted rectangle



Set a start point and an end point. The figure can be filled. Specify the center, width and height for "Slanted rectangle".



Display judgement results, detected data or fixed text characters. Specify the display position, character size and number of digits.

List of Menu Options

Character/Figure Drawing No.000 to 999*

- ₋ Comment
 - ⊢ Camera
 - ⊢ Color by Judgement
 - ⊢ Color (OK Color)
 - ⊢ NG Color

```
— Start XY, End XY
└ No.0 - 9 -
                             Line
                                                           — Segment / Half line 0 / Half line 1 /
                                           ⊢ Line Display
                                                                Wall-to-wall
                                           L
                                             Arrowhead — None / Start / End / Both
                                          ⊤ IP XY
                             Cross
                                           - Cross Display - Normal / Wall-to-wall
                                           ∟ Length
                                                         — 3 - 999

→ Start XY, End XY

                             Rectangle
                                           └ Solid
                                           Center XY, Width, Height, Angle
                             Slanted
                             rectangle
                                           ∟ Solid
                                          - Center XY, Width, Height, Start Angle, End Angle, Angle
                          ⊢ Ellipse
                                           ⊢ Solid
                                           L
                                              Arrowhead — None / Start / End / Both
                            Character
                                              Display Character
                          L
                                           \top
                                           ⊢ Coordinate XY
                                           ⊢ Character Size
                                                                     22 - 440
                                           ⊢ Display Base
                                                                     Top Left / Top Center / Top
                                                                     Right / Left Center / Center /
                                                                     Right Center / Bottom Left /
                                                                     Bottom Center / Bottom Right
                                           ⊢ Offset Unit
                                                                     Characters / Pixel
                                           ⊢ Offset X
                                           ⊢ Offset Y
                                           ⊢ Judgement
                                                                     10E/OKNGER
                                              Display
                                           ⊢ Digit Count
                                                                     1 - 15
                                                                     0 - 3
                                           F
                                              Decimal Digit
                                           L
                                              Alignment
                                                                     Left / Center / Right
                                                                ____
                                                                     * When the number of blocks is 10.
```

Creating Character/Figure Drawing

1. Select "Inspection" > "Draw Char/Fig." from the menu bar.

The list of Character/Figure Drawing checker is displayed. The number of figures that have been set in the highlighted checker number is displayed in the message field beneath the list. Example) No. of Set Figures 1/10

- **2.** Select the checker number to be set and press the ENTER key. The setting window for Character/Figure Drawing is displayed.
- **3.** Select a camera No. in "Camera".

The image of the selected camera is displayed.

Block No. Checker M		1	
000	<enter co<="" td=""><td>mment></td><td>-</td></enter>	mment>	-
001	ERROR (O	075)	
002			1
003			
004			
005			
006			
007			
800			
009			
010			
011			
012 No. of Sc	et Figures	1/10	2
(area)		1/10	2
No. of So Comment Camera		<u>`</u>	¥
No. of So Comment Camera	0 Judgemen Not set	<u>`</u>	2
No. of Si Comment Camera Color by Color NG Colo	0 Judgemen Not set	<u>`</u>	
No. of So Comment Camera Color by Color NG Colo	0 Judgemen Not set	<u>`</u>	
No. of So Comment Camera Color by Color NG Colo 1	0 Judgemen Not set	<u>`</u>	
No. of So Comment Camera Color by Color NG Colo	0 Judgemen Not set	<u>`</u>	

Setting Color

Set the color of figures. The display color can be switched or hidden depending on the judgement results (OK / NG) of the checkers with the same camera number.

4. If you want to change the display color depending on the judgement results of each checker, select "Color by Judgement".

(When you do not use the function to change the color depending on the judgement results, proceed to Step 6.)

The list of settable checkers is displayed. Unset checkers are shown in gray and cannot be selected.

5. Select the checker and checker number to be set.

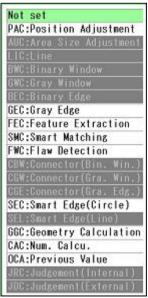
The selected checker and checker number is displayed in a symbol in the "Color by Judgement" field.

Note

When the checker which outputs more than one judgement results has been selected, specify which judgement result is used.

Example: When selecting "Smart Edge (Circle)"

Judgement, Measurement Judgement, Standard Deviation Judgement, Circularity Judgement, Unused Edge Count Judgement, Individual Judgement (Judgement of each cell)



6. When "Color" (Color by Judgement) has been set, select "OK Color" or "NG Color".

A total of twelve colors are available, which are "Hide", 10 preset colors and one user-specified color.

7. Select a desired color and press the ENTER key.

The box of the selected color is checked.

When you selected "Set RGB", set the values of RGB to create a desired color. The setting procedure is the same as that of "ENVIRONMENT" > "Color". (See page 319)

Selecting Figure

Up to ten figures with the same camera and color settings can be set.

8. Select the list of figure.

Now you can select No.0 to 9.

If more than one figure is created, the figure with the larger number is displayed in the front.

For example, rectangles of the same size are created in the same position, No.0 is in red and No.1 is in blue. In this case, only the blue rectangle of No.1 is displayed on the screen window.

1 2 3 4 5 5 6 Line 7 Cross 8 Rectansile 9 Slanted rectangle Ellipse Character

0

9. Select the figure number to set.

The available six figures are displayed.

10. Select the figure number to create.

The setting window of the selected figure is displayed. The items to specify the size of the figure and the display position are in the upper table, and the optional items to set appearance such as Arrowhead or Solid are beneath the table.

Refer to the next page for how to set each figure.

Note

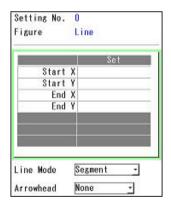
After the selection of a figure, it cannot be changed to another figure.

To change the figure, delete the current figure and recreate a new figure.

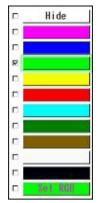
Note

The set figure name is displayed in the list.

When the figure name is displayed in red, it shows that the figure cannot be drawn correctly. Moving the cursor onto the figure number displays the reason why it cannot be drawn in the message field. Change the setting to draw the figure correctly.







Copying and Deleting Figure

Figures can be deleted or copied from the pop-up menu to be displayed by pressing the FUNC key.

- 1. Highlight the figure number you want to delete or copy and press the FUNC key.
- 2. Select "Delete" or "Copy".

When selecting "Delete", the dialog message appears. Select "YES".

 When selecting "Copy", move the cursor onto the figure number to paste, press the FUNC key, and select "Paste".
 The copied figure is pasted.

If a figure already exists in the destination, the message of overwrite confirmation appears. Select "Yes" to overwrite it.

4.13.3	Setting the	Drawing	Position and	Size of a	a Drawing
	U U				U U

Line (Straight Line)

Specify the X and Y coordinates of the start and end points to display a line. The start and end points can be specified with the cursor, values and the coordinates detected by each checker. For details of selectable items, see page 247.

Specifying Start Point and End Point

Select the table to set the start point XY and end point XY on the setting window of Line, and move the cursor onto "Start X" and press the ENTER key.

A list of available items is displayed. (The checkers displayed in gray indicates that they are not unset.)

2. Select the item to input in Start X from the list of the selectable items.

When selecting "Cursor", move the cross mark displayed on the screen window and press the ENTER key.

Note

About the items that X and Y-coordinates are input together When selecting items other than Numerical Calculation, System Register and Constant, X and Y-coordinates are input together. For example, when selecting "GEC: Gray Edge" for setting Start X, the XY-coordinate of the detected edge is input for Start X and Start Y. If Start Y has been already input, it is overwritten.

If you want to set the item that the X and Y-coordinates are input together to X-(or Y-)coordinate and the item that a single coordinate is input such as Numerical Calculation, System Register or Constant to Y-(or X-)coordinate, specify the item that the coordinates are input together first and then specify the item that a single coordinate is input.

3. In the same way, set Start Y, End X and End Y.

Copy Paste Delete	0	•
	Judgement Not set	4
Color		
NG Color		
0	Line	
	Line	

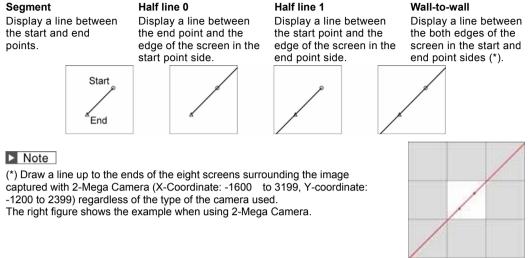
Setting No.	(
Figure	L	.ine
		Set
Start	Х	
Start	Y	
End	χ	
End	Y	
Line Mode	K	Segment -
Arrowhead	F	lone -

Set	tting No 0
Fi	PAC:Position Adjustment
	AUC:Area Size Adjustment
	BEC:Binary Edge
Ē.	GEC:Gray Edge
-	FEC:Feature Extraction
-	SMC:Smart Matching
-	FWC:Flaw Detection
	CGE:Connector(Gra. Edg.)
	SEC:Smart Edge(Circle)
	SEL:Smart Edge(Line)
	GGC:Geometry Calculation
_	CAC:Num. Calcu.
Li	OCA:Previous Value
Ar	System Register
A.	Constant
	Cursor

Optional Settings

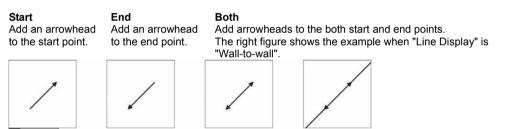
1. Select "Line Display".

Select the type of the line from the following four types.



2. Select "Arrowhead".

Set this when adding arrowhead to the line.



Note

When "Line Display" is set to "Half line 0", "Half line 1" or "Wall-to-wall", the arrowheads are displayed at the start and end points.

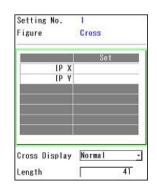
Cross

Specify the X and Y coordinates of the intersection point of a cross to display a cross. The intersection point can be specified with the cursor, values and the coordinates detected by each checker. For details of selectable items, see page 247.

Specifying Intersection Point

 Select the table to set the intersection point X and Y on the setting window of Cross, and move the cursor onto "IP X" and press the ENTER key.

A list of available items is displayed. (The checkers displayed in gray indicates that they are not unset.)



2. Select the item to input in IP X from the list of the selectable items.

When selecting "Cursor", move the cross mark displayed on the screen window and press the ENTER key.

Display the cross of the length up to the ends of the screen. (*)

About the items that X and Y-coordinates are input together (page 238)

3. In the same way, set IP Y.

Optional Settings

Set the length of a cross.

1. Select "Cross Display".

Normal (Default)

Wall-to-wall

Display the cross of the length specified in the next step.

+

(
-	-

Note

(*) Draw a line up to the ends of the eight screens surrounding the image captured with 2-Mega Camera (X-Coordinate: -1600 to 3199, Y-coordinate: -1200 to 2399) regardless of the type of the camera used. The right figure shows the example when using 2-Mega Camera.

2. When selecting "Normal" in "Cross Display", set the length of the cross in "Length".

The length to be set is the total length of the vertical line and horizontal line of the cross. The available value is an odd value in the range of 3 to 999 (pixels).

Rectangle

Specify the X and Y coordinates of the start and end points to display a rectangle. The start and end points can be specified with the cursor, values and the coordinates detected by each checker. For details of selectable items, see page 247.

Specifying Start Point and End Point

Refer to the procedure of "Specifying Start Point and End Point" for Figure: Line (page 238).

Optional Setting

Rectangle can be filled.

1. Select "Solid".

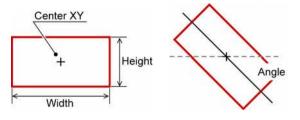
No (Default): Displays only the frame border of rectangle. **Yes**: Fills the inside of rectangle with the same color of the frame boarder.



Slanted Rectangle

Specify the center coordinate, width, height and rotation angle to draw a slanted rectangle. For details of selectable items, see page 247.

Setting Size of Rectangle, Rotation Angle and Display Position



Specifying Center Coordinate

1. Select the table on the setting window of Slanted rectangle, and move the cursor onto "Center X" and press the ENTER key.

A list of available items is displayed. (The checkers displayed in gray indicates that they are not unset.)

2. Select the item to input in Center X from the list of the selectable items.

When selecting "Cursor", move the cross mark displayed on the screen window and press the ENTER key.

Refer to

About the items that X and Y-coordinates are input together (page 238)

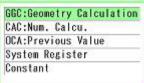
3. In the same way, set Center Y.

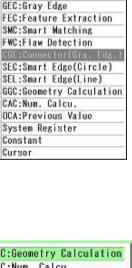
Specifying Width and Height

4. Move the cursor onto "Width" and press the ENTER key.

A list of available items is displayed.

- 5. Select the item to input in Width from the list of the selectable items.
- 6. In the same way, set Height.





Slanted rectangle

41.000 41.000

0.000

*

Setting No. 0 Figure

> Center X Center Y

> > Width

Height

Cursor

Solid

Angle

No

PAC:Position Adjustment

Specifying (Rotation) Angle

Set the rotation angle of the rectangle. Specify the angle in a range of -360 to 360 regarding the position at three o'clock as 0 degree. Clockwise is positive angle (0 to 360) and counterclockwise is negative angle (0 to -360).

Note

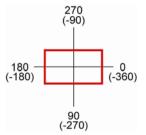
When specifying a value of Numerical Calculation or System Register for the reference of the angle, the value may exceed +/-360. In that case, the angle of the remainder is automatically calculated by dividing the input value by 360.

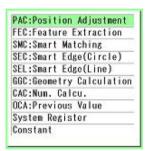
Example) When the value of System Register is 750 750 divided by 360 is 2, and the remainder is 30. = 30 degrees

7. Move the cursor onto "Angle" and press the ENTER key.

A list of available items is displayed.

8. Select the item to input in Angle from the list of the selectable items.





Ellipse

Specify the center coordinate, width, height and (rotation) angle to draw an ellipse. An arc can be also drawn by specifying the angle range.

For details of selectable items, see page 247.

Setting Size of Ellipse, Position and Angle

Refer to

The setting procedures of Center, Width and Angle are the same as that of "Slanted rectangle". Refer to page 241.

Setting Start Angle and End Angle Drawing Elliptic Arc)

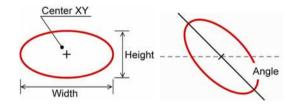
To draw an elliptic arc, set the start and end points of the arc by specifying the angles. The start point is called Start Angle and the end point is called End Angle. In the same way of (Rotation) "Angle", set them in a range of -360 to +360.

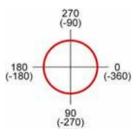
Note

When specifying a value of Numerical Calculation or System Register for the reference of each angle, the value may exceed +/-360. In that case, the angle of the remainder is automatically calculated by dividing the input value by 360.

Example) When the value of System Register is 750

750 divided by 360 is 2, and the remainder is 30. = 30 degrees





1. Move the cursor onto "Start Angle" and press the ENTER key.

A list of available items is displayed. (The checkers displayed in gray indicates that they are not unset.)

- 2. Select the item to input in Start Angle from the list of the selectable items.
- 3. In the same way, set End Angle.



End

Solid

No

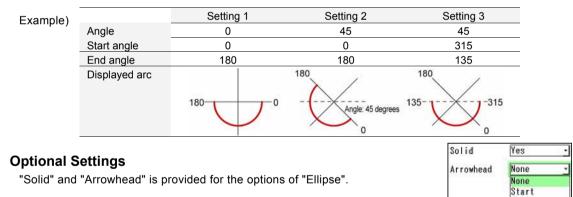
Both

Yes

About 0-degree Position

The position of "0 degree" for the start and end angles is at three o'clock as mentioned above. However, if the ellipse is rotated (when the angle specified in the previous section is other than 0), the specified angle is at the position of 0 degree.

Note that the position of the displayed arc varies when the (rotation) angle of each ellipse differs even if the same values are set to the start and end angles as shown in the example below.

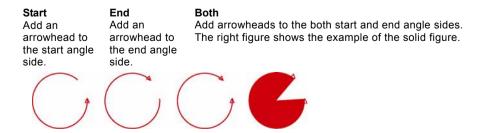


1. Set "Solid".

When filling an arc, the area from the start angle to the end angle is filled as shown in the right figure.

2. Set "Arrowhead".

Select one from the following three types to add the arrowhead.



Character

Displays a maximum of 16 one-byte characters such as inspection results of checkers and system values. Set the characters to display, display position, character size, number of digits and alignment.

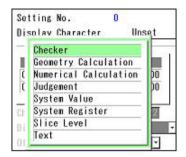
Specifying Characters to Display

1. Select "Display Character" in "Character" setting window.

A list of available items is displayed. (The items displayed in gray indicates that they are not unset.)

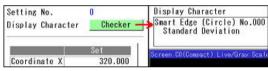
The data that can be set for each item is as follows.

Checker:	Comment of each checker, Inspection result (*Same as the items that can be input in Numerical Calculation)
Geometry Calculation:	Comment, Inspection result
Numerical Calculation:	Comment, Inspection result (Previous value is selectable.)
Judgement:	Comments of JRC(Internal), JDC(External), Judgement
System values:	Inspection time, Inspection frequency, Total judgement, Scan count, Type No.
System Register:	System Register 0 - 7
Slice Level:	Maximum and Minimum values of each slice level group
Text:	Up to 16 one-byte characters



2. Select characters to display from the list.

After the selecting is completed, the detail of the displayed characters is shown in the upper part of the screen window.

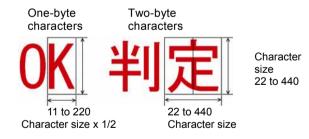


Character Size and Display Base

About Character Size

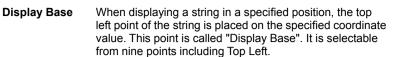
Specify the vertical size of a character in the range of 22 to 440 pixels by 22. This size includes the vertical size of the character, top and bottom margins.

As shown in the right figure, the horizontal and vertical sizes of two-byte characters are the same, however, the horizontal size of one-byte characters is a half of the vertical size.



About Display Position

Coordinate X, Coordinate Y Refer the coordinate values detected by each checker, results of numerical calculation or values stored in the system registers, or specify specific positions with values or the cursor. It is also possible to refer the coordinate of the characters that have been set for the currently setting Character/Figure Drawing checker. However, only the character coordinate that has been set to the smaller number than the currently setting number can be referred.

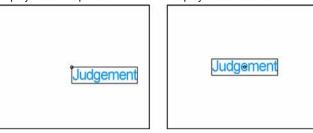




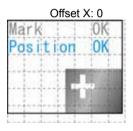
 Note
 Differences in the display positions among display bases

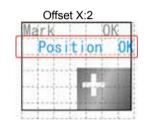
 Example)
 When setting Coordinate X and Y to the center of the screen

 Display Base = Top Left
 Display Base = Center



Offset It is used to move strings from Coordinate X and Coordinate Y for a certain amount to display. The amount of moving strings is called "Offset" and the unit is "Offset Unit". Select either "Characters" or "Pixel" for Offset Unit. When the offset unit is "Characters", a one-byte character of the size specified in "Character Size" is counted as one character.





1. Select the table to set the coordinate X and Y, and move the cursor onto "Coordinate X" and press the ENTER key.

A list of available items is displayed. (The checkers displayed in gray indicates that they are not unset.)

For details of selectable reference items, see page 247.

2. Select the item to input in Coordinate X from the list of the selectable items.

When "Character" has been already created in the number smaller than the currently setting figure number, the coordinate of that character can be referred.

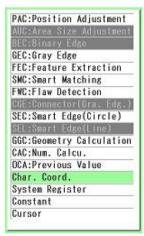
Refer to

About the items that X and Y-coordinates are input together (page 238)

- 3. Set "Coordinate Y".
- 4. Set "Character Size".

Settable Range: 22 to 440

	Set
Coordinate X	320.000
Coordinate Y	240.000
Character Size	22
Display Base	Top Left
Offset Unit	Characters •
Offset X	0
Offset Y	0



5. Set "Display Base".

Select from nine points (the encircled positions in the right figure), which are eight points on the circumscribing rectangle of the characters (including margins) and the center point.

Top Left (Default) / Top Center / Top Right / Left Center / Center / Right Center / Bottom Left / Bottom Center / Bottom Right

Note

When the displayed characters are numerical values, the size of the circumscribing rectangle of characters depends on the "Digit Count" optionally set.

6.	Set "Offset Unit", "Offset X" and "Offset Y".	
----	---	--

The settable offsets X and Y are as shown in the right table.

Offset Unit	Offset X	Offset Y
Character (Default)	±145	±54
Pixel	±1600	±1200

Optional Settings for Display Method

The following options are available depending on created display characters. Set as necessary.

Judge Display: "1/0/E" (Default) / "OK/NG/ER"

When Display Character is Judgement, select either values or characters to display the judgement.

Digit Count: 1 to 15

Set when Display Character is numerical values. Specify the digit number that is over the displayed values. Set the total digit number including the symbol for negative values, decimal point for actual values and the number of decimal places.

Note

When the digit number of the displayed value exceeds the specified digit count, all the digits are displayed as asterisks "*".

Decimal Digit: 0 to 3

Set when Display Character is actual values.

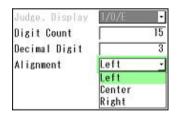
When the specified digit number is smaller than the number of decimal places for the displayed value, the value is rounded to the specified digit number.

Example) When Display Character is 100.125 and Decimal Digit is 2, the displayed value is "100.13".

Alignment: Left (Default) / Center / Right

Set when Display Character is numerical values. Select the alignment of characters when the displayed characters are smaller than the specified digit count.

Judge. Display	1/0/E ·
Digit Count	1/0/E
Dealers Black	OK/NG/ER





A list of the Data Can Be Referred to Figure

	Coordinate X, Y	Width, Height	Angle
PAC: Position Adjustment	O Base Position Coord. Detect Position Coord. Base Coord. (Detect Coord. of Base Checker)	×	O Base Position Angle Detect Position Angle
AUC: Area Size Adjustment	0	×	×
BEC: Binary Edge	0	×	×
GEC: Gray Edge	0	×	×
FEC: Feature Extraction	O Center of Gravity Coord. Circumscribing Rectangle Coord. (Upper left, Upper right, Lower left, Lower right)	×	O (Principal axis angle)
SMC: Smart Matching	0	×	0
FWC: Flaw Detection	0	×	×
CGE: Connector (Gray Edge)	O Area 0 Area 1 (*a	×	×
SEC: Smart Edge (Circle)	O Center Coord. 0 Center Coord. 1 (*b Cell Individual Result 0 Cell Individual Result 1 (*c	×	O Max. Angle Min. Angle
SEL: Smart Edge (Line)	O Max. Measurement Coord. Min. Measurement Coord. Line0 Start Coord. Line0 End Coord. Line1 Start Coord. (*b Line1 End Coord. (*b Cell Individual Result 0 Cell Individual Result 1 (*b	×	O Line 0 Angle Line 1 Angle (*b
GGC: Geometry Calculation	0	O Distance/Radius/Major Axis/Minor Axis	0
CAC: Numerical Calculation	0	0	0
OCA: Numerical Calculation (Previous Result)	0	0	0
Character Coordinate (*d)	O (Character coord. of Character/Figure Drawing)	×	×
System Register	0	0	0
Constant	0	0	0
Cursor	0	×	×

*a) When selecting "Gap", "Float" or "Width Measurement" in "Execution Mode"
*b) When selecting "Measure Width" in Detect Mode
*c) When selecting "Measure Width" or "Measure Diameter" in Detect Mode
*d) Only when Figure = Character

Note

The checker with a camera number different from that selected for the setting Character/Figure Drawing checker cannot be referred.

4.14 Checker List

This function shows setting status and execution result of the checkers, position adjustments, area size adjustments, numerical calculations, judgements and character/figure drawing. To change the settings of them, you can jump to the setting window from this window.

In this function, all displayed items in the table are called "checker" including position adjustment, judgement and character/figure drawing as well as the general checkers.

Displaying Checker List

- **1.** Select "INSPECTION" from the menu bar.
- 2. Tilt the ENTER key right and select displayed "Checker List".

The checker list is displayed.

3. Press the TRIG key.

A test is executed and its result appears on the screen.

When a live image is displayed on the screen, PV captures a new image first and runs a test. When a memory image is displayed, it runs a test using the current memory image without capturing any images.

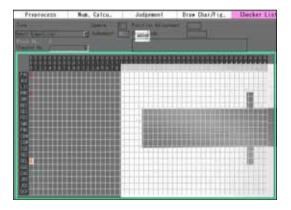
Checker Pattern displayed on Screen Window

High transparency setting of the SETUP menu allows an image or checker patterns on the screen window, which is overlapping with the window of Checker List, to be seen.

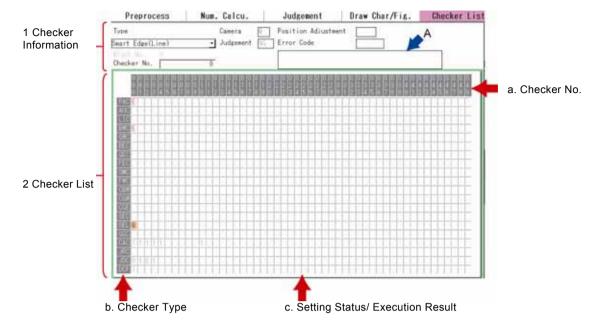
When its camera setting is the same as that of the image currently displayed on the screen window, the checker pattern selected in the checker list is displayed in orange.

The condition to display the checker patterns for checkers other than the selected checker is determined by the setting of "Pattern Display" in the Image Menu.

Refer to page 84 for the details of setting procedure.



Overview of Checker List



1. Checker information

It displays the information of the checker selected in Checker List described in 2. Selecting the checker outputting the judgement of which is error ("E") shows detail of the error in the field of A in the figure above.

2. Checker List

a: Checker No.

Fifty checkers are displayed per page. (e.g. No.000 - 049) To display checkers after No.050, tilt the ENTER key left/ right. Tilting the ENTER key and pressing the SHIFT key switches pages.

b: Checker type

The checkers are displayed in symbols. It displays Position adjustment on the top line and Judgement (output) on the bottom line.

Checker type is displayed in the area of 1. Checker information.

c: Setting status/ Execution result

This field shows the setting status and the execution result of the checker type and checker No. of the selected cell in the following symbol and color. You can change the displaying colors.

Blank:	Unset
"1" (Green):	Already set, Judgement: OK
"0" (Pink):	Already set, Judgement: NG
"E" (Red):	Already set, Judgement = Error Error information is displayed in the "A" field of the checker information display area.
Highlight Color (Yellow):	In some cases, selecting the cell of Position Adjustment (PAC) displays some other cells in yellow. This indicates that the PAC that you are selecting is adjusting the checker displayed in yellow.

Changing Display Color

The color of characters displayed in the checker list, of selecting cells and of enhanced cells can be changed.

1. Press the FUNC key on the Checker list window.

The pop-up menu appears.

2. Select "Colors.

The color setting window appears.

3. Select an item to change its color.

The amount of containing Red, Green and Blue of the current color of the selected item are displayed in the values of 0 to 255.

4. Adjust RGB values to make a desired color.

The larger value makes the brighter color. The smaller value makes the darker color.

Changing the value updates the color of "Enter" button. Observe it to adjust the color.

5. When it became the desired color, select "Enter". After setting is completed, press the CANCEL key.

The color setting window reappears.

Note

After setting the RGB values, pressing the CANCEL key before selecting "Enter" restores the color.

6. After setting the color, press the CANCEL key.

It returns to the checker list window.

Changing Checker Settings (Jump to Setting Window)

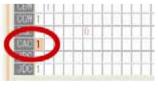
After running a test by the TRIG key on the Checker list window, you can jump to the setting window from it the Checker List to change or refer to the checker setting.

- **1.** Tilt the ENTER key up/down on the Checker list window to select the checker list.
- 2. Select a cell of the checker type and No. to change the setting.

The setting window of the selected checker appears.

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

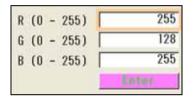
It returns to the checker list window.

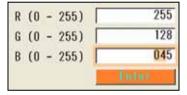


APPENDED THE HEAD WORLD	THE COLUMN	E SHEREAR TOLL		CT/F HERE	110
Prearecess	Num, Calcu.	Automent	Checkar Lint	Eroup Nove	
Numerical Calenda	ties CACODO				
Comment					
Expression					
CELEDS_FXW					
unction Descript	iet))				
uncline Bescript	ies	Kanima	1	100.000	
unction Bescript	ien .	A CONTRACTOR OF	-		
function Descript	ies ()	Minimu	-	100.000	
unction Rescript	les .	A CONTRACTOR OF) Jm		
function Reportat	100	Minimut Output	3n	0.000 	
function Descript	ien)	Minimu	31		

		5	
OPERATION ENVIRONM	ENT TYPE	INSPECT	ION
Slice Level	Preprocess		
Colors Display Patterns	- Ci	amera	
Block No. 0	J	udgement	
Checker No.	0		

Selected Cell Color	
OK Color	
NG Color	
ERROR Color	
Highlight Color	





Chapter 4

4.15 Outputting Inspection Results to the External Device

PV500 has features of outputting judgements of inspections and results of numerical calculations through the parallel I/O connector, the I/O terminal block, and the ports, and writing them in an attached SD memory card. In addition, captured images can be saved in a PC through Ethernet port and written in an attached SD memory card.

Multiple data can be output to multiple destinations. For example, a judgement is output to the I/O connector, a result of numerical calculation is output to a PLC through the COM.0 port, and an inspection image is output to a PC through Ethernet port at the same time.

These settings are set in "Input/Output" setting window.

Displaying the Input/Output Setting Window

- **1.** Select "ENVIRONMENT" from the menu bar.
- 2. Select "Input/Output".

"Input/Output" setting window is displayed.

OPERATION ENVIRONMENT 1	TYPE INSPECTION	SAVE/READ TOO
System Settings In	put/Output	Camera
Parallel 1/0	REND OFF MIN	(m)
Parallel 1/0 Output	ACCEPT OFF M	
Serial	Set Signal A	
General Output	Set Signal A	
Image Output	Set Signal A	
Save Image Memory	Set Signal A	
Print Screen	Set Signal A	

4.15.1 Outputting through Parallel I/O

Scan count, Judgement, or result of numerical calculations can be output to the parallel I/O connector and Judgement No.0-7 can be output to the parallel I/O terminal block.

Outputting a Result of Judgement Expression

Note

- Judgement that can be output is JDC (External output register). JRC (Internal register) cannot be output.
- When outputting a Judgement result while you inspect in "Automatic Switch" mode, PV outputs the result of only the block executed lastly.

Outputting Judgement No.0-15 (No.0-7)

When execution mode is "Execute All", Judgements No.0-15 are output to the "OUT0-15" of the I/O connector and Judgements No.0-7 are output to the "OUT0-7" of the I/O terminal block.

When execution mode is "User-Defined" or "Automatic Switch", 16 points are output to the "OUT0-15" of the I/O connector and 7 points are output to the "OUT0-7" of the I/O terminal block in ascending order from the smallest number of judgement of the executed block or the last executed block respectively.

- Select "Parallel I/O Output" in "Input/Output" setting window.
- 2. Select "Once, Judgement(16 bit)" for "Output Data".

OPERATION ENVIRONMENT T	YPE INSPECTION	SAVE/READ TOOL		SETUP MENU
System Settings	out/Output	Camera	Color	Password
Parallel 1/0 Parallel 1/0 Dutput Serial General Output Image Output Save Image Memory Print Screen	Output Data Handshake Scan Count Judgement Numerical Cal Bit Width (bi Data Bit (bit Output Signal Timeout (ms)	it)	Yes No Dutput No 16 16	ement(16 bit)

3. Set "Output Signal Guarantee Time".

Settable range is 1 - 1000 ms. (Default: 10 ms)

After outputting OUT signal and TACT signal, PV500 holds to output for the time specified in the item. TACT signal turns off after the specified time passes. (Whether OUT signal is held or reset depends on the setting in "System Settings" > "Operation" > "Parallel I/O Output Reset Condition".)

For more details, refer to Chapter 8.3 Timing Chart, page 356.

Now you completed the setting.

Outputting All Judgement (JDC) That Have Been Set

Results of setting judgement expressions can be output (up to 1000 data).

Using "OUT0-15" of data of the I/O connector, the results are output divided in 16-point unit. (The data can be output by 8 points using "OUT0-7".) As a timing signal of data communication, STROBE signal of I/O connector, or STROBE signal and ACKNOWLEDGE signal are used.

Refer to

About output timing of signals, refer to Chapter 8.3.2 Outputting All Results (Output = All), page 360.

- 1. Select "Parallel I/O Output" in "Input/Output" setting window.
- 2. Select "All Selectable" for "Output Data".
- 3. Set "Judgement" to "Output".

4. Set "Bit Width".

[8-bit]: Outputs by 8 data using 8 points of "OUT0-7" [16-bit]: Outputs by 16 data using 16 points of "OUT0-15" Refer to the next section for output example.

5. Set "Handshake".

Handshake is to output data while communicating completion signals of sending and receiving with external devices.

- "Yes": As a data output completion signal. STROBE signal is used and as a signal to receive a data receive completion signal of external devices, ACKNOWLEDGE signal is used.
- As a data output completion signal. STROBE signal is used. Not using ACKNOWLEDGE "No": signal, the next data will be output after a certain period of time. In this method, PV500 does not confirm whether the external device has received data or not.

Note

"Data Bit" is a parameter for outputting Numerical Calculation and Scan Count. If you output only Judgement, it is not necessary to set. (The setting value of Data Bit does not influence the output result of Judgement.)

OPERATION ENVIRONMENT	TYPE INSPECTION	SAVE/READ TOOL		SET
System Settings	nput/Output	Camera	Color	
Parallel 1/0 Parallel 1/0 Output	Output Data Handshake		All sel	ectab
Serial General Output	Scan Count		No	2
Image Output	Judgement Numerical C	alculation	Output	
Save Image Memory Print Screen	Bit Width (Data Bit (b		16	-
	4-	al Guarantee Time(10
	Timeout (ms)		5000

table

6. Set "Output Signal Guarantee Time".

Settable range is 1 - 1000 ms. (Default: 10 ms)

When Handshaking is not employed: OUT signal is output in the doubled cycle of the time specified in this item.

When Handshaking is employed:

After handshaking of the first inspection, output of the second inspection is not executed during "Output Signal Guarantee Time".

7. Set "Timeout (ms)" when you employ handshake.

Settable range is 4 - 2000 ms. (Default: 5000 ms) Specify maximum time from data output to ACKNOWLEDGE signal (data receipt completion signal) input from the external device. If ACKNOWLEDGE signal is not input within this period, a time error occurs and ERROR0 signal is output.

Output Example when outputting only Judgement

Output Data Assignment in the case of "8 bit" (1000-data output)

	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
1st	JDC007	JDC006	JDC005	JDC004	JDC003	JDC002	JDC001	JDC000
2nd	JDC015	JDC014	JDC013	JDC012	JDC011	JDC010	JDC009	JDC008
				:				
125th	JDC999	JDC998	JDC997	JDC996	JDC995	JDC994	JDC993	JDC992

Output Data Assignment in the case of "16 bit" (1000-data output)

	OUT	OUT	OUT	OUT	OUT	OUT	OUT	OUT								
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1st	JDC	JDC	JDC	JDC	JDC	JDC	JDC	JDC								
	015	014	013	012	011	010	009	008	007	006	005	004	003	002	001	000
2nd	JDC	JDC	JDC	JDC	JDC	JDC	JDC	JDC								
	031	030	029	028	027	026	025	024	023	022	021	020	019	018	017	016
								:								
63rd	OFF	JDC 999	JDC 998	JDC 997	JDC 996	JDC 995	JDC 994	JDC 993	JDC 992							

Note

Until the last number of data which has been set a judgement expression, data will be output. For example, when No.0-5 and No.30 are set, No.0-30 are output and after No.30 is not output. No.6-29 are output "OFF".

In the case of Execution Mode = Automatic Switch

(When the lastly executed block = Block No.3, Bit Width [8 bit])

	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	OUT0
1st: Ju	ıdgemen	t result o	f Block I	No.3				
	JDC	JDC	JDC	JDC	JDC	JDC	JDC	JDC
	307	306	305	304	303	302	301	300

Afterwards, outputs to the last number of judgement expression created in Block No.3.

*Only the results of the block executed lastly are output.

Outputting Scan Count and Numerical Calculation

Scan Count and Results of Numerical Calculations can be output to "OUT0-15" (or "OUT0-7") of the I/O connector dividing in multiple times.

Note

- Numerical Calculations can be set to output or not for each expression. Only the expression that is set to "Output" is output.
- The output order is Scan Count -> Judgement -> Numerical Calculation.
- When outputting a numerical calculation result while you inspect in "Automatic Switch" mode, PV
 outputs the result of only the block executed lastly.

Refer to

About output timing of signals, refer to Chapter 8.3.2 Outputting All Results (Output = All), page 360.

- 1. Select "Parallel I/O Output" in "Input/Output" setting window.
- 2. Select "All Selectable" for "Output Data".
- **3.** To output Scan Count and Numerical Calculation, select "Output" for them.

Parallel I/0 Output Data All selectable Parallel I/0 Output Handshake Yes • Serial Scan Count Output • General Output Judgement Output • Image Output Numerical Calculation Output • Save Image Memory Bit Width (bit) 16 • Output Signal Guarantee Time(ms) 10 Timeout (ms) 5000

OPERATION ENVIRONMENT TYPE INSPECTION SAVE/READ TOOL

4. Set "Bit Width".

Select it depending on the value of output data.

[8-bit]:	Outputs to "OUT0-7" by 8-bit. When "Data Bit" is 32-bit, it outputs by 8-bit in four divided data from lower bit.
[16-bit](default):	Outputs to "OUT0-15" by 16-bit. When "Data Bit" is 32-bit, it outputs by 16-bit in two divided data from lower bit.

Note

Refer to the next section for output example.

5. Set "Data Bit".

Select it depending on the maximum value of output data.

	Value that can be output
[8bit]:	0 to 255
[16bit]:(default)	0 to 65535
[32bit]:	-2147483648 to 2147483647 *Negative values are output in the complement number of 2.

Note

Setting of "8-bit" and "16-bit":

- Negative values cannot be output. If the values are negative, the result is output as "0".
- The data exceeding the output range (8-bit or 16-bit) will be output as value of "0".

6. Set "Handshake" and "Output Signal Guarantee Time (ms)". When you employ handshake, specify "Timeout (ms)".

See the section of "Outputting All Judgement (JDC) That Have Been Set", page 252.

Example of Bit Assignment when outputting numerical data

	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1	Ουτο
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

In the case of Data Bit: 32-bit, Bit Width: 8-bit

In the case of Data Bit: 32-bit, Bit Width: 16-bit

0 04		. Duta														
-	UT 15	OUT 14	OUT 13	OUT 12	OUT 11	OUT 10	OUT 9	OUT 8	OUT 7	OUT 6	OUT 5	OUT 4	OUT 3	OUT 2	ОUТ 1	OUT 0
1st (I	Low	er 16bi	its)	-		-		-	-		-					
Bi	it15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
2nd ((Higl	her 16	bits)													
Bi	it31	Bit30	Bit29	Bit28	Bit27	Bit26	Bit25	Bit24	Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16

Example of Output Data Assignment in Automatic Switch execution mode

In the case of outputting Numerical Calculation with Bit Data: 8-bit and Bit Width: 8-bit (When the lastly executed block = Block No.5)

T7 OUT6	OUT5 OUT4	OUT3	OUT2	OUT1	OUT0
---------	-----------	------	------	------	------

1st: Numerical Calculation CAC400

Bit7 Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 Bit0

2nd: Numerical Calculation CAC401

Bit7 Bit6 Bit5 Bit4 Bit3 Bit2 Bit1	Bit0
------------------------------------	------

Afterwards, outputs to the last number of numerical calculation expression created in Block No.5 and set to output.

Example of Output Data Assignment

Scan Count, Judgement, and Numerical Calculation output with Bit Data: 32-bit and Bit Width: 16-bit

Scan Count = 100, Judgement=JDC000-14(15 points), Numerical Calculation CAC000=70000

	OUT 15	OUT 14	OUT 13	OUT 12	OUT 11	OUT 10	OUT 9	OUT 8	OUT 7	OUT 6	OUT 5	OUT 4	OUT 3	OUT 2	ОUТ 1	OUT 0
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 0-14)																
	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 (Lo	4th (Lower 16 bits of CAC000)															
	0	0	0	1	0	0	0	1	0	1	1	1	0	0	0	0
5th (H	igher 1	6 bits	of CAC	C000)												
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Specify a type of output data, destination and output condition.

Data That Can Be Output

- Scan Count: 0 2147483647
- Total Judgement: 1 (OK) or 0 (NG/Error) Regardless of "No. of Digits" setting, 1-digit data is output per judgement.
- Result of Judgement Expression (up to 1000 points): 1 (OK) or 0 (NG/Error) Regardless of "No. of Digits" setting, 1-digit data is output per judgement.
- Result of Numerical Calculation (up to 1000 data): -214783648.000 to + 2147483647.000.

Note

Scan Count will be automatically reset and return to "0" when you turn off the power of PV500 or switch types. In addition, resetting statistics data by I/O input or command input resets Scan Count as well.

Output Destination

Output destination setting can be set in "General Output" setting window.

Serial (COM.0):

To output to COM.0 port. With certain PLCs, you can make "PLC communication" which allows to write data in a register of PLC directly.

Refer to Refer to page 391 about PLC communication.

Ethernet:

Through Ethernet port, data can be received with PC or PLC.

(TCP/IP connection is established with PC or PLC as "TCP/IP client" and with PV500 as "TCP/IP server".)

With certain PLCs, you can make "PLC communication" which allows to write data in a register of PLC directly. When you use a PC, prepare Hyper terminal or Telnet software. PC or PLC is needed to be in the status where they can always receive data.

Date and time can be added to the header of data to output.

Note In this case, the port number of PV500 is "8601".

Refer to Refer to page 326 for information of TCP/IP settings.

SD Memory Card:

To write data on a text file in a SD memory card attached to the memory card slot of PV500. Time can be added to the header of data to output.

The name of a text file to write data on and saving path are as follows.

- File name: yymmdd.txt (yymmdd is read from information of the built-in calendar of PV500.)
- Path: ¥Panasonic MEW Vision¥PV500¥Result¥

Displaying General Output Setting Window

- Select "ENVIRONMENT" > "Input/Output" from the menu bar.
- 2. Select "General Output" in "Input/Output" setting window.

the second se	un I/Datast	EAVE/REX0 TOOL Camera	Cutor	Pass
System Settings D Parallel 1/0 Parallel 1/0 Output Serial Genetal Output Image Output Save Image Memory Print Screen	Destination Protocol Date and Tis Scan Count Tetal Judges	- -	Note Sone Serial (COR I thanket SD Card Million	
	No. of Digit Decimal Digit Unumped Digit	t)	fill sim i Set	

Selecting Destination and Output Data

1. Select a data destination in "Destination".

You can select only one type as a destination.

Note
Select "Protocol" when you selected "Serial (COM.0)". Refer to page 391 about PLC communication.

2. To output Date and Time, select "Output",

For "SD Card" setting of destination, setting "Date and Time" to "Output" adds "Time" to output data. Date and Time cannot be added when the destination is "Serial (COM.0)".

3. To output Scan Count/ Total Judgement/ Judgement/ Numerical Calculation, select "Output".

4. To output BCC (block check code), select "Output".

BCC cannot be added when the destination is "SD Card".

Specifying Digit Number of Output Data

In general purpose communication, real numbers (values including after decimal point) can be output. Set the digit number of integer and after decimal point.

- **1.** Specify total digits of integer part and after decimal point in "No. of Digits".
- 2. In "Decimal Digit", specify digits for after decimal point used from the digits set in step 1.

If you set "No. of Digits" = 14 (default) and "Decimal Digit" =3 (default), the value consisting of 11-digit integer and 3-digit decimal number is output. If you set "Decimal Digit" = 2 or 1, the value is rounded.

System Settings Inc	put/Dutput	Camera	Color	Passwor
Parallel 1/0 Parallel 1/0 Oxtput Serial Ceneral Oxtput Save Image Output Save Image Memory Print Screen	Destination Protocol Date and Ti Scan Count Total Judge Judgement Numerical C BCC No. of Digi Decimal Dig Unused Digi PLC Communi	me ment alculation ts it	NO NO NO NO NO	rroose Comm.

When the value exceeding the specified digits is processed, the value is output as "0" and an error signal is output.

3. Set "Unused Digit".

If the digit number of the data is less than the output digit number you have set, select a handling of unused digit.

Comma Separated:	Unused digits are deleted. Multiple data are output in different number of digits. Data are separated with a comma (",") before being output.
Filled with '0' (default):	Unused digits are filled with "0". Although the data become longer, multiple data are output in the same number of digits.

Example of Output

Output Data:	Date:	2008/01/15
-	Time:	09:25:48
	Scan Count:	1234 times
	Total Judgement:	OK
	Judgement:	JDC000 = OK, JDC001 = unset, JDC002 = NG
	Numerical Calculation:	CAC000 = 215.8, CAC001 = unset, CAC002 = -368.0
Output Condition:	Date and Time:	Output (Not available when Destination is Serial(COM.0))
	No. of Digits:	6
	Decimal Digit:	1
	Unused Digit:	Filled with '0'
	BCC:	Output (Not available when Destination is SD Card)
	Unused Digit:	

Output destination="Serial (COM.0)":

0 0 1 2 3 4	1	1	0	0 0 2 1 5 8	- 0 3 6 8 0	BCC	CR
Scan Count	Total Judge.	Judge	ement	Numerical Calculation 0	Numerical Calculation 2	2-digit Block Check Code	

Output destination="SD card":

0 9 : 2 5 : 4 8	0 0 1 2 3 4	1	1 0	0 0 2 1 5 8	- 0 3 6 8 0 CR
Time	Scan Count	Total Judge.	Judgement	Numerical Calculation 0	Numerical Calculation 2

Output destination="Ethernet":

0 8 / 0 1 / 1 5	0 9 : 2 5 : 4 8	8 0 0 1 2 3	4 1	1	0]	
Date	Time	Scan Count	Total Judge.	Judge	ment		
		0 0 2 1 5 8	- 0 3	68	0	BCC	CR
		Numerical Calculation 0	Nume Calcula			2-digit Block Check Code	

► Note

Judgement JDC001 and Numeric Calculation CAC001 are not output because they are unset.

4.16 Saving/ Outputting an Inspection Image

Captured inspection images can be saved in PV500, output to a PC through Ethernet, or saved in an attached SD memory card. Also, you can read the images to change the checker settings and run a test. Images that can be output/saved are gray images. (Preprocessed images cannot be output.)

4.16.1 About Image Memory

PV500 has multiple memories including the memory to store camera capturing images for inspection and the one to store images for settings. In addition, you can output and save images to a SD memory card or a PC connecting with the Ethernet port.

Storage Space of PV500 and External Devices to Store Images

PV500	0	
1	Inspection image memory	The memory to store images captured by camera. Inspection executes on the images.
2	Test image memory	An image in this memory is copied from the latest image of Inspection image memory. The image is used to make checker setting. Setting display image to "Memory" in SETUP menu shows the test image. You can call up the images from the Save image memory (No.3) 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 m	emory 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.
Ether	net (PC etc.)	
7	The folder specified by Image Receiver	The images stored in the Inspection image memory (No.1 above) can be output in Ethernet port during inspections. In this case, the PC requires the designated software "Image Receiver" which specifies a destination folder.

*) The number of sets of images can be saved varies depending on the combination of camera type and the number of them.

When using only Quad-speed camera or Ultra compact camera

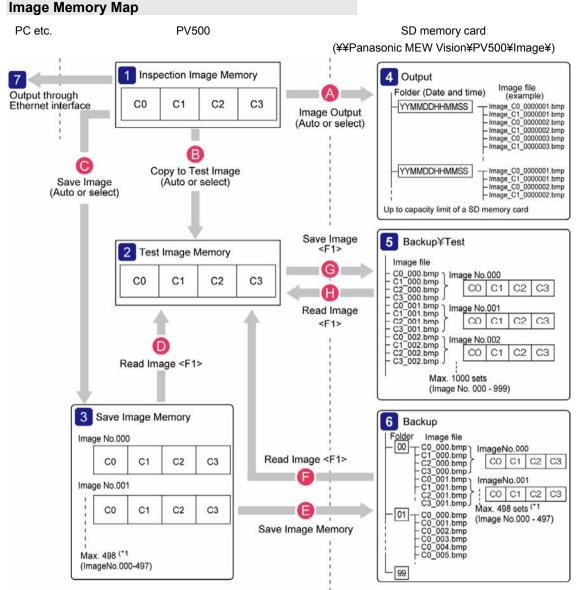
1	2	3	4
498	299	195	143
1	2	3	4
86	36	20	11
	1	1 2	1 2 3

When using 2-mega camera with Quad-speed camera or Ultra compact camera

Number of Quad-speed cameras/ Ultra compact cameras	1		2		3	
Number of 2-mega cameras	1	2	3	1	2	1
Number of storable images (unit: set)	73	33	18	62	30	54

Refer to

For information on the setting of destination of print screen, refer to section 3.2.5 (page 48).



*1) The number of sets of images can be saved varies depending on the combination of camera type and the number of them.

Refer to

A	: Chapter4.16.2, page 265
B	: Chapter 6.2.2, page 312
C	: Chapter 4.16.3, page 265
D	: Chapter 4.16.4, page 266
Ø	: Chapter 4.16.3, page 265
Ø	: Chapter 4.16.4, page 266
G	: Chapter 4.16.4, page 267
0	: Chapter 4.16.4, page 266

Displaying "Image Output" Setting Window

- Select "ENVIRONMENT" > "Input/Output" from the menu bar.
- 2. Select "Image Output" in "Input/Output" setting window.

OPERATION ENVIRONMENT T	YPE INSPECTION SAVE/READ TOOL	SETUP
System Settings Inc	put/Output Camera	Color
Parallel 1/0 Parallel 1/0 Output Serial General Output Save Image Memory Print Screen	Destination Output Conditions Interval Camera No.0 Output Camera No.1 Output Camera No.2 Output Camera No.3 Output File Header Additional Information 0 Additional Information 2 Additional Information 3 Overwrite No. of Folders E&R signal ON at Output Error Forced Outage at Output Error	SD Card • At Interval 2 No • No • No • No • None None None 10 No •

Specifying a Camera Image to Output

You can set images to output or not by a camera.

1. Select "Yes" in "Camera No.0 Output" of "Image Output".

Doing so makes setting that an inspection image of camera No.0 is output.

2. In the same way, set a Camera No. to "Yes" to output its image.

Selecting Destination

1. Select a "SD Card" or "Ethernet" in "Destination".

Note

When outputting through Ethernet to a PC, the port number of PV500 is "8602".

The special software for image receiving, "Image Receiver" needs to be installed in the PC. You can download the Image Receiver from our web site described below.

http://Panasonic-denko.jp/ac/e/

Downloading the software requires a user information registration.

OPERATION ENVIRONMENT T	PE INSPECTION SAVE/READ TOOL	SETUP
System Settings Inc	ut/Output Camera	Color
Parallel 1/0 Parallel 1/0 Dutput Serial General Output Save Image Memory Print Screen	Destination Dutput Conditions Interval Camera No.0 Output Camera No.0 Output Camera No.2 Output Camera No.2 Output File Header Additional Information 0 Additional Information 1 Additional Information 2 Additional Information 3 Overwrite No. of Folders ERR signal ON at Output Erro Forced Output Erro	

Outputting to a SD memory card

A folder named as date and time (YYMMDDHHMMSS= year, month, day, hour, minute, second) is created in the following path of a SD memory card and image files are saved in it.

¥Panasonic MEW Vision¥PV500¥Image¥Output¥

Initially, decide the number of folders to save images. When using a SD memory card with PV500, it has a limit that up to 100 files can be saved in per folder. Thus, the specified number of folders by 100 files can be saved. Select either overwriting from older files or terminating image saving when the number of files reaches the saving limits.

1. Select "No. of Folders".

The default is "10" and the range of available value is "1 to 1000".

2. Set "Overwrite".

[No] (Default): Terminates image saving.

[Yes]: Deletes the oldest folder and all images stored in the folder, and creates a new folder to continue saving.

Outputting through Ethernet

When the PC has an error, such as uninvoked Image Receiver and disconnection of cables, images cannot be output correctly. Decide the operation of PV500 in such case.

When "Output Conditions" is set to "Command Reception", two items described below cannot be selected. In this case, if outputting an image failed, ERROR1 signal will be output.

1. Set [ERR signal ON at Output Error].

To turn on the ERROR0 signal when an error occurs, select "Yes". (Default: No)

2. Set [Forced Outage at Output Error].

[No] (Default): Continues the inspection.

[Yes]: Terminates the inspection. Confirm the connection following the displayed message. When outputting Synchronously, images can be resent.

Selecting Output Condition

Other than outputting by an inspection, images can be output when the specified conditions are fulfilled.

1. Select a condition to output images in "Output Condition".

[All Images](default):	Images are output at every inspection.
[NG Judgement]:	Images are output when the judgement selected in "Image Output" is NG. (If any condition is not specified, no image is output.)
[At Interval]:	Images are output per the specified number of inspections.
[Command Reception]:	Images are output when receiving the certain signal* from external device. * The signal of "Output Latest Image" assigned to one of ASSIGN 0-5.

2. Set an interval in "Interval".

(This is the item to set when you select "At Interval" in Step 1.) The range of available value is 2 to 10000. Specifying "10" outputs an image at the first inspection, and then outputs every ten inspections as 11th time, 21st time, 31st time...

Note

Set image output timing. There are two settings; not to execute the next inspection until image output is complete, to output images while PV500 is able to output them. The latter setting may not output a part of specified conditions.

Selecting Output Timing

Set the timing to output images.

There are two settings; to output images every time one inspection is executed, to output images while PV500 is able to output them until the start of the next inspection.

Refer to page 314 for details.

Selecting Additional Information for a File Name

A file name of image consists of the following information.

Header:	Up to eight characters can be specified.
Additional information 0-3:	Four types of information can be added.
Type No.:	Type No. (000 - 255) when the image is captured.
Date:	The date (yymmdd) of built-in calendar of PV500 when the image is captured.
Time:	The time (hhmmss) of built-in calendar of PV500 when the image is captured.
Total Judgement:	Total judgement of the image (OK/NG) * Total judgement is other than OK/NG, such as NJ = Unset
Scan Count:	Scan count: 7 digits
Camera No.:	C0 - C3 (2 digits) Number of the camera which captured the image.
Image No.:	Seven digits of number which is automatically added.

- Enter "File Header" with the software keyboard.
 Default: "Image "
- Select an item from four types for "Additional Information 0" to "Additional Information 3". Select "None" when no additional information is needed.

System Settings In		Camera	Calor	Patty
	Destination Output Condi Interval Comera No.0 Camera No.1 Camera No.1 Camera No.3 File Header Additional I Additional I Additional I Overwrite	Camera tions Dutput Dutput Dutput Dutput oformation 0 eformation 2 eformation 3	Color 20 Card At Interva No No No None None None None None None None None None None None None No No No No No No No No No No	۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲ ۲
	No. of Fulde ERE signal D	rs N at Datput Error		10

Setting and Condition:

ondition: 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.0 Scan Count 100 Image 050 071215 NG C0 0000100.bmp

File Name:

Example)

Note

Maximum number of digits for a file name is 50.

The image memory of PV (see page 261, Memory Map - 3) saves up to 498 sets of images, considering a set as two images of camera 0 - 1 for 2-camera type, and four images of camera 0 - 3 for 4-camera type. This image will be cleared when you cut the power of PV500. When you need to save the images, back up them in a SD memory card or a PC employing PVWIN.

Note

- The maximum number of saving sets varies depending on camera type and its combination.
- If the number of saving images reaches the upper limit of the image memory capacity before the number becomes the maximum number of sets, no more images can be saved. In the case, it overwrites images from older one or terminates image saving.
- Images are stored from No.0 of Save Image memory in ascending order. The larger image number is the . more newly saved image.
- Backing up the images of the Save image memory to a SD memory card and clearing the data of Save image memory can be executed also by inputting I/O signal or sending a command from an external device.
 - See page 349 about backup by inputting an I/O signal (ASSIGN signal).
 - See page 370 about backup/delete by sending a command.
- 1. Select "ENVIRONMENT" > "Input/Output" from the menu bar.
- 2. Select "Save Image Memory" in "Input/Output" setting window.
- 3. Select a condition to save images in "Saving Condition".

OPERATION ENVIRONME	NT TYPE INSPECTION	SAVE/READ TOOL		SETUP N
System Settings	Input/Output	Camera	Color	
Parallel 1/0 Parallel 1/0 Out Serial General Output Image Output Save Image Memo Print Screen	put Overwrite	ition	All Yes No Yes	



[No] (Default):	No image is saved.
[AII]:	All inspection images are saved.
[NG Judgement]:	Images are saved when the result of judgement expression specified in "Save Image Memory" is NG. (If any condition is not specified, no image is saved.)

4. In "Overwrite", select an operation when the saved images reach the limit of the number or the memorv.

[Yes] (default):	Continues to save images overwriting the older images.
[No]:	Terminates image saving. (Inspections will be continued.)

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

Backing up Images in Save Image Memory to SD Memory Card

1. Select "SAVE/READ" from the menu bar.

2. Select "Save Image Memory".

Backup of Save image memory to a SD memory card cannot be executed during operations (in RUN mode). Selecting "Save Image Memory" during operations displays a message. Select "YES" to stop the operation.

OPERATION ENVIRONMENT Save Setting Bata

07

03

04

06

SD card free space

3. Specify a folder number of the SD memory card to save.

00 to 99 are available. Specifying it displays a confirming message. If you specified the number where image data already exists, the message to confirm overwriting appears.

4. Select "Yes".

After the saving is complete successfully, a message appears. Press the ENTER key to close.

Clearing Images of Save Image Memory

- 1. Select "SAVE/READ" from the menu bar.
- 2. Select "Clear Image Memory".

A confirming message appears.

3. Select "Yes".

Clearing is executed.

OPERATION ENVIRONMENT	TIPE INDE	CTION SAVE	/HEAD T	001.		SETUP MENU	
Save Setting Data	Read Sett	ing Data	Save	Image Memory	Clear	Image Memory	/
				RUN: Type	No.000		
				SETUP: Type	No . 000	-	RE
		S. Constant	CEICome	act) Live/Gray 5	2001 ala:		
	All image	memories (vill be	cleared. Are	you sur	17	
			Yes	No			
		_					

Read Setting Data Save Image Memory

Do you want to save the data to the selected area? Yes No

536,870,912 Bytes

Clear Imag

RUN: Type No.000

SETUP: Type No.000

4.16.4 Operation of Test Image Memory

The Test image memory (page 261, Memory map - 2) calls up images from the Save image memory or a SD memory card in SETUP menu to set checkers and execute a test. To operate the Test image memory, use Image Menu displayed by pressing the F1 key in SETUP menu.

Calling up to Test Image Memory

The images saved in the following three areas can be called up to the Test image memory.

D	Image memory:	Read from the Save image memory of PV500.
G	Memory image in SD:	Backup images in a SD memory card (folder = ¥Image¥Backup¥00-99)
0	Test image in SD:	Test images in a SD memory card (folder = ¥Image¥Backup¥Test)

1. Press the F1 key to display Image menu.	Scroll Magnification
2. Select "Read Image".	Full Screen
The window to select the reading source appears.	Save Image
The window to select the reading source ap	Read Image

3. Specify a reading source.

When you specify "Image Memory in SD", then specify a folder number.

4. Select an image number to read.

As the lastly saved image* appears, change image numbers observing the display and specify the desired image number.

(*) The larger image number is the more newly saved image. The smaller image number indicates the older image.

5. Select "Read".

The specified image is called up.

Note

In the following case, a message "Reading image failed." appears, and images cannot be read.

- In the test images saved in the selected image number, there is an image of the camera number that has been set to "Unused" for "Camera Type" under "Camera" in PV500.
 - Example) In the above example, there are the images of camera 0 and camera 2 in Image number 1. If either camera 0 or camera 2 has been set to "Unused", reading the images cannot be performed.

Saving Images in Test Image Memory to SD Memory Card

The images in the Test image memory can be saved in a SD memory card.

This operation is useful to pick up necessary images among the images saved in the Save image memory of PV500 and to save them.

1. Press the F1 key to display Image menu.

2. Select "Save Image".

The window to specify a saved image number in the SD memory card appears.

3. Specify the destination number.

The confirmation message appears.

4. Select "Yes".

After the saving is complete successfully, a message appears. Press the ENTER key to close.

OPERATION ENVIRONMENT	TYPE INSPEC	TION SAVE	E/READ 10)()L	90
Save Setting Data	Read Setti	ng Data	Save	mage Memory	y Clear Ima
SD Card Free Space	536,87	10,912 B)	rtes	RUN: Type	No.000
No. 000	Date	4		SETUP: Ty	pe No.000 📰
001		-	-	ict) Live/Grav	Scale 100X
002		-			
004					
005					
006					
007					
	Do you want	to save	the data	a to the se	lected area?
			Yes	No	



OPERATION ENVIRONMENT

Save Setting Data

Pattern Display

Read from

TYPE

Image Memory Test Image in SD

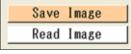
Image Memory in SD

INSPECTION

6.8

Read Setting Da





4.17 Reading/saving Setting Data (Save/Read)

The settings set in SETUP menu and RUN menu can be saved. The information existing in the execution memory can be saved in the saving memory of PV or a SD memory card except certain data*. This information is "Setting data".

Note

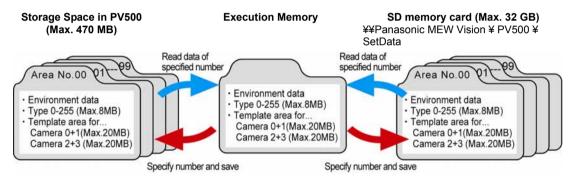
*The data to be specified in [TOOL] > [General] is individual information for each PV500 and saved in the different area from the Storage Space of PV500. You cannot save in a SD memory card or copy into another PV500.

Where to Save the Setting Data

The conditions in the execution memory are temporarily called up to execute programs and are not saved in the memory.

Regarding types No.0 - 255 as a set of data, PV500 saves the data in "Storage Space in PV500". The data can be saved also in a SD memory card.

Every time PV500 starts up, it reads a set of data from the storage space in PV500 to the execution memory. And then, PV calls up a product type from the data to set inspection conditions and to execute inspections.



4.17.1 Saving Setting Data

This function saves data of 256 product types and environment data set in the execution memory into the main memory or a SD card.

- 1. Select "SAVE/READ" from the menu bar.
- 2. Select "Save Setting Data".

The setting data saving window is displayed.

- 3. Select "Storage Space in PV500" (or "SD Card") for "Save to".
- Saving data. Please wait a moment. 1,665/2,368 Abort

OPERATION ENVIRONMENT TYPE INSPECTION **SAVE/READ** TOOL Save Setting Data Read Setting Data Save Image Memory

4. Select the list and "No." to save.

Saving is executed.

An overwrite confirmation message appears if data already exists. Select [Yes] to overwrite and [No] to save another area. To stop saving during the process, select "Abort". In this case, the destination area No. will be cleared when the destination is the storage space in PV500. When it is a SD memory card, the original data will be held.

- When saving the data is completed, the saved information is displayed.
- Size (KB): Size of the setting data
- Version of the data created: Version of PV500 where the setting data was created
- Date: Date and time when the data was saved. The information of data and time is referred from the calendar of PV500.

4.17.2 Reading Setting Data

The setting data registered in the Storage Space in PV500 or a SD memory card can be called up to the execution memory. The setting data that has been stored in the execution memory will be overwritten. Before reading, save the setting data as necessary.

- 1. Select "SAVE/READ" from the menu bar.
- 2. Select "Read Setting Data".

The setting data reading window is displayed.

- **3.** Select "Storage Space in PV500" (or "SD card") for "Read From".
- **4.** Select the list and the data to read. Reading is executed.

Reading is executed.

To stop reading during the process, select "Abort". In this case, the data of Type and ENVIRONMENT will be initialized.

eau r	Storage	Space in PV500 Space in PV500	
ree 5	SD Card	opace in riese	496,599,040 B
No.	Size(KB)	Modified Versio	m Date
00	365	1.020	2007/11/15 14:30:40
01	65	1.000	2008/02/15 20:34:26
02	80	1.020	2007/11/15 23:09:04
03	142	1.020	2007/11/15 17:25:06
04	365	1.100	2008/05/07 14:32:14
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
_			
D		- DI	
Read	ling dat	a. Please	wait a moment.

Compatibility of Setting Data

Version

When reading the setting data created in the later version of PV500 than the current one, the data may not be read depending on the version where the data was created. The compatibility of setting data in each version is as follows:

Current version	Readable setting data
Ver.2.0	Ver.2.0 or older
Ver.1.60	Ver.1.60 or older
Ver.1.50	Ver.1.50 or older
Ver.1.40 to 1.43	Ver.1.43 or older
Ver.1.30	Ver.1.30 or older
Ver.1.20 to 1.22	Ver 1.22 or older
Ver.1.10 to 1.14	Ver.1.14 or older
Ver.1.02 or before	Ver.1.02 or older

Camera Type

The data of PV500s with different camera types are compatible.

Two-camera type product can read the setting data created by 4-camera type, and vice versa.

4.17.3 Deleting Setting Data

To delete the setting data registered in the Storage Space in PV500 or a SD memory card, follow the procedure below. You cannot delete multiple data. Delete one by one.

1. Select "SAVE/READ" from the menu bar.

2. Select "Save Setting Data".

The setting data saving window is displayed.

3. Select "Storage Space in PV500" or "SD Card" for "Save to" where the data to delete exists.

4. Select the list and move the cursor onto the data to delete.

5. Press the FUNC key and select "Delete" from the displayed menu.

The pop-up menu appears on the upper left of the window (under "Free Space").

	OPERATION	ENVIRONMENT T	YPE INSPECT	ION SAVE/	/READ	TOOL			SET
	Save Sett	ting Data	Read Settir	ıg Data	Save	Image	Memory	Clea	ar Ima,
ç	Save to SI) Card 🔽					,		
F	ree Spac	e —					933,642	,240	Bytes
0	Delete	Size(KB)	Version o	f data cr	eated		Date		1
Ī	00	144		1.020		2007/	04/07 1	7:56:1	2
	01	80	Ī	1.020		2007/	11/15 20):22:1	2
	02	142		1.020		2007/	11/15 20):22:3	8
	03	144	-	1.100		2007/	11/15 20):46:1	4
	04								

6. Select "Yes" following the displayed message.

The setting data is deleted. If you select "No", deleting is not executed.

271

4.18 Displaying Data on the Screen and Updating Settings (Data R/W)

In RUN menu, inspection results (judgement, data, execution time, etc.), setting values (parameters of checkers, etc.), information of PV (calendar, system register value, etc.) can be displayed. This is Data R/W (Read/Write) function.

The displayed value can be modified for some data.

The data is displayed on the Data R/W sheet. Up to four sheets of data can be set and displayed per type and a sheet can show up to 80 items (5 columns x 16 rows).

4.18.1 Setting Data R/W

Register data in Data R/W sheet. The sheet is made up by cells displaying items. Up to 80 cells can be set. (5 columns x 16 rows)

Setting Cell Number of Data R/W Sheet

Set the number of cells by specifying the number of columns and the number of rows. The settable range is 1 column x 1 row to 5 columns x 16 rows.

1. Select "TYPE" from the menu bar.

The menu appears.

2. Select "Data R/W".

"Data R/W" setting window is displayed.

- 3. Select a sheet number of Data R/W to set.
- 4. Press the FUNC key and select "Number of Cells" from the pop-up menu.

The window to set the number of cells appears.

5. Enter the number of columns and rows and then press the CANCEL key.

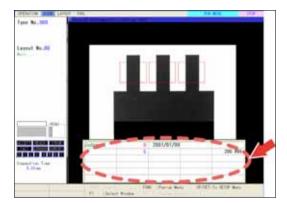
The specified number of cells are displayed.

Note

The number of cells is counted from the upper left.

When setting the number of columns to "3", the 4th column and after will be deleted even though data has been registered in them and the data also will be deleted. Note that setting the number of columns to "4" or more again cannot restore the deleted data.

Select Type	Type Setting	Marker Display	Data R/W	Initi
Data R/W 0 Data R/W 1 Data R/W 2 Data R/W 3	Number of Cells Judgewort display Alignment Digit after Decimal Decrevite Decrevite Decret Decret Decret Decret Decret All	Point •		



OPERATION ENVIRONM	ENT THRE INSPECTO	ON SAVE/READ TOOL		SETUP MENU
Select Type	Type Setting	Marker Display	Data R/W	Initia
Data R/W 0				
Data R/W 1				
Data R/W 2				
Data R/W 3				
		umber of Columns		
		unber of Rows	<u> </u>	
		under of nows		

Registering Data in Data R/W Sheet

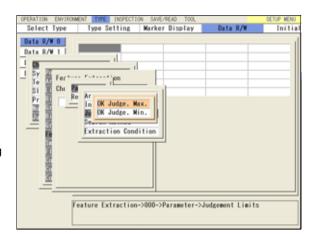
1. Select a sheet number of Data R/W to register data in Data R/W setting window.

2. Select a cell to register data.

The item selecting window is displayed.

Refer to

- For the information of settable items, refer to page 275.
- When the settable items in the list are displayed in gray (when the color setting is the default), it shows that those parameters are not available or the results do not exist.
 For example, the scan pitch in the parameters of gray edge is only available when the shape of the area is "Plane". When the shape is "Line", "Scan Pitch" is displayed in gray.



3. Select data to register.

Depending on data type, details including checker number or parameter are needed to be selected. Follow the window display.

For some checkers, the list of result types is displayed on multiple pages. Tilt the ENTER key left or light to change the page.

Note

The description field shows the detail of registered data after registration.

Now you completed registering data. Set the following two items as necessary.

- Character alignment: Display position of characters in a cell
- Overwrite permission: Setting to permit overwriting data in RUN menu

Note

- Data with value after decimal point is displayed 3-digit after the point. The display digits after decimal point can be changed from the pop-up menu displayed by pressing the FUNC key.
- In Connector (Binary Window), Connector (Gray Window), Connector (Gray Edge), you can register some types of data into Data R/W sheet from the setting windows. Refer to the description of each checker for details.



Character Alignment and Overwrite Permission

1. Press the FUNC key and select "Alignment" from the pop-up menu.

Select from Right (default), Center, and Left.

2. Select "Overwrite" from the same menu.

Every time you select "Overwrite", permission status switches between on (checked) and off (unchecked). In the default setting, overwriting is permitted.

This item is selectable only when you select the registered data that can be overwritten such as parameters of checkers.

Data R/W O Data R/W 1	Number of Cells Judgment display	,	
Data R/W 2 Data R/W 3	Alignment Digit after Decimal Point «Overwrite		Center Left •Right
	Copy Paste Delete Delete All		

To copy the data registered in a cell to the other cell.

1. Select the cell that you want to copy and press the FUNC key.

The pop-up menu appears.

- 2. Select "Copy".
- 3. Select the cell that you want to paste and press the FUNC key.

The pop-up menu appears.

4. Select "Paste".

Copying is executed.

Selecting Judgement Display

Display of Judgement can be changed. This setting is common for all Data R/W sheets. You cannot select separately for each sheet or cell.

- Select the cell you have set a judgement in and press the FUNC key. Then, select "Judgement Display".
- 2. Select "1/0/E" or "OK/NG/ER"

Judgement	1/0/E	OK/NG/ER
OK	1	OK
NG	0	NG
Error	E	ER

Number of Cells Judgment display	• 1/0/E
Alignment	, OK/NG/ER
Digit after Decimal Point •Overwrite	•
Copy Paste	
Delete	
Delete All	

Deleting a Cell, Clearing a Whole Sheet

- **1.** Select a sheet number of Data R/W.
- 2. Select the cell you want to delete and press the FUNC key.

The pop-up menu appears.

3. To delete only the selected cell, select "Delete", and to delete a whole sheet, select "Delete All".

The confirmation message appears. If you select "Yes", the registered data of a cell or a whole sheet are deleted.

4.18.2 Data R/W in RUN Menu

Data R/W 0 -3 are displayed in the designated window, Data R/W 0 window - Data R/W 3 window. In RUN menu, the following operations can be done; selecting a window to display, changing the position and size, and displaying frame (rule lines).

Refer to Chapter 5.3.2 Arranging Layout (page 300).

Displaying Data R/W

1. Select "VIEW" from the menu bar in RUN menu.

The menu appears.

OPERATION	A1E#	LAYOUT	TOOL			
Type No.(Scree				✓Data	R/W 0
	Wind	ow Transp	arency (R	UN mervu)	-Data	R/# 1 R/# 2
	Wind	ow Sequer	ce Order			R/# 3

2. Select "Data R/W".

Marked off Data R/W window is displayed and others are not displayed.

3. Select a window number of Data R/W to display.

The selected number of Data R/W window is marked off and displayed.

Asterisk symbol (*) shown in a cell indicates that not all digits of the value can be displayed within the width of the current cell. Adjust the cell width to display the all digits.

Refer to

In RUN menu, you can change the outlook of Data R/W including the window size and cell width. Refer to page 302 for details.

To hide the displayed Data R/W window

Select "Data R/W" from "VIEW" menu and select the number of Data R/W window to hide.

Changing Values Using Data R/W

While displaying Data R/W window, you can change the data registered in Data R/W. (Some data cannot be changed such as results.)

It is helpful to execute inspections changing values frequently (when introducing PV500), or to permit changing some limited values (when using password for limitation of switch to the SETUP menu to prevent to change the setting data by mistake).

Note

If any parameter other than values is registered in Data R/W, it will be replaced with a value to display. The item name will not be displayed. When changing the setting, the item name is displayed in the subwindow. Example) When the preprocess group selected in a checker has been registered in Data R/W

Display in Data R/W
0
1
2
3
4
5

- 1. Press the F1 key ("Select Window") in RUN menu.
- 2. Select a Data R/W window where the data you want to change is registered.

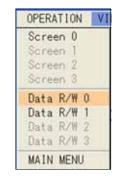
The Data R/W window is displayed and you can select a cell.

3. Select a cell where the data to change is registered.

Selecting modifiable cell displays the modifying window. If you select the cell where the data cannot be changed is registered, nothing appears.

4. Select or enter value and fix.

Now you completed the modification.



JUDGEMENT	0.00	2007/11/15		
			No	_
			A	
TRIG IStart	FUNC	1 Pop-up Mer	ć	TUP Mere
FI :Select #			E	

5. To save the changed value, select [TOOL] -> [Save Setting Data] of the menu bar.

If you cut the power or read the setting data in SETUP menu before saving the changed data, the data is cleared and the values are replaced to the previous ones.

The data that can be registered in cells of Data R/W are listed below.

Note

- "Yes" in the "Change" column indicates the value of the cell is modifiable from Data R/W sheet.
- The columns of Position Adjustment and Area Size Adjustment show that the item can be registered in Data R/W or not, when they are used for the adjustments.

Items that can be registered in Data R/W

Statistics group

A number is indicated in "Statistics" column for statistics items. See below.

No.	Numeric Statistics	All Statistics	OK Statistics	NG Statistics
2	Statistics of checker results	Minimum	OK Judge. Min.	NG Judge. Min.
	If the checker is OK, calculates "All Statistics"	Maximum	OK Judge. Max.	NG Judge. Max.
	and "OK Statistics". If the judgement is NG, calculates "All Statistics" and "NG Statistics".	Average	OK average	NG average
		Range	OK Range	NG range
		Variance	OK Variance	NG Variance
3	Judgment Statistics If the checker is OK, calculates "All Statistics" and "OK Statistics". If the judgement is NG, calculates "All Statistics" and "NG Statistics". When referring the statistics of judgments(JR/JD) during in RUN mode, the latest result is referred.	Scan Count (Judgment Count)	OK count	NG count

Checker

Position Adjustme	ent (PAC)	Change	Statistics
Parameter	Base Checker Parameter No.0-3 *1)	Yes	No
Result	Judgement	No	3
	Inspection time	No	2
	Base Position X	No	2
	Base Position Y	No	2
	Base Position Theta	No	2
	Adjustment Amount X	No	2
	Adjustment Amount Y	No	2
	Adjustment Amount Theta	No	2
	Detect Position X	No	2
	Detect Position Y	No	2
	Detect Position Theta	No	2
	Base Judgement Results	No	3
	Base Inspection Time	No	2
	Base X-Coordinate	No	2
	Base Y-Coordinate	No	2
	Base Proj. X Axis	No	2
	Base Proj. Y Axis	No	2
Area Size Adjustn	nent (AUC)	Change	Statistics
Parameter *2)		Yes	No
Result	Inspection time	No	2
	Judgement	No	3
	X coordinate	No	2
	Y coordinate	No	2
	Proj. X	No	2
	Proj. Y	No	2

*1) Applies to the items that "Position Adjustment - Base checker" column is "Yes" for each checker*2) Applies to the items that "Area Size Adjustment" column is "Yes" for each checker

Line (LIC)				Chan	ge Statistics	-
Parameter	Area	Area Setting (Refer to p.286)		Yes	No	-
	Setting	Area Size Adjustment (Refer t	o p. 286)	Yes	No	-
	Inspection	Preprocess	- I /	Yes	No	-
	Conditions	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			Yes	No	-
	Limits	Min. No. of Pixels		Yes	No	_
		Max. No. of Objects		Yes	No	_
				Yes	No	_
Decult		Min. No. of Objects			-	_
Result		Judgement		No	3	-
		Inspection time		No	2	-
		Pixel Judgement		No	3	_
		Object Judgement		No	3	-
		No. of Pixels		No	2	_
		No. of Objects		No	2	-
Binary Wine	dow (BWC)			Chan	ge Statistics	
Parameter	Area	Area Setting (Refer to p.286)		Yes	No	_
	Setting	Area Size Adjustment (Refer t	o p.286)	Yes	No	_
	Inspection	Preprocess		Yes	No	
	Conditions	Slice Level		Yes	No	
		Target		Yes	No	
		Filter		Yes	No	
	Judgement	OK Judge. Max.		Yes	No	
	Limits	OK Judge. Min.		Yes	No	
Result		Judgement		No	3	_
		Inspection time		No	2	_
		Area		No	2	-
Gray Windo	w (GWC)			Chan	ge Statistics	
Parameter	Area	Area Setting (Refer to p.286)		Yes	No	-
Falameter	Setting	• • • • • •	a n 206)	Yes	No	_
	Inspection Conditions	Area Size Adjustment (Refer t Preprocess	<u>0 p.200)</u>	Yes	No	_
	Judgement	OK Judge. Max.		Yes	No	_
	Limits	OK Judge. Min.		Yes	No	_
Result	2	Judgement		No	3	_
NESUIL		Inspection time				_
				No	2	-
	-,	Gray Average		No	2	-
Binary Edge	e (BEC)		Change	Statistics	Pos. Adj Base checker	Area Size Adjustmen
Parameter	Area	Area Setting(Refer to p.286)	Yes	No	No	Yes
	Setting	Area Size Adjustment (Refer to p.286)	Yes	No	No	
	Inspection	Preprocess	Yes	No	Yes	Yes
	Condition	Slice Level	Yes	No	Yes	Yes
		Edge Condition	Yes	No	Yes	Yes
		Detect Position	Yes	No	No	No
		Filter	Yes	No	Yes	Yes
	Search	Filter	Yes	No	Yes	Yes
	Method	Width	Yes	No	Yes	Yes
	Judgement	OK Judge. Max.	Yes	No	No	No
	Limits	OK Judge. Min.	Yes	No	No	No
			162	INU	INU	INU

Binary Edge (BEC)			Change	Statistics	Pos. Adj Base checker	Area Size Adjustment
Result		Judgement	No	3	Refer to the	Refer to the
		Inspection time	No	2	items of	items of Area
		No. of Objects	No	2	 Position Adjustment 	Size Adjustment
		X coordinate	No	2	- (PAC)	(AUC)
		Y coordinate	No	2	(17(0))	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
		Detect Color	No	2	_	
		Proj. X	No	2		
		Proj. Y	No	2	_	
Gray Edge (GEC)		Change	Statistics	Pos. Adj Base checker	Area Size Adjustment
Parameter	Area	Area Setting (Refer to p.286)	Yes	No	No	Yes
	Setting	Area Size Adjustment (Refer to p.286)	Yes	No	No	
	Inspection	Preprocess	Yes	No	Yes	Yes
	Conditions	Scan method	Yes	No	Yes	Yes
		Edge condition	Yes	No	Yes	Yes
		Edge Threshold	Yes	No	Yes	Yes
		Detect Position	Yes	No	Only "Font and Peak"	
	Search	Scan Pitch	Yes	No	Yes	Yes
	Method	Filter	Yes	No	Yes	Yes
		Width	Yes	No	Yes	Yes
		Average Range	Yes	No	Yes	Yes
	Judgement	OK Judge. Max.	Yes	No	No	No
	Limits	OK Judge. Min.	Yes	No	No	No
Result		Judgement	No	3	Refer to the	Refer to the
		Inspection time	No	2	items of	items of Area
		No. of Objects	No	2	Position	Size
		X coordinate	No	2	Adjustment	Adjustment
		Y coordinate	No	2	– (PAC)	(AUC)
		Differential Value	No	2	-	
		Proj. X	No	2	-	
		Proj. Y	No	2	_	
Feature Ext	raction (FEC)		Change	Statistics	Pos. Adj Base checker	Area Size
	A					Adjustment
Parameter	Area	Area Setting (Refer to p. 286)	Yes	No		Adjustment Yes
Parameter	Area Setting	Area Setting (Refer to p.286) Area Size Adjustment (Refer to p.286)	Yes Yes	No No	No No	Yes
Parameter		Area Size Adjustment (Refer to p.286)			No	
Parameter	Setting	Area Size Adjustment (Refer to p.286) Preprocess	Yes Yes	No No	No No Yes	Yes Yes
Parameter	Setting Inspection	Area Size Adjustment (Refer to p.286) Preprocess Slice Level	Yes Yes Yes	No	No No Yes Yes	Yes Yes Yes
Parameter	Setting Inspection	Area Size Adjustment (Refer to p.286) Preprocess Slice Level Filter	Yes Yes Yes Yes	No No No	No No Yes Yes Yes	Yes Yes Yes Yes
Parameter	Setting Inspection	Area Size Adjustment (Refer to p.286) Preprocess Slice Level Filter Target	Yes Yes Yes Yes Yes	No No No No	No No Yes Yes Yes Yes	Yes Yes Yes Yes Yes
Parameter	Setting Inspection	Area Size Adjustment (Refer to p.286) Preprocess Slice Level Filter	Yes Yes Yes Yes Yes Yes	No No No No No	No No Yes Yes Yes	Yes Yes Yes Yes
Parameter	Setting Inspection Conditions	Area Size Adjustment (Refer to p. 286) Preprocess Slice Level Filter Target Sorting Sorting Order	Yes Yes Yes Yes Yes Yes Yes	No No No No	NoNoYesYesYesYesYesYesYesYes	Yes Yes Yes Yes Yes Yes Yes Yes
Parameter	Setting Inspection	Area Size Adjustment (Refer to p.286) Preprocess Slice Level Filter Target Sorting Sorting Order Labeling	Yes Yes Yes Yes Yes Yes Yes Yes	No No No No No No No No No	NoNoYesYesYesYesYesYesYesYesYes	Yes Yes Yes Yes Yes Yes Yes Yes Yes
Parameter	Setting Inspection Conditions Search	Area Size Adjustment (Refer to p. 286) Preprocess Slice Level Filter Target Sorting Sorting Order	Yes Yes Yes Yes Yes Yes Yes Yes	No No No No No No No No No No	NoNoYesYesYesYesYesYesYesYesYesYesYes	Yes Yes Yes Yes Yes Yes Yes Yes Yes
Parameter	Setting Inspection Conditions Search	Area Size Adjustment (Refer to p.286) Preprocess Slice Level Filter Target Sorting Sorting Order Labeling Boundary Perimeter	Yes Yes Yes Yes Yes Yes Yes Yes Yes	No No No No No No No No No No No	NoNoYesYesYesYesYesYesYesYesYesNo	Yes Yes Yes Yes Yes Yes Yes Yes
Parameter	Setting Inspection Conditions Search	Area Size Adjustment (Refer to p.286) Preprocess Slice Level Filter Target Sorting Sorting Order Labeling Boundary Perimeter Projection Width, Height	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	No No No No No No No No No No No No	NoNoYesYesYesYesYesYesYesYesNoYes	Yes Yes Yes Yes Yes Yes Yes Yes No Yes
Parameter	Setting Inspection Conditions Search	Area Size Adjustment (Refer to p.286) Preprocess Slice Level Filter Target Sorting Sorting Order Labeling Boundary Perimeter Projection Width, Height Principal axis angle	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	No No No No No No No No No No No No No	No No Yes No Yes No	Yes Yes Yes Yes Yes Yes Yes Yes No Yes No
Parameter	Setting Inspection Conditions Search Method	Area Size Adjustment (Refer to p.286) Preprocess Slice Level Filter Target Sorting Sorting Order Labeling Boundary Perimeter Projection Width, Height Principal axis angle Fill Holes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	No	No No Yes No Yes No Yes No Yes	Yes Yes Yes Yes Yes Yes Yes Yes No Yes No Yes
Parameter	Setting Inspection Conditions Search Method Extraction	Area Size Adjustment (Refer to p. 286) Preprocess Slice Level Filter Target Sorting Sorting Order Labeling Boundary Perimeter Projection Width, Height Principal axis angle Fill Holes Max. Object Area	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	No	No No Yes No Yes No Yes Yes No Yes Yes No Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes No Yes No Yes Yes Yes
Parameter	Setting Inspection Conditions Search Method	Area Size Adjustment (Refer to p. 286) Preprocess Slice Level Filter Target Sorting Order Labeling Boundary Perimeter Projection Width, Height Principal axis angle Fill Holes Max. Object Area Min. Object Area	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	No	No No Yes No Yes No Yes Yes No Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes No Yes No Yes Yes Yes Yes
Parameter	Setting Inspection Conditions Search Method Extraction	Area Size Adjustment (Refer to p. 286) Preprocess Slice Level Filter Target Sorting Order Labeling Boundary Perimeter Projection Width, Height Principal axis angle Fill Holes Max. Object Area Min. Object Area Max. Proj. Width	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	No	No No Yes No Yes Yes No Yes	Yes Yes Yes Yes Yes Yes Yes Yes No Yes No Yes Yes Yes Yes Yes
Parameter	Setting Inspection Conditions Search Method Extraction	Area Size Adjustment (Refer to p. 286) Preprocess Slice Level Filter Target Sorting Order Labeling Boundary Perimeter Projection Width, Height Principal axis angle Fill Holes Max. Object Area Min. Object Area	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	No	No No Yes No Yes No Yes Yes No Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes No Yes No Yes No Yes Yes Yes

Feature Ext	raction (FEC)			Change	Statistics	Pos. Adj Base checker	Area Size Adjustment
	Judgement	OK Judge. N	lax.	Yes	No	No	No
	Limits	OK Judge. N	lin.	Yes	No	No	
Result	Common	Judgement		No	3	Refer to the	Refer to the
	Result	Inspection tir	me	No	2	items of	items of Area
	Individual	No. of Objec	ts	No	2	Position	Size
	Result 1:	Area		No	2	 Adjustment (PAC) 	Adjustment (AUC)
	1/2 page	Gravity X		No	2	= (PAC)	(AUC)
		Gravity Y		No	2		
		Projection W	lidth	No	2	_	
		Projection H		No	2	_	
		Perimeter	oigint	No	2		
		Principal axis	sanale	No	2		
		Proj. X	sangle	No	2		
				No	2		
	la di dala di	Proj. Y	n n De sterrele				
	Individual Result 2:	Upper Left X		No	2		
	2/2 page	Upper Left Y		No	2		
		Circumscribi Upper Right	ng Rectangle X	No	2		
		Circumscribi Upper Right	ng Rectangle Y	No	2		
		Circumscribi Lower Left X	ng Rectangle	No	2		
		Circumscribi Lower Left Y	ng Rectangle	No	2		
			ng Rectangle	No	2		
			ng Rectangle	No	2		
Smart Matc	hing (SMC)			Change	Statistics	Pos. Adj Base checker	Area Size Adjustment
Parameter	Area Setting	Search Area	(Refer to p.286)	Yes	No	No	Yes
	Inspection	Preprocess		Yes	No	Yes	Yes
	Conditions	Detect B/W F Template	Reversed	Yes	No	Yes	Yes
		Angle - Accu	racy	Yes	No	No=> Position Adjustment	Yes
						Yes= > Pos/Rot Adjustment	
		Sorting		Yes	No	Pos/Rot Adjustment Yes	Yes
		Sorting Orde		Yes Yes	No	Pos/Rot Adjustment Yes Yes	Yes Yes
		Sorting Orde Template Ro	tated by 180d	Yes Yes		Pos/Rot Adjustment Yes	
		Sorting Orde Template Ro Ignore Dark	tated by 180d Image	Yes Yes Yes	No No No	Pos/Rot Adjustment Yes Yes Yes Yes	Yes
		Sorting Orde Template Ro	tated by 180d Image	Yes Yes	No No	Pos/Rot Adjustment Yes Yes Yes	Yes Yes
	Sequence	Sorting Orde Template Ro Ignore Dark Threshold to	tated by 180d Image	Yes Yes Yes Yes Yes	No No No No	Pos/Rot Adjustment Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes
	Sequence	Sorting Orde Template Ro Ignore Dark Threshold to Image	tated by 180d Image Ignore Dark Min.	Yes Yes Yes Yes	No No No	Pos/Rot Adjustment Yes Yes Yes Yes Yes	Yes Yes Yes Yes
	Sequence	Sorting Orde Template Ro Ignore Dark Threshold to Image	tated by 180d Image Ignore Dark Min. Correlation	Yes Yes Yes Yes Yes	No No No No	Pos/Rot Adjustment Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes
	Sequence	Sorting Orde Template Rc Ignore Dark Threshold to Image 1st	tated by 180d Image Ignore Dark Min. Correlation Max. Count Min.	Yes Yes Yes Yes Yes	No No No No No	Pos/Rot Adjustment Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes
	Sequence	Sorting Orde Template Rc Ignore Dark Threshold to Image 1st	tated by 180d Image Ignore Dark Min. Correlation Max. Count Min. Correlation	Yes Yes Yes Yes Yes Yes Yes	No No No No No No	Pos/Rot Adjustment Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes

Smart Matc	hing (SMC)			Change	Statistics	Pos. Adj Base checker	Area Size Adjustment
		4th	Min.	Yes	No	Yes	Yes
			Correlation				
			Max. Count	Yes	No	Yes	Yes
		5th	Min. Correlation	Yes	No	Yes	Yes
			Max. Count	Yes	No	Yes	Yes
		6th	Min. Correlation	Yes	No	Yes	Yes
			Max. Count	Yes	No	Yes	Yes
		Square Cor		Yes	No	Yes	Yes
	Subtractio n	Min. Subtra	cted Size	Yes	No	No	No
		Subtraction	Threshold	Yes	No	No	No
		Filter		Yes	No	No	No
		Max. OK No Objects	o. of Subtracted	Yes	No	No	No
Result		Judgement		No	3	_ Refer to the	Refer to the
		Inspection t		No	2	_ items of	items of Area
		No. of Obje		No	2	 Position Adjustment 	Size Adjustment
		Detect Tem		No	2	- (PAC)	(AUC)
		Correlation	Value	No	2	(17(0))	(/(00)
		<u>X</u>		No	2	_	
		Y		No	2	_	
		Angle	reated Objects	No	2	_	
			racted Objects	No	2	_	
		Object	ax. Subtracted	No	2	_	
		Proj. X		No	2		
		Proj. Y		No	2	_	
		No. of Obje Correlation		No No	2	_	
			()			2 , , , , , ,	
Flaw Detect	. ,	Anna Oattin			Change	Statistics	
Parameter	Area		g (Refer to p.286)		Yes	No	
	Setting		djustment (Refer	to p.286)	Yes	No	
	Inspection	Preprocess			Yes	No	
	Conditions	Scan Direct			Yes	No	
	Search		Cells for Calculation	on Range	Yes	No	
	Method		Cells per Shift		Yes	No	
		Threshold			Yes	No	
		Min. Flaw S			Yes	No	
		Detect Mod			Yes	No	
	Judgement	OK Judge. I			Yes	No	
	Limits	OK Judge. I	Min.		Yes	No	
Result		Judgement			No	3	
		Inspection t			No	2	
		No. of Obje	cts		No	2	
		Flaw size			No	2	
		First Cell of			No	2	
		X coordinat	е		No	2	
		Y coordinat	e		No	2	
		Proj. X			No	2	
		Proj. Y		-	No	2	

Area			
	Area Setting (Refer to p.286)	Yes	No
Setting	Area Size Adjustment (Refer to p.286)	Yes	No
Inspection	Preprocess	Yes	No
Conditions	Slice Level	Yes	No
	Target	Yes	No
	Filter	Yes	No
	Set Individually	Yes	No
Judgement	Common Judgement Max.	Yes	No
Limits	Common Judgement Min.	Yes	No
	Individual Judgement Max.	Yes	No
	Individual Judgement Min.	Yes	No
	Judgement	No	3
	Inspection time	No	2
	No. of Cells	No	2
	Area	No	2
	Individual Judgement	No	3
Gray Window	v (CGW)	Change	Statistic
Area		Yes	No
Setting			No
Inspection			No
Conditions			
Judgement	Set Individually	Yes	No
Limits	Common Judgement Max.	Yes	No
	Common Judgement Min.	Yes	No
	Individual Judgement Max.	Yes	No
	Individual Judgement Min.	Yes	No
	Judgement	No	3
	Inspection time	No	2
	No. of Cells	No	2
	Gray Average	No	2
	Individual Judgement	No	3
Gray Edge (C	GE)	Change	Statistic
Area Setting	Area Setting (Refer to p.286)	Yes	No
Inspection	Preprocess	Yes	No
Condition	Detect Direction	Yes	No
	Scan method	Yes	No
	Edge condition 0	Yes	No
	Edge condition 1	Yes	No
	Detect Position	Yes	No
Search	Scan Pitch	Yes	No
Method	Filter	Yes	No
	Width	Yes	No
	Average Range	Yes	No
Gray Edge (C		Change	Statistic
	Max. Judge. Pitch	Yes	No
Judgement	Min. Judge. Pitch	Yes	No
Limits			
	Max Distance Difference Judgement	Yes	No
	Max. Distance Difference Judgement	Yes	No
Limits	Min. Distance Difference Judgement	Yes	No
Limits	Min. Distance Difference Judgement Set Individually	Yes Yes	No No
Limits	Min. Distance Difference Judgement Set Individually Common Threshold 0	Yes Yes Yes	No No No
Limits	Min. Distance Difference Judgement Set Individually	Yes Yes	No No
	Limits Gray Window Area Setting Inspection Conditions Judgement Limits Gray Edge (C Area Setting Inspection Condition Search	Set IndividuallyJudgementCommon Judgement Max.LimitsCommon Judgement Min.Individual Judgement Max.Individual Judgement Max.Individual Judgement Min.Judgement Min.JudgementInspection timeNo. of CellsAreaIndividual JudgementAreaIndividual JudgementPreprocessSettingArea Setting (Refer to p. 286)SettingArea Setting (Refer to p. 286)InspectionPreprocessConditionsSet IndividuallyJudgementCommon Judgement Max.LimitsCommon Judgement Max.Individual Judgement Max.Individual Judgement Max.Individual Judgement Min.Individual Judgement Max.Individual Judgement Min.Individual Judgement Max.Inspection timeNo. of CellsGray Edge (CGE)Area Setting (Refer to p. 286)AreaArea Setting (Refer to p. 286)SettingDetect DirectionScan methodEdge condition 0Edge condition 0Edge condition 1Detect PositionScan PitchMethodFilter	Set IndividuallyYesJudgement LimitsCommon Judgement Max.YesIndividual Judgement Min.YesIndividual Judgement Max.YesIndividual Judgement Min.YesJudgementNoInspection timeNoNo. of CellsNoAreaNoIndividual JudgementNoGray Window (CGW)ChangeAreaArea Setting (Refer to p. 286)YesInspectionPreprocessYesInspectionSet IndividuallyYesConditionsSet IndividuallyYesJudgementSet IndividuallyYesInspectionSet IndividuallyYesInspectionSet IndividuallyYesJudgementMax.YesIndividual Judgement Max.YesIndividual Judgement Max.YesIndividual Judgement Max.YesIndividual Judgement Max.YesJudgementNoInspection timeNoInspection timeNoNo. of CellsNoInspection timeNoNo. of CellsNoIndividual JudgementNoInspectionYesSettingPreprocessPreprocessYesSettingDetect DirectionYesEdge condition 0YesEdge condition 1YesDetect DirectionSear methodYesEdge condition 1YesDetect PositionYesSearch

Connector	- Gray Edge (C	GE)	Change	Statistics	
Result	Common	Judgement	No	3	=
	Result	Pitch Total Judgement	No	3	-
	1/2 page	Distance Difference Total Judgement	No	3	-
		Inspection time	No	2	-
		No. of Cells	No	2	=
		Max. Pitch	No	2	=
		Min. Pitch	No	2	=
		Average Pitch	No	2	-
	Individual	Pitch Individual Judgement	No	3	=
	Result 1: 2/2 page	Individual judgement for Distance Difference	No	3	_
		Pitch	No	2	_
		Distance Difference	No	2	_
		Area 0: X-Coord. Edge	No	2	_
		Area 0: Y-Coord. Edge	No	2	_
		Area 0: Edge Differential	No	2	
		Area 1: X-Coord. Edge	No	2	_
		Area 1: Y-Coord. Edge	No	2	_
		Area 1: Edge Differential	No	2	_
Smart Edge	e (Circle) (SEC))	Change	Statistics	Pos. Adj Base checker
Parameter	Area	Area Setting (Refer to P.286)	Yes	No	No
	Setting	Area Size Adjustment (Refer to P.286)	Yes	No	No
	Virtual	Preprocess	Yes	No	Yes
	Circle	Detection Method	Yes	No	Yes
	Detect	Edge ratio used	Yes	No	Yes
	Condition	Execution Mode	Yes	No	Yes
		Base Angle	Yes	No	No
		Descrittation Associations and	Yes	No	No
		Result No. Assignment	165	110	
	Edge Detect		Yes	No	Yes
	Edge Detect Condition				-
		Scan Direction 0	Yes	No	Yes
		Scan Direction 0 Scan Method 0	Yes Yes	No No	Yes Yes
		Scan Direction 0 Scan Method 0 Edge Condition 0	Yes Yes Yes	No No No	Yes Yes Yes
		Scan Direction 0 Scan Method 0 Edge Condition 0 Edge Threshold 0	Yes Yes Yes Yes	No No No	Yes Yes Yes Yes

*) The name varies depending on Detect Mode.

Judgement

Limits

- When selecting "Width": Max.: Width (Min.)"

- When selecting "Diameter": Max.: Dia. (Min.)"

Averange Range 0

Scan Direction 1

Edge Condition 1

Edge Threshold 1

Detect Position 1

Averange Range 1

Denoising Range 0

Denoising Range 1

Meas.: Radius* Maximum

Meas.: Radius* Minimum

Filter 1

Width 1

Denoising 0

Denoising 1

Scan Method 1

Yes

No

Yes

No

Smart Ed	lge (Circle) (SEC)	Change	Statistics	Pos. Adj Base checke
		Max. Standard Deviation	Yes	No	No
		Min. Standard Deviation	Yes	No	No
		Max. Circularity	Yes	No	No
		Min. Circularity	Yes	No	No
		Max. Unused Edge Cnt.	Yes	No	No
Result	Detected	Max. Measurement	No	2	Refer to the
	Result: 1/3	Min. Measurement	No	2	items of
	page	Average Measurement	No	2	Position
		Standard Deviation	No	2	 Adjustment
		Max. Angle	No	2	– (PAC)
		Min. Angle	No	2	
		Center X 0	No	2	
		Center Y 0	No	2	
		Radius 0	No	2	_
		Circularity 0	No	2	_
		Center X 1	No	2	_
		Center Y 1	No	2	_
		Radius 1	No	2	_
		Circularity 1	No	2	-
	Common	Judgement	No	3	_
	Result: 2/3	Measurement Judgement	No	3	_
	page	Standard Devation Judgement	No	3	_
		Circularity Judgement	No	3	
		Unused Edge Count Judgement	No	3	
		Inspection Time	No	2	
		Used Edge Count	No	2	_
		Unused Edge Count	No	2	
		No. of Cells	No	2	_
	Individual	Cell Individual Result: Judgement	No	3	
	Result: 3/3	Cell Individual Result: Measurement	No	2	
	page	Cell Individual Result: Deviation	No	2	_
		Cell Individual Result: X 0	No	2	_
		Cell Individual Result: Y 0	No	2	_
		Cell Individual Result Differential 0	No	2	_
		Cell Individual Result: X 1	No	2	—
		Cell Individual Result: Y 1	No	2	—
		Cell Individual Result: Differential 1	No	2	
		Cell Individual Result: Judgement Code	No	2	_

Smart Edge	e (Line) (SEL)		Change	Statistics	Pos. Adj Base checker	Area Size Adj.
	Area	Area Setting (Refer to P.286)	Yes	No	No	Yes
Parameter	Setting	Area Size Adjustment (Refer to P.286)	Yes	No	No	
	Approximat	Preprocess	Yes	No	Yes	Yes
	e Line	Detection Method	Yes	No	Yes	Yes
	Detect	Edge ratio used	Yes	No	Yes	Yes
	Condition	Execution Mode	Yes	No	Yes	Yes
		Base Angle	Yes	No	No	No
		Result No. Assignment	Yes	No	No	No
	Edge Detect	Scan Direction 0	Yes	No	Yes	Yes
	Condition	Scan Method 0	Yes	No	Yes	Yes
		Edge Condition 0	Yes	No	Yes	Yes
		Edge Threshold 0	Yes	No	Yes	Yes
		Detect Position 0	Yes	No	Yes	Yes

Smart Edg	e (Line) (SEL)		Change	Statistics	Pos. Adj Base checker	Area Size Adj.
		Filter 0	Yes	No	Yes	Yes
		Width 0	Yes	No	Yes	Yes
		Averange Range 0	Yes	No	Yes	Yes
		Scan Direction 1	Yes	No	No	No
		Scan Direction 1	Yes	No	No	No
		Scan Method 1	Yes	No	No	No
		Edge Condition 1	Yes	No	No	No
		Edge Threshold 1	Yes	No	No	No
		Detect Position 1	Yes	No	No	No
		Filter 1	Yes	No	No	No
		Width 1	Yes	No	No	No
	Judgement	Denoising 0	Yes	No	No	No
	Limits	Denoising Range 0	Yes	No	No	No
		Denoising 1	Yes	No	No	No
		Denoising Range 1	Yes	No	No	No
		Meas.: Deviation* Maximum	Yes	No	No	No
		Meas.: Deviation* Minimum	Yes	No	No	No
		Max. Standard Deviation	Yes	No	No	No
		Min. Standard Deviation	Yes	No	No	No
		Max. Linearity	Yes	No	No	No
		Min. Linearity	Yes	No	No	No
		Max. Unused Edge Cnt.	Yes	No	No	No
Result	Common	Max. Measurement	No	2	Refer to the	Refer to the items of Area Size Adj. (AUC)
	Result: 1/3	Min. Measurement	No	2	items of Position Adj. (PAC)	
	page	Average Measurement	No	2		
		Standard Deviation	No	2		
		Max.: X	No	2		
		Max.: Y	No	2		
		Min.: X	No	2	-	
		Min.: Y	No	2	-	
		Judgement	No	2	-	
		Measurement Judgement	No	2	-	
		Judgement	No	2	-	
		Measurement Judgement	No	2	_	
		Standard Devation Judgement	No	2	_	
		Linearity Judgement	No	2	_	
		Unused Edge Count Judgement	No	2	-	
		Inspection Time	No	2	_	
		Used Edge Count	No	2	_	
		Unused Edge Count	No	2	_	
		No. of Cells	No	2	-	
	Detected	Line 0 Start Coord. X	No	2	-	
	Result: 2/3	Line 0 Start Coord. Y	No	2	-	
	page	Line 0 End Coord. X	No	2	_	
		Line 0 End Coord. Y	No	2	_	
		Line 0 Element a	No	2	_	
		Line 0 Element b	No	2	_	
		Line 0 Element c	No	2	-	
		Line Angle 0	No	2	_	
				2	_	
		Linearity 0	No	4		

*1) The name varies depending on Detect Mode. - When selecting "Distance": Max.: Distance (Min.)" - When selecting "Width": Max.: Width (Min.)"

Smart Edge (Line) (SEL)		Change	Statistics	Pos. Adj Base checker	Area Size Adj.
	Line 1 Start Coord. X	No	2		
	Line 1 Start Coord. Y	No	2	_	
	Line 1 End Coord. X	No	2	_	
	Line 1 End Coord. Y	No	2	_	
	Line 1 Element a	No	2	_	
	Line 1 Element b	No	2	_	
	Line 1 Element c	No	2	_	
	Line Angle 1	No	2		
	Linearity 1	No	2	_	
Individual	Individual Judgement	No	3	_	
Result: 3/3	Measurement	No	2	_	
page	X0	No	2	_	
(Results of each cell)	Y0	No	2	_	
each ceil)	Diff.0	No	2	_	
	_X1	No	2	_	
	Y1	No	2	_	
	Diff.1	No	2	_	
	Judgement Code	No	2		

Geometry C	alculation		Change	Statistics
Parameter	Attribute	Line Display	Yes	No
	Setting	Angle Range	Yes	No
		Direction	Yes	No
		Intersecting Angle	Yes	No
	Judgement	Max. X Judge.	Yes	No
	Limits	Min. X Judge.	Yes	No
		Max. Y Judge.	Yes	No
		Min. Y Judge.	Yes	No
		Max. Standard Devi. Judge.	Yes	No
		Min. Standard Devi. Judge.	Yes	No
		Max. Angle Judge.	Yes	No
		Min. Angle Judge.	Yes	No
		Max. Distance Judge.	Yes	No
		Min. Distance Judge.	Yes	No
		Max. Intersecting Angle Judge.	Yes	No
		Min. Intersecting Angle Judge.	Yes	No
		Max. Radius Judge.	Yes	No
		Min. Radius Judge.	Yes	No
		Max. Major Axis Judge.	Yes	No
		Min. Major Axis Judge.	Yes	No
		Max. Minor Axis Judge.	Yes	No
		Min. Minor Axis Judge.	Yes	No
Result	1/2 page	X	No	2
		Y	No	2
		Standard Deviation	No	2
		Angle	No	2
		Line Parameter A	No	2
		Line Parameter B	No	2
		Line Parameter C	No	2
		Distance	No	2
		Intersecting Angle	No	2
		Radius	No	2
		Major Axis	No	2
		Minor Axis	No	2
		Inspection Time	No	2

Geometry Calculation		Change	Statistics
2/2 page	Judgement	No	3
	X Judge.	No	3
	Y Judge.	No	3
	Standard Devi. Judge.	No	3
	Angle Judge.	No	3
	Distance Judge.	No	3
	Intersecting Angle Judge.	No	3
	Radius Judge.	No	3
	Major Axis Judge.	No	3
	Minor Axis Judge.	No	3

For All Checkers - Area Setting

Line, Binary Edge, Gray Edge, Smart Matching, Flaw Detection (Line, Plane), Connector (Binary Window, Gray Window), Smart Edge (Line) Area Setting Start Point X End Point X Fend Point X End Point Y Start Point Y Fes No Binary Window, Gray Window, Feature Extraction Area Setting Start Point X Change Start Point X Fes No Binary Window, Gray Window, Feature Extraction Area Setting Start Point X Change Start Point X Fes No Start Point X Fes No Start Point X Fes No Contector (Ellipse), Smart Edge (Circle) Flaw Detection (Ellipse), Smart Edge (Circle) Flaw Detector (Gray Edge) Flaw Detecto		J		
Start Point YYesNoEnd Point XYesNoEnd Point YYesNoBinary Window, Gray Window, Feature ExtractionChangeStatisticsArea SettingStart Point XYesNoStart Point XYesNoEnd Point XYesNoEnd Point XYesNoEnd Point XYesNoEnd Point XYesNoEnd Point YYesNoEnd Point YYesNoVertex X (When the shape is polygon)YesNoVertex Y (When the shape is polygon)YesNoFlaw Detection (Ellipse), Smart Edge (Circle)Vertex Y (When the shape is polygon)YesFlaw Detection (Ellipse), Smart Edge (Circle)Vertex Y (YesNoRadius XYesNoRadius XYesRadius XYesNoRadius XYesNoConnector (Gray Edge)Start Point X0YesNoEnd Point X0YesNoEnd Point X0YesNoEnd Point X0YesNoStart Point X1YesNoStart Point X1YesNoStart Point X1YesNo	Detection (Line,	Plane), Connector (Binary Window,	Change	Statistics
End Point XYesNoEnd Point YYesNoBinary Window, Gray Window, Feature ExtractionChangeStatisticsArea SettingStart Point XYesNoStart Point XYesNoEnd Point XYesNoEnd Point XYesNoEnd Point XYesNoEnd Point XYesNoEnd Point YYesNoVertex X (When the shape is polygon)YesNoVertex Y (When the shape is polygon)YesNoFlaw Detection (Ellipse), Smart Edge (Circle)Center XYesNoRadius XYesNoRadius XYesNoRadius YYesNoConnector (Gray Edge)End Point X0YesNoEnd Point X1YesNoEnd Point X1YesNo	Area Setting	Start Point X	Yes	No
End Point YYesNoBinary Window, Gray Window, Feature ExtractionChangeStatisticsArea SettingStart Point XYesNoStart Point YYesNoEnd Point XYesNoEnd Point YYesNoEnd Point YYesNoVertex X (When the shape is polygon)YesNoVertex Y (When the shape is polygon)YesNoFlaw Detection (Ellipse), Smart Edge (Circle)Vertex Y (When the shape is polygon)YesNoFlaw Detection (Ellipse), Smart Edge (Circle)Center YYesNoRadius XYesNoRadius XYesNoRadius YYesNoRadius YNoStart Point X0Connector (Gray Edge)Start Point X0YesNoStart Point X0End Point Y0YesNoStart Point X1YesNoStart Point X1YesNoStart Point X1YesNo		Start Point Y	Yes	No
Binary Window, Gray Window, Feature ExtractionChangeStatisticsArea SettingStart Point XYesNoStart Point YYesNoEnd Point XYesNoEnd Point XYesNoEnd Point YYesNoVertex X (When the shape is polygon)YesNoVertex Y (When the shape is polygon)YesNoFlaw Detection (Ellipse), Smart Edge (Circle)Center XYesNoCenter YYesNoRadius XYesNoRadius XYesNoRadius XYesNoConnector (Gray Edge)Start Point X0YesNoStart Point X0End Point Y0YesNoStart Point X1YesNoStart Point X1YesNoStart Point X1YesNo		End Point X	Yes	No
Area SettingStart Point XYesNoStart Point YYesNoEnd Point XYesNoEnd Point YYesNoEnd Point YYesNoVertex X (When the shape is polygon)YesNoVertex Y (When the shape is polygon)YesNoFlaw Detection (Ellipse), Smart Edge (Circle)Center XYesNoCenter YYesNoRadius XYesNoRadius XYesNoRadius YYesNoConnector (Gray Edge)Start Point X0YesNoStart Point X0End Point X0YesNoStart Point X1YesNoStart Point X1YesNoStart Point X1YesNoStart Point X1YesNoStart Point X1YesNo		End Point Y	Yes	No
Start Point YYesNoEnd Point XYesNoEnd Point XYesNoEnd Point YYesNoVertex X (When the shape is polygon)YesNoVertex Y (When the shape is polygon)YesNoFlaw Detection (Ellipse), Smart Edge (Circle)Center XYesCenter YYesNoRadius XYesNoRadius YYesNoConnector (Gray Edge)Start Point X0YesYesNoStart Point X0YesStart Point YOYesNoEnd Point Y1YesNoStart Point X1YesNoStart Point X1YesNo	Binary Window,	Gray Window, Feature Extraction	Change	Statistics
End Point XYesNoEnd Point XYesNoEnd Point YYesNoVertex X (When the shape is polygon)YesNoVertex Y (When the shape is polygon)YesNoFlaw Detection (Ellipse), Smart Edge (Circle)Center XYesNoCenter YYesNoCenter YYesNoRadius XYesNoRadius YYesNoConnector (Gray Edge)Start Point X0YesNoEnd Point X0YesNoEnd Point X0YesNoEnd Point X0YesNoStart Point Y0YesNoStart Point Y0YesNoStart Point X1YesNoEnd Point X1YesNoStart Point X1YesNo	Area Setting	Start Point X	Yes	No
End Point YYesNoEnd Point YYesNoVertex X (When the shape is polygon)YesNoVertex Y (When the shape is polygon)YesNoFlaw Detection (Ellipse), Smart Edge (Circle)YesNoCenter XYesNoCenter YYesNoRadius XYesNoRadius YYesNoConnector (Gray Edge)Start Point X0YesImage: Start Point X0YesNoEnd Point X0YesNoEnd Point X0YesNoStart Point X1YesNoStart Point X1YesNoStart Point X1YesNo		Start Point Y	Yes	No
Vertex X (When the shape is polygon)YesNoVertex Y (When the shape is polygon)YesNoFlaw Detection (Ellipse), Smart Edge (Circle)YesNoCenter XYesNoCenter YYesNoRadius XYesNoRadius XYesNoConnector (Gray Edge)YesNoStart Point X0YesNoEnd Point X0YesNoStart Point X0YesNoEnd Point X0YesNoStart Point X0YesNoEnd Point X1YesNoStart Point X1YesNoStart Point X1YesNoStart Point X1YesNo		End Point X	Yes	No
polygon)Vertex Y (When the shape is polygon)YesNoFlaw Detection (Ellipse), Smart Edge (Circle)Center XYesNoCenter YYesNoRadius XYesNoRadius YYesNoConnector (Gray Edge)Start Point X0YesStart Point X0YesNoEnd Point X0YesNoStart Point X1YesNoEnd Point X1YesNoStart Point X1YesNoStart Point X1YesNoStart Point X1YesNoStart Point X1YesNo		End Point Y	Yes	No
polygon)Flaw Detection (Ellipse), Smart Edge (Circle)Center XYesNoCenter YYesNoRadius XYesNoRadius YYesNoConnector (Gray Edge)Start Point X0YesStart Point YOYesNoEnd Point X0YesNoEnd Point Y0YesNoStart Point Y1YesNoStart Point Y1YesNoStart Point Y1YesNoStart Point X1YesNo		· · ·	Yes	No
Center XYesNoCenter YYesNoRadius XYesNoRadius YYesNoConnector (Gray Edge)Start Point X0YesStart Point YOYesNoEnd Point X0YesNoEnd Point X0YesNoStart Point Y0YesNoEnd Point X1YesNoStart Point Y1YesNoStart Point X1YesNo		· ·	Yes	No
Center YYesNoRadius XYesNoRadius YYesNoConnector (Gray Edge)Start Point X0YesStart Point YOYesNoEnd Point X0YesNoEnd Point X0YesNoStart Point Y0YesNoEnd Point X0YesNoStart Point Y0YesNoEnd Point X1YesNoStart Point Y1YesNoEnd Point X1YesNo	Flaw Detection ((Ellipse), Smart Edge (Circle)		
Radius XYesNoRadius XYesNoRadius YYesNoConnector (Gray Edge)Start Point X0YesNoStart Point YOYesNoEnd Point X0YesNoEnd Point X0YesNoEnd Point YOYesNoStart Point Y1YesNoStart Point X1YesNoEnd Point X1YesNo		Center X	Yes	No
Radius YYesNoConnector (Gray Edge)Start Point X0YesNoStart Point Y0YesNoEnd Point X0YesNoEnd Point X0YesNoStart Point Y0YesNoStart Point Y0YesNoEnd Point Y0YesNoStart Point Y1YesNoStart Point X1YesNoEnd Point X1YesNo		Center Y	Yes	No
Connector (Gray Edge)Start Point X0YesNoStart Point Y0YesNoEnd Point X0YesNoEnd Point Y0YesNoStart Point Y1YesNoStart Point Y1YesNoEnd Point X1YesNoStart Point X1YesNoStart Point X1YesNoEnd Point X1YesNo		Radius X	Yes	No
Start Point X0YesNoStart Point Y0YesNoEnd Point X0YesNoEnd Point Y0YesNoStart Point Y1YesNoStart Point X1YesNoEnd Point X1YesNoStart Point Y1YesNoEnd Point X1YesNo		Radius Y	Yes	No
Start Point Y0YesNoEnd Point X0YesNoEnd Point Y0YesNoStart Point X1YesNoStart Point Y1YesNoEnd Point X1YesNo	Connector (Gray	y Edge)		
End Point X0YesNoEnd Point Y0YesNoStart Point X1YesNoStart Point Y1YesNoEnd Point X1YesNo		Start Point X0	Yes	No
End Point Y0YesNoStart Point X1YesNoStart Point Y1YesNoEnd Point X1YesNo		Start Point Y0	Yes	No
Start Point X1YesNoStart Point Y1YesNoEnd Point X1YesNo		End Point X0	Yes	No
Start Point Y1YesNoEnd Point X1YesNo		End Point Y0	Yes	No
End Point X1 Yes No		Start Point X1	Yes	No
		Start Point Y1	Yes	No
End Point Y1 Yes No		End Point X1	Yes	No
		End Point Y1	Yes	No

Line, Binary Window, Gray Window, Binary Edge, Gray Edge, Change Statistic Feature Extraction, Smart Edge (Circle), Smart Edge (Line)			Statistics
Area Size	Size Area Size Adjustment Offset (Top)		No
Adjustment	Area Size Adjustment Offset (Bottom)	Yes	No
	Area Size Adjustment Offset (Left)	Yes	No
	Area Size Adjustment Offset (Right)	Yes	No
Flow Detection, Connector (Binary Window, Gray Window)		Change	Statistics
Area Size	Area Size Adjustment Offset (Start)	Yes	No
Adjustment	Area Size Adjustment Offset (End)	Yes	No

For All Checkers - Area Setting - Area Size Adjustment

Numerical Calculation

			Change	Statistics
Numerical	Parameter	Max. Judge.	Yes	No
Calculation (CAC)		Min. Judge.	Yes	No
	Result	Judgement	No	3
		Result	No	2
Numerical	Result	Judgement	No	3
Calculation Previous Value (OCA)		Result	No	2

Judgement

			Change	Statistics
JRC (Internal)	Judgement	Result	No	3
JDC (External)	_		No	3

System Values

	Change	Statistics
Inspection Time	No	No
Inspection Cycle	No	No
Total Judgement	No	No
Scan Count	No	No
Run Type No.	No	No
Date (Y-M-D)	No	No
Time (H-M-S)	No	No

System Register

	Change	Statistics
SYS:REG0 to SYS REG7	Yes	No

Slice Level

Slice Level	Change	Statistics
Maximum value (Group A to Z)	Yes	No
Minimum value (Group A to Z)	Yes	No

Preprocess

Camera No.0 - 3, Group A - E, 1st step - 10th step	Change	Statistics
Туре	Yes	No
Parameter 0 (Parameter name) to Parameter 8 (Parameter name)	Yes	No

* The parameter name set for the selected step (1-10) is displayed. It shows the parameter number without name is not used for the selected preprocess type.

Text

Text	Change	Statistics
(Up to 16 characters)	No	No

Numerical Calculation

Numerical Calculation (CAC)	Change	Statistics
Max. Judgement	Yes	No
Min. Judgement	Yes	No
Numerical Result	No	2
Judgement	No	3
Previous Result (OCA)	Change	Statistics
Numerical Result	No	2
Judgement	No	3

Judgement

Judgement (JRC)	Change	Statistics
Judgement	No	3
Judgement (JDC)	Change	Statistics
Judgement	No	3

Statistics group

No.	Numeric Statistics	All Statistics	OK Statistics	NG Statistics
2	Statistics of checker results	Minimum	OK Minimum	NG Minimum
	If the checker is OK, calculates "All	Maximum	OK Maximum	NG Maximum
	Statistics" and "OK Statistics". If the	Average	OK Average	NG Average
	checker is NG, calculates "All Statistics" and "NG Statistics".	Range	OK Range	NG Range
and NG Statistics .	and NO Statistics .	Variance	OK Variance	NG Variance
3	Judgement Statistics If the checker is OK, calculates "All Statistics" and "OK Statistics". If the checker is NG, calculates "All Statistics" and "NG Statistics". When referring the statistics of judgements (JR/JD) during in RUN mode, the latest result is referred.	Scan Count (Judgement Count)	OK Count	NG Count

4.19 Marker

Marker is the function that displays figures of line, rectangle, circle, polygon or cross line on the screen window of RUN menu. This function can display an image on the screen like indicating a guide to position the object with no effect on the inspection time. This function also can move the marker by inputting commands from the externa

Up to eight markers can be set for each product camera.

Note

Creating and editing markers are operated in S However, they can be displayed only in the RUI Markers cannot be displayed on the screen win SFTUP menu

Refer to

Marker display: see page 304.

Creating Marker

1. In SETUP menu, select "TYPE" > "Marker Display" from the menu bar.

The marker menu is displayed. The marker list shows marker numbers and their shapes.

- 2. Specify a camera No. to set a marker.
- 3. Select the marker list and then select a marker number from 0 - 7 to create.

Note

The marker shape of larger number is displayed in front on the screen window.

For example, if you create markers in the same size and on the same position, setting No.0 in blue and No.7 in yellow, only the yellow marker No.7 is displayed on the screen.

4. Select a color from the eight colors.

5. Select "Set" of "Area Setting" to set area shape and area.

The procedure to select area shape and to specify area is the same as of checker area.

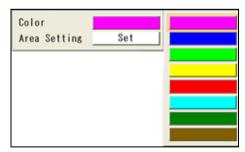
It can be set for the captured image and a total of 9 screens surrounding it. However, in the case of the marker of cross line, it can be set and displayed only in the area of the captured image.

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

When you close the marker setting window, the marker on the screen disappears which was displayed while you are setting it. This is because SETUP menu cannot display markers.

e created al device.	F
t type per	
ETUP Menu. N Menu. Idow in	

Sel	ect Type	Туре
Camera	a (0	•
0	Rectangle	£
1	Ellipse	
2		
3		
4		
5		
6		
7		





Copying Marker

1. Highlight the marker number you want to copy and press the FUNC key.

The pop-up menu appears.

- 2. Select "Copy".
- **3.** Highlight the marker number you want to paste and press the FUNC key.

The pop-up menu appears.

4. Select "Paste".

The marker is copied.

OPERATION ENVIRONMENT TYP Select Type Type Copy Paste Delete ectangle 1 2 3

Note

If a marker already exists in the destination, the message of overwrite confirmation appears. Selecting "Yes" executes copying the marker.

Deleting Marker

1. Highlight the marker number you want to delete and press the FUNC key.

The pop-up menu appears.

2. Select "Delete".

The confirmation screen is displayed.

3. Select "Yes".

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

OPERATION	ENVIRONM	ENT TYP
Select	Туре	Type
1) ectangle Rectangle	

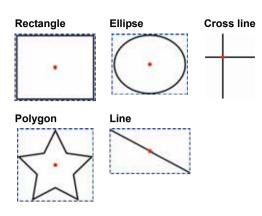
Moving Marker (Inputting Command from External Device)

Ver. 1.60 or later

The created marker can be moved by inputting commands (*1) from the external device. It is also possible to read the current position.

The position of the marker is based on the coordinate of the middle point of the circumscribing rectangle of the marker (the intersection point of two lines for Shape: Cross line).

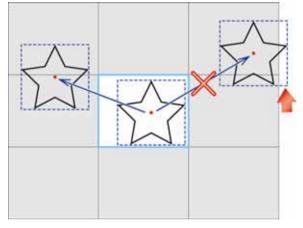
In the example on the right, the solid line shows the created marker, the dotted line shows the circumscribing rectangle of the marker, and the point in the center shows the middle point. The circumscribing rectangle and the middle point are not displayed on the screen window.



Movable range

As a result of moving through the distance specified with the command parameter from the current position, if the circumscribing rectangle of the marker (the intersection point of two lines in the case of cross line) is located within the nine screens (which are the captured image and eight surrounding screens), the marker can be moved.

As a result of the move, if only a part of the circumscribing rectangle goes out of the nine screens, the marker cannot be moved and an error occurs



Note

- Moving the marker is performed by specifying the moving distance from the current position. It is not possible to specify the coordinate of the destination to move.
- The position to be read and the specified moving distance is in units of pixel. It is not possible to read and specify the moving distance in the unit after calibration.
- Reading the marker position and writing the moving distance is performed with a set of X and Y coordinates. Reading (writing) is not available by specifying only X coordinate or Y coordinate.

Refer to

(*1) Read Command and Write Command: From page 377

Chapter 5

Setting of Operation and RUN Menu

Perform inspections along with the settings made in the previous chapter.

Start RUN mode

1. Switch to RUN menu by operating the "OPE/SET" switch.

If you switched to SETUP menu from RUN menu during an inspection stoppage, follow the procedure described below to restart the operation.

In other cases, switching to RUN menu starts the operation automatically.

2. Select "OPERATION" > "Start RUN Mode" from the menu bar.

When the dialog message appears, select "YES" to start the operation. The sign of "RUN" appears in the upper right of the screen.

OPERATION VIEW	LAYOUT	TOOL
Select Type Reset Statistics Start RUN Mode Stop RUN Mode To SETUP Menu	0	21140
Layout No.00		

Stop RUN mode

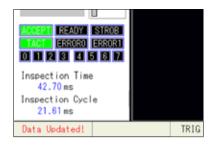
To stop RUN mode, follow the procedure below.

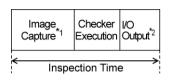
1. Select "OPERATION" > "Stop RUN Mode" from the menu bar.

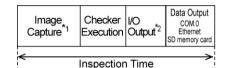
When the dialog message appears, select "YES" to stop the operation. The sign of "STOP" appears in the upper right of the screen.

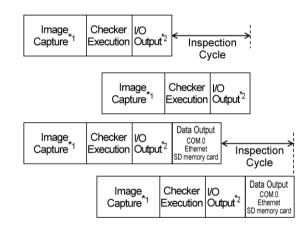
Inspection Time and Inspection Cycle

Executing an inspection shows "Inspection Time" or both of "Inspection Time" and "Inspection Cycle" in ms units in the lower left of the screen.









Inspection Time

When "Inspection Process" is set to "Serial", Inspection Time equals "READY signal OFF time" which is the time from START signal input to I/O output.

When you output data to COM.0 port, Ethernet port, or a SD memory card, or when you output inspection images in "Synchronous" method, Inspections Time is the time from Start signal input to completion of the data output.

Inspection Cycle

The time from the I/O output of the previous inspection to the I/O output of the current inspection. It is displayed only when "Inspection Process" is set to "Parallel".

When you output data to COM.0 port, Ethernet port, or a SD memory card, or when you output inspection images in "Synchronous" method, it is the time from the completion of the previous inspection data output to the completion of the current inspection data output.

Note

*1) The time of Image Capture includes the time of capture delay.

*2) When the data is output in several times, it indicates the I/O output to the last one.

The settings and operation listed below are available in RUN menu.

•	Select Type (OPERATION)	Switches types to execute.		Daga 206
•	Reset Statistics (OPERATION)	Resets the statistics data of the current type.		Page 296
•	Modification and registration of the display (VIEW, LAYOUT)	Sets the screen layout. Selects a winnow to display, selects contents of the screen window to display, specifies the size and position of the windows, and sets the window transparency and window sequence order. This information can be registered as layout data.		page 299
•	Save setting data (TOOL)	Saves the settings modified in RUN menu in the storage space in PV500 or a SD memory card.		
•	Save/clear image memory (TOOL)	Erases images saved during inspections and backups them in a SD memory card.		Page 297
•	Information (TOOL)	Displays the information of PV.	_	
•	Eject SD memory card (TOOL)	Prepares to eject the SD memory card.		
•	Data modification from the Data R/W window (Data R/W)	Modifies the modifiable data registered in the Data R/W.		page 274

5.2.1 Control of "OPERATION" Menu

Switching Types

Note

In RUN menu, you can switch types but modify them such as adding, deleting, copying types and entering a title.

 Select "OPERATION" > "Select Type" from the menu bar.

The list of product types appears.

2. Select a Type No. to switch.

The type is switched. When it is operating, the inspection will be continued on the switched type.

Note

While PV500 is inspecting with Individual Trigger, you cannot switch type when the PV is waiting for Individual Trigger*.

OLEVELINE ALEVELY PROPERTY OF	For.			BA KOC
Type No. 252		CORPORE DATE IN CO.		
and the second second				
	Type Title			
ayout No.00				
1409 - CCCC	House and the second	Concerning of the second s		
		Title?	-	
		r litter		
	000 finter	r litte?	_	
		r litte?		
	252 (Inter	Title?		
			_	
4610				
NAMES ADDRESS OF TAXABLE				
ATHER INCOMES INCOMES				
			_	
Insurant inter Time			- 1	
R.05ms	1			

The message appears 10 seconds after. Select to cancel Individual Trigger to switch type or to continue to wait for the trigger without type switch.

When selecting neither Yes nor No, the state will be the one of waiting for Individual Trigger displaying this message. If the signal of the rest of image capture is input, the type will be automatically switched. The status where the device is waiting for the rest of camera triggers after receiving some of the camera triggers.

You cannot switch Type when Cancel individual trigger a				is being	received.
	Yes	No	ļ		

In the following cases, Type Switch will be executed.

- When the rest of trigger signals are input within 10 seconds from selecting Type Switch. Executes Type Switch after image capturing is complete.
- When Abort Inspection/Process is executed within 10 seconds from selecting Type Switch. Stops waiting for Individual Trigger and executes Type Switch.
- When executing Individual Trigger Timeout. Executes Type Switch after the period of Individual Trigger Timeout passed.

Resetting Statistics Data

1. Select "OPERATION" > "Reset Statistics" from the menu bar.

When the dialog message appears, select "YES". If you select "No", resetting is canceled.

5.2.2 Control of "TOOL" Menu

Ejecting SD Memory Card

1. Select "TOOL" > "Eject SD Card" from the menu bar.

The message appears.

2. Select "Yes".

The message saying "The SD card can be ejected safely," appears. Select "OK" to eject the SD memory card.

Saving Setting Data

Saves the settings modified in RUN menu (or modified by a command of the external device). If you cut the power before saving the settings, the modified data will be cleared.

Note

It is displayed only when data saving in RUN menu is permitted. Refer to the setting of "ENVIRONMENT" > "Password" > "Save Changes in RUN menu" in SETUP menu.

1. Select "TOOL" > "Save Setting Data".

The destination selecting window is displayed.

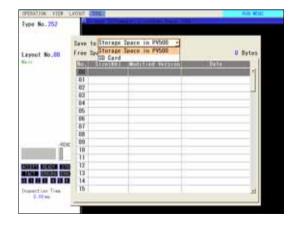
2. Select a place to save it.

Select "Storage Space in PV500" (or "SD card") for "Save to".

3. Select a "No." of a saving area.

When the dialog message appears, select "YES" to save. If you select "No", saving is canceled.

4. After saving is completed, press the CANCEL key.



Backing Up Saved Image

Backups the images saved in the image memory during inspections to a SD memory card. Backupping cannot be executed during operations (RUN).

1. Select "TOOL" > "Save Image Memory".

The message is displayed if it is operating. To stop the operation and backup the images, stop it from "OPERATION" menu.

2. Select a place in the SD memory card to save them.

When the confirmation message appears, select "YES".

3. After the saving is complete, the message appears. Select "OK" and press the CANCEL key.

Deleting Saved Image

Deletes the images saved in the image memory during inspections.

1. Select "TOOL" > "Clear Image Memory".

When the dialog message appears, select "YES". When the message disappears, deleting the images is complete.

Displaying Information of PV

1. Select "TOOL" > "Information" from the menu bar.

The list of PV information is displayed.

5.3 Setting Display in RUN Menu

Set the contents to display in RUN menu.

"Layout" is a combination of display contents described below. Up to 32 layouts can be registered and switched by a signal of the keypad or the external device.

Four types of layouts are initially registered in PV500. These are "Preset Layout".

Selecting Display Window / Size and Position of Windows

RUN menu can display up to four screen windows which show images and up to four Data R/W windows which show and modify the data. The size, position and sequence order of windows can be changed freely.

Contents Displayed in Screen Window

The contents displayed in each screen window are type and magnification of an image, checker pattern, or calibration scale. Set them with "Image Menu" from each screen window.

Window Transparency (RUN menu)

The transparence of Data R/W windows can be changed. Higher transparency of the window helps to observe the image.

This information is not included in the layout information.

Note

- The information of layout and window transparency is initialized by executing "Initialize" of "ENVIRONMENT" in SETUP menu.
- After being initialized, layout information will be three preset layouts registered as layout 0 3 and window transparency will be "0%".
- At startup, the layout number specified with the startup setting is called up. Refer to Chapter 6.2.1, page 311 about the setting procedure

5.3.1 Selecting a Preset Layout

PV500 has preset layouts to select. Based on a selected preset layout, you can arrange the layout and register it as a custom layout.

1. Select "LAYOUT" > "Layout" from the menu bar.

The layout setting window is displayed.

2. Select a layout No.

Layout No.0 - 31 can be selected.
Note
In the layout No.0 - 3, preset layouts 0 - 3 are registered initially.
Specifying No.0 - 3 here can select a preset layout.

3. Press the F2 (: Select Preset) key or press the FUNC key and select "Select Preset" from the displayed menu.

TRIG		FUNC	:Pop-up Menu	OP/SET: To SETUP Menu
F1	:Save Layout	F2	:Select Preset	ENTER :Switch Layout

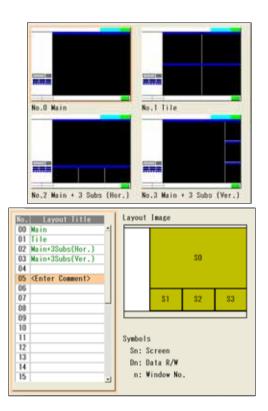
The window for selecting the preset layout No.0 - 3 appears. Four patterns of layouts (number of screen windows, the size, and the position) are preset. Display image of every pattern is set to Live and Gray.

4. Operate the ENTER key to select the desired layout number.

The window returns to the layout registering window. The selected layout image is displayed on the right.

5. Press the ENTER key.

The screen returns to RUN menu and shows the windows in the layout you selected.



5.3.2 Arranging Layout

Now we select displayed screen windows (up to four windows; No.0 - 3), R/W windows (up to four windows; No.0 - 3), and arrange the size and the position of the windows and other display settings.

Note

Be sure to save the setting data by registering the layout after layout arranging from "Layout". If you switch to the other layouts or turn off the power of PV500 before registering and saving the setting, the arranged layout will be cleared.

Selecting a Display Window

1. Select "VIEW" from the menu bar.

The menu is displayed.

Select "Screen" to select a screen window number to display.

OPERATION	VIER LAYOUT TOOL	-
Type No.(Screec Data R/W	· Data R/W 0
	Window Transparency (RUN eersy)	→Data R/W 1 Data R/W 2
	Window Sequence Order	Data R/W 2

The selected number of screen window is marked off and the Image menu is displayed. Select a camera image to display on the screen window and adjust the magnification. Refer to Chapter 3.2.2 Selecting a Display Image (Image Menu) (page 39) for details.

3. Select "Screen" from "VIEW" menu and select the number of screen window to hide.

The window number is unchecked.

- 4. Select "Data R/W" from "VIEW" menu and select the number of Data R/W window to hide. The selected number of Data R/W window is marked off and displayed.
- 5. Press the Cancel key.
- 6. Select "Data R/W" from "VIEW" menu and select the number of Data R/W window to hide. The window number is unchecked.

Adjusting Position and Size of the Screen Window

1. Press the F1 key.

The list of currently displayed window is displayed.

- 2. Operate the ENTER key to select a screen window to modify. Image menu is displayed.
- 3. Select "Move Window".
- 4. Move the window by operating the ENTER key and press the ENTER key to fix the position.

The frame of the window is displayed as white broken line while the window is moved.

- 5. Select "Change Size".
- 6. Move the start point of the screen window by operating the ENTER key and press the ENTER key to fix the position.
- 7. Move the end point of the screen window and press the ENTER key to fix it.

	N
--	---

ote Displaying magnification does not change. Perform "Magnification" or "Full Screen" of Image menu as necessary.

Resizing Screen Window to Display Image in 100% (or 50%) (Optimize size)

The screen window is changed into the size that can display an image in 100% for Quad-speed/ Ultra Compact camera and in 50% for 2-Mega-pixel camera.

1. Select "Optimize Size".

The size of the screen window is changed.

Selecting Image Type Displayed on Screen Window

See Chapter 3.2.2, page 39.

OPERATION	VIEW LAYOUT TOOL	
Type No.(Screen Data R/W	 Ive/Grav Scale →Data R/W 0
	Hindow Transparency (RUN menu)	✓Data R/₩ 1 Data R/₩ 2
	Window Sequence Order	Data R/W 3

OPERATION VIEW LAY
Select Camera
Memory/Live
Preprocess
Pattern Display
Scroll
Magnification
Full Screen
Move Window
Change Size
Optimize size
Close

Arranging a Data R/W Window

The data and the number of cells displayed in a Data R/W window can be specified from "TYPE" > "Data R/W" in SETUP menu.

In RUN menu, the items listed below can be set.

- Position/ size: Changes the position and size of the windows. The procedure is the same as the one of screen windows.
- Cell width: Sets the width of cells to display data by the columns.
- Translucent: Sets whether the transparence applies to Data R/W windows or not.
- Frame display: Displays or hides the frame when multiple cells are shown.

1. Press the F1 key.

The list of currently displayed window is displayed.

2. Operate the ENTER key to select a Data R/W window to modify.

3. Press the FUNC key and select "Move" or "Size" from the pop-up menu.

Move the window by operating the ENTER key and specify the size. The procedure is the same as the one of screen windows.

Move Size	
Cell Width Translucent Hide Frame Octimize Size	
Close	

4. Select the column to change its cell width and press the F1 key.

The cell width can be specified by a column basis.

5. Select "Cell Width" from the pop-up menu.

The setting window is displayed. Specify it in pixels according to the digit of the displayed data.

Even when Calibration is employed, specify the cell width in pixels.

6. Specify the value and press the ENTER key.

The cell width is changed. Change the cell width of other columns if needed.

7. Press the FUNC key and select "Translucent" from the pop-up menu.

The Data R/W window is displayed in the "Transparence" specified in VIEW menu. As you open the pop-up menu, "Translucent" is checked. Selecting "Translucent" again cancels to apply the transparence and the window is displayed in 0% of transparence.

8. Press the FUNC key and select "Hide Frame" from the pop-up menu.

The frame line is undisplayed. As you open the pop-up menu, "Hide Frame" is checked. Selecting "Hide Frame" again displays the frame.

Optimizing Window Size (Optimize Size)

Adjust the window size so that it displays all cells and no margin. This is optimization.

While you can adjust the window size by modifying the start/end point by "Size", using "Optimize Size" allows adjusting efficiently in one operation.

1. Press the FUNC key to display the pop-up menu.

2. Select "Optimize Size".

The size of the Data R/W window is changed.

Changing Window Transparency (RUN Menu)

The transparence of Data R/W windows can be changed. Select whether the transparence set here applies to each Data R/W window or not.

This is a function that helps to observe images and other windows when they are displayed overlapping with the window.

Note

The information of window transparency is not included in the layout information.

1. Select "VIEW" from the menu bar.

2. Select "Window Transparency (RUN menu)".

The transparence setting window is displayed. Default value is 0%. The larger value, the higher transparence.

- 3. Select desired transparency.
- 4. After setting is completed, press the CANCEL key.

Changing Sequence Order of Windows

When displaying multiple windows, the sequence order can be changed.

Note that Data R/W windows are displayed in front of screen windows and cannot be displayed in behind. The overlapping order can be arranged only among screen windows or only among Data R/W windows.

To arrange the order, replace the windows back and forth.

For example, replace the first and the second, or the second and the third.

1. Select "VIEW" > "Window Sequence Order".

The window sequence arranging window is displayed.

2. Select the window to change the order.

The letters of the selected window are displayed in red.

3. Select the window to replace its order with the window selected in step 2.

You can select only the replaceable window. The window of the selected number is displayed in the selecting color in the image display area.

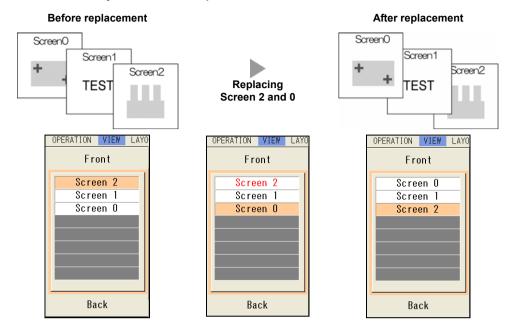
Note

To cancel the adjustment, press the CNACEL key.

Window	Transparency	(RUN	MENU)	0%	٠
				20%	
				40% 60%	
				80%	
				100%	

OPERATION	VIEW LAYOUT TOOL	
Type No.2	Screen Data R/W	;
	Window Transparency (RUN menu)	
	Window Sequence Order	

4. Press the ENTER key to execute the replacement.



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

Selecting Pattern Display

Select patterns to display on the screen window.

The patterns that can be selected to display or hide are as follows.

- Inspection area, arrow showing a scan direction and detect position of a checker
- Result of geometry calculation
- Figures set in character/figure drawing
- Marker
- Calibration scacle

Judge OK

Note

About types of display images and magnification, refer to Chapter 3.2.2 Selecting a Display Image (Image Menu), page 39.

1. Press the F1 key.

The list of currently displayed window is displayed.

2. Operate the ENTER key to select a screen window to set.

3. Select "Pattern Display".

Pattern Display setting window is displayed.

4. Select "Display" or "Hide" for "Area".

Area is an inspection area frame of each checker. In the right figure, it is indicated with a dotted line.

5. Select "Display" or "Hide" for "Scan Direction".

This item is available only when selecting "Display" for "Area".

"Scan Direction" is an arrow to indicate the scan direction of a checker.

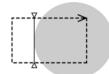
In the right figure, it is indicated at the right edge of the upper side.

Target Checker

Binary Edge / Gray Edge / Connector (Gray Edge) / Smart Edge (Circle) / Smart Edge (Line) (including Position Adjustment and Area Size Adjustment)

Display	-
Hide	-
Display	
ATT	-
Display	<u>.</u>
Display	-
Display	-
No	
	Hide Display All Display Display Display

OPERATION VIEW LAYOUT TOOL



6. Select "Display" or "Hide" for "Detect Position".

Detect Position is a line or mark indicating a position detected by each checker. In the right figure, it is indicated with a solid line.

The detect position in the right figure is the line and mark at the edge of the circle.

7. Select "All" or "Display NG checkers only". for "Display Condition".

Display NG Checkers Only:

Displays the area and detect position of checkers judged as NG. (Only when selecting "Display" for each item.) All (Default): Displays the areas and detect positions of all checkers (only when

Displays the areas and detect positions of all checkers (only when selecting "Display") regardless of an inspection result.

Note

The "Display Condition" can be set only for the inspection area, scan direction and detected position of a checker.

8. Select "Display" or "Hide" for "Marker", "Geometry Calculation" and "Character/Figure Drawing" respectively.

9. Select "No" or "Yes" for "Calibration Scale".

[No] (Default): Not display a calibration scale. [Yes]: Displays a calibration scale.

Registering a Layout

An arranged display can be saved as a layout (up to 32 layouts). Saving it can switch layouts by a keypad operation or a signal input from the external device.

Be sure to register the adjusted layout and save the setting data by following procedure after layout arranging. If you switch to the other layouts or turn off the power of PV500 before registering the setting, the arranged layout will be cleared.

1. Select "LAYOUT" > "Layout" from the menu bar.

The layout setting window is displayed.

- 2. Move the cursor onto the layout number to register.
- 3. Press the F1 key to register the current layout.

If another layout has been registered in the selected layout No., a confirmation message appears to overwrite. Select "Yes" then. Now you completed registering.

4. Press the FUNC key and select "Enter Title" from the pop-up menu.

Enter a title with the software keyboard as necessary.

- 5. Press the CANCEL key.
- 6. Switch to SETUP menu.
- 7. Select "SAVE/READ" -> "Save Setting Data".
- 8. Save the data in the Storage Space in PV500 or a SD memory card.

Copying/deleting a Layout

- 1. Select "LAYOUT" > "Layout" from the menu bar.
- 2. Move the cursor onto the layout number to copy (or delete).
- **3**. Press the FUNC key and select "Copy" from the pop-up menu.

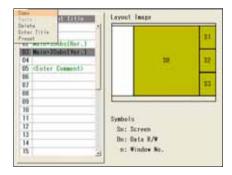
If you want to delete it, select "Delete".

4. Move the cursor onto the layout number to paste, press the FUNC key, and select "Paste" from the pop-up menu.

The layout is copied.

5. To display or modify the pasted layout, press the ENTER key.

As you press the CANCEL key, the screen shows the layout of the previous number displayed before displaying the setting window. Also in this case, copying is complete.



0. Layout	-	-		
01 111+				
02 Main+3Subs	(Mar.)		50	81
03 Main+35uhr	s(Ver.)			
04	144.0			
05 (Enter Cas	menth-			
06	where the state of the state of the	STATISTICS.	ALC: UNDER DRAFT TO ALC:	33
	Data already	evicts.		
07	Data already	exists.	Overwrite?	
07			Constantion of	
07 08 09	Data already Ye		Constantion of	
07 08 09			Constantion of	
97 98 99			Constantion of	
97 98 99		s No Symbols		
07 08 09 - 10 11 12 13		s No Symbols Sn: Se		
07 08 09		s No Symbols Sn: Se Dn: Du		

5.3.4 Switching a Layout

Now we switch the registered layout. With keypad, you can switch from the layout list or pressing the F2 key.

Note

You can also switch it by inputting a signal from the external device.

Selecting from Layout List

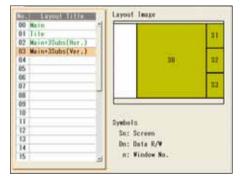
When many layouts are registered, switching from the layout list is suitable.

1. Select "LAYOUT" > "Layout" from the menu bar.

The layout setting window is displayed.

2. Select a layout No. to switch to.

The screen returns to RUN menu and the selected layout is shown.



Switching a Layout with the F2 Key

When registered layouts are less than 10, switching with the F2 key is suitable.

1. Press the F2 key (: Change Layout) in RUN menu.

The screen switches to the layout of the next number.

2. Pressing the F2 key again switches to the layout of the next number.

Each time you press the F2 key, the screen switches the layout in the registering order.

Chapter 6

Environment Settings (Changing System Settings)

6.1 Overview of ENVIRONMENT

In ENVIRONMENT in SETUP menu, the following items can be set including inspection conditions except checkers. The settings in ENVIRONMENT are the common settings for all Types.

System Settings

•

.

This menu sets the status of PV500 at startup and in the execution mode.

•	Startup setting	Page 311
•	Operation	
	 Operation when switching to SETUP menu 	Page 312
	 Inspection sequence and output timing of results and images 	Page 313
	 Operation on a template of Smart Matching 	Page 115
•	System Register	Page 316

Input/output

(Page 317)

This menu sets items on communication with external devices such as parallel I/O and serial port.

Camera

This menu sets camera type to use and the polarity of FLASH signal output from PV500.

- Camera Page 54
- FLASH polarity Page 55

Color

(page 319)

This menu sets display color of letters and background on the screen and transparence of dialogue window in SETUP menu.

Password

This is the function to protect from operational errors. Inputting a password is required when switching from RUN menu to SETUP menu. The function prevents changing the inspection conditions by mistake.

Refer to

For the information of operation to switch to SETUP menu, refer to page 313.

Initialize

This menu initializes all settings under ENVIRONMENT menu.

6.2 System Settings

6.2.1 Setting Startup Status (Startup Setting)

From this menu, you can specify product type to call up at startup of PV500 and display contents (layout). When you read up the setting data from the storage space of PV500 or a SD memory card, Type and Layout you specified with this menu are called up.

Refer to

To specify the setting data (Type 0-255) to read from the storage space in PV500 at startup, select [TOOL] > [General]. Refer to page 325 for details.

Select Layout at Startup

Select a layout as a startup in RUN menu from the registered layout number.

If the specified layout No. does not exist, the window is displayed in the default layout (same as the preset layout No.0). At that time, the current layout number displayed on the screen appears as "--".

Refer to

For details about adjustment or registration of layouts, refer to Chapter 5.3, page 299.

 Select "Startup Setting" in "System Settings" setting window.

OPERATION ENVIRONMENT	TYPE INSPECTION	SAVE/READ TOOL		SETUP MENU
System Settings	Input/Output	Camera	Color	Password
Startup Setting Operation System Register	Operation Select Layout No.		Selected 0	Layout No
	Type No. Select Type No.		Selected	Type No

2. Set "Layout No.".

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

3. Select "Select Layout No." (default: 0).

The list of layout number is displayed.

4. Select a desired layout No.

5. Press the CANCEL key.

Note

The last layout No. is held by using the backup battery on the back of PV500. When the battery runs out or no battery is installed, the preset layout No. 0 is read.

Selecting a Type to Be Read at Startup

Select a type to read at startup.

Refer to

Also from the type switching window, the setting of a type to read at startup can be changed. Refer to page 52 for details.

1. Select "Setup Setting" in "System Settings" setting window.

2. Select "Type No."

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

- 3. Specify a type No. to read in "Select Type No.".
- 4. After setting is completed, press the CANCEL key.

Note

The last type No. is held by using the backup battery on the back of PV500. When the battery runs out or no battery is installed, the type with the smallest number from the existing types is called up. Also, if the type specified in "Select Type No." does not exist at startup, the type with the smallest number from the existing types is called up.

6.2.2 Selecting Operation when Switching to SETUP Menu (Operation/Password)

About Inspection Continuance

You can select whether you continue the inspection when switching to SETUP menu during an inspection in RUN menu. As the default setting, it is set to stop the inspection when switching to SETUP menu.

Note

If you switched to SETUP menu from RUN menu during an inspection stoppage, the operation remains stopped regardless of this setting.

- Select "Operation" in "System Settings" setting window.
- 2. Select "Not Available" or "Available" for "RUN Mode in SETUP Menu ".

Not Available (default): Stops the operation when switching to SETUP menu. Available: Continues the operation even when switching to SETUP menu.

To stop operation in SETUP menu, select "OPERATION" > "Stop RUN Mode" from the menu bar. To restart operation, select "OPERATION" > "Start RUN Mode".

OPERATION ENVIRONMENT	TYPE INSPECTION	SAVE/READ 1	100		SETUP MENU
System Settings In	wut/Output	Camera		Color	Passwo
Startup Setting Operation System Register	dun Wode in SETU Rhen Switching t			Not Avail Save imag	
	Inspection Process Output Results			Serial . Synchronous .	
i	lmage Output Parallel 1/0 Out Continuous Inspe		Condition	Synchrono Hold No (Once)	
Ĩ	emplate Setting Position Area Display	l.		Use the Li Set Posit No	
	femplate Registr Smart Matching P			Per Check Type Switz	
OPERATION ENV	IRONMENT T	YPE IN	SPECTION	SAVE/RE	EAD TOOL
UPERATION ENV	IKUNMENT T	TPE IN	SPECTION	SAVE/R	AD TUUL
To RUN Menu	Start	RUN Mo	ide St	op RUN	Mode
OPERATION ENV	IRONMENT T	YPE IN	SPECTION	SAVE/RE	AD TOOL
To RUN Menu	Start	RUN Mo	de St	op RUN	Mode

Saving Inspection Image in Image Memory (Test Image Copy)

This function saves the last inspection images of the cameras in Test image memory. The default setting is to save images. Change the setting only when you do not save them.

- 1. Select "Operation" in "System Settings" setting window.
- 2. Select "Save image in 'Test'" or "Not save image in 'Test" for "When Switching to SETUP...".

Save image in 'Test' (default):

Saves the lastly inspected image of camera in Test image memory when switching to SETUP menu. **Not save image in 'Test':** Saves no test image.

Protecting the Setting Data Using a Password

The function to protect from operational errors. Inputting a password is required when switching from RUN menu to SETUP menu. The function prevents changing the inspection conditions by mistake.

1. Select "Password".

The password setting window is displayed.

2. Set "Password Setting" to "Valid".

Valid:

Inputting a password is required when switching to SETUP menu.

Invalid (default):

You can switch to SETUP menu without a password.

3. Move to "Password" field and enter a password with the software keyboard.

Set a password up to 15 letters.

Select "Yes" or "No" for "Save Changes in RUN Menu".

Some data can be modified in RUN menu where a password is not required. Select whether you permit saving modified data.

Yes (default):

To add [Save Setting Data] menu in [Tool] of RUN menu to save the data also in RUN menu. **No:** Not to display [Save Setting Data] menu in RUN menu.

Prohibiting the operation from the keypad

(Ver.1.42 or later)

The PV500 has "Keypad is invalid" function to disable various operations such as switching the menu to SETUP MENU with the keypad and editing in RUN MENU as a function to protect the PV500 from incorrect operations. When this function has been specified, "Keypad is invalid" is displayed in the key guide space on the window.

Switching the keypad operation between Invalid and Valid is executed with an exclusive communication command. Refer to page 381 for details.

Note

While PV500 is not energized, the information on keypad operation status is saved with the power of the backup battery. To use this function, open the cover on the back and connect the battery with PV500. (Before shipment, the battery and PV500 are not connected.)

Refer to

How to attach a backup battery: Page 11







Selecting Inspection Process

To reduce inspection time when the tact time is short, change operation mode.

Serial processing

Inspects one by one in order.

The inspection time displayed on the screen is as shown in the right figure.

Parallel processing

As the next image can be captured after image capturing is complete, the inspection time can be reduced as the right figure.

The screen shows time and cycle of inspection.

Image Capture	Checker Execution	Result Output I/O	Image Capture	Checker Execution	Result Output I/O
			< Ins	pection Tin	ne
Serial pr	ocessing				
Image Capture	Checker Execution	Result Output I/O	Execution Cycle		/
	Imag Captu				
Parallel	processing	1		Redu	ced

1. Select "System Settings" > "Operation".

The setting window of operation is displayed.

2. Select "Serial" or "Parallel" for "Inspection Process".

Default: Serial

Selecting Output Timing of General Results and

Images

Specify output timing of inspection results (general results) and inspection images to the external devices.

Output Results:	
Synchronous:	When outputting all results are completed, an inspection is complete. Because the time of outputting general results is included, its inspection time is longer than Asynchronous processing.
Asynchronous:	An inspection is complete before outputting results, and PV500 completes data output until the next inspection result output. Because the time of outputting general results is NOT included, its inspection time is shorter than Synchronous processing.
Image Output:	
Synchronous:	An inspection is complete after image output is completed. Because the time of outputting images is included, its inspection time is longer than the other two options.
Asynchronous (image output first):	An inspection is complete before outputting images, and then PV500 outputs images when it can. When the interval of START signal input (the period between inspection start and the next inspection start) is short, and Image Output is not completed after several inspections, PV500 completes Image Output by delaying the next inspection start.
Asynchronous (inspection first):	An inspection is complete before outputting images, and then PV500 outputs images when it can. When the interval of START signal input (the period between inspection start and the next inspection start) is short, and Image Output is not completed after several inspections, PV500 executes inspections first by canceling Image Output immediately.

- Select "System Settings" > "Operation". The setting window of operation is displayed.
- 2. Specify "Output Results". Default: Synchronous
- 3. Specify "Image Output".

Default: Synchronous

OPERATION ENVIRONMENT	TYPE INSPECTION	N SAVE/READ TOOL		SETUP MENU
System Settings	Input/Output	Camera	Color	Password
Startup Setting Operation System Register	Run Mode in SE When Switching Inspection Pro Output Results Image Output Parallel 1/0 C Continuous Ins	; to SETUP_ cess ; utput Reset Condi	Serial Synchrono Synchrono	e in 'lest'
	Template Setti Position Area Display Template Regis Smart Matching	tration	Use the L Set Posit No Per Check Type Swit	er •

Parallel I/O Reset Condition

This item is to select reset timing of OUT signal when outputting inspection result through Parallel I/O connector and Parallel I/O terminal.

Hold (default): To hold until outputting the next result. When the first and second inspections turn on OUT0 signal, the signal keeps ON until the third output of inspection result without turning off.

Reset: All OUT signals turn off when TACT signal turns off.

Refer to

Refer to Chapter 8.3 "Timing Chart" (page 356) for details.

Inspecting with Internal Trigger (Continuous Inspection)

This method executes inspections repeatedly before receiving START signal from the external device. This is "Continuous Inspection" and helpful to inspect continuously due to a long object. A signal input from the external device can stop repeating inspections.

1. Select "System Settings" > "Operation".

The setting window of operation is displayed.

2. Select whether you inspect repeatedly in "Continuous Inspection".

No (Once) (default):	Executes an inspection by START signal input.

Automatic: After Trigger:	After PV500 starts up, inputting START signal at the start of the first inspection executes inspections repeatedly.
Automatic: After Power On:	After PV500 starts up, inspection is repeatedly executed soon. START signal input is not necessary.

6.2.4 Setting Default Variable (System Register)

PV500 offers eight value registers. These registers can be used in an expression of numerical calculation, or can be referred for a drawing position or figure size of character/figure drawing.

The values of the registers can be changed by sending a command through COM.0 interface or Ethernet interface from the external device.

Setting Default Value to Store in Registers

The value can be changed and read from the external device.

- 1. Select "System Register" in "System Settings" setting window.
- 2. Select register No. to change the value.
- 3. Specify the value and press the ENTER key.

The available values range from -9,999,999.999 to +9,999,999.999.

This function assigns functions of signals input from the external device to PV500, and makes settings on outputting result data and images.

Parallel I/O:	Setting of the minimum OFF time of READ END signal and ACCEPT signal, and assignment of ASSIGN0-5 signals.	Page 318
Parallel I/O Output:	Setting of outputting inspection results through I/O interface (Selecting the destination and output data, setting output method)	Page 251
Serial:	Setting of communication condition of COM.0 port (transmission format)	Page 318
General output:	Setting of outputting inspection results through RS-232C interface and Ethernet interface	Page 257
Image output:	Setting of outputting inspection images to the external device (Selecting the destination and output camera image, setting output method)	Page 260
Save Image Memory:	Setting to save inspection images in the image memory of PV	Page 265
Print Screen:	Selecting a saving place of screen capture	Page 48

Displaying Input/Output Window

- 1. Select "ENVIRONMENT" from the menu bar.
- 2. Select "Input/Output".

The screen of communication setting is displayed.

OPERATION ENVIRONMENT	TYPE INSPECTION SAVE/READ 1	10L	SETUP MENU
System Settings 🔤 🛛	put/Dutput Camera	Color	Password
Parallel 1/0 Parallel 1/0 Output Serial General Output Image Output Save Image Memory Print Screen	RENO OFF Min.(ms) ACCEPT OFF Min.(ms) Set Signal ASSIGN Set Signal ASSIGN Set Signal ASSIGN Set Signal ASSIGN Set Signal ASSIGN Set Signal ASSIGN	[lemplate : Switch BU Save Data Read Data Read Data	in PV in SD from PV

6.3.1 Changing Setting of I/O Terminals (Parallel I/O)

Set the minimum OFF time of READ END signal and ACCEPT signal. And also, assign functions to ASSIGN0-7 when operating by inputting signals to I/O connector and I/O terminals ASSIGN0-5 from the external device.

Note

See chapter 8: Operation and Data Output through I/O Terminals, page 339.

1. Select "Parallel I/O" in the input/output setting window.

The parallel setting window is displayed.

2. Specify "REND OFF Min." and "ACCEPT OFF Min."

Settable Range: 0 (default) to 1000 Set these items when external devices such as a PLC cannot detect signal switch between ON and OFF because the OFF time of READ END signal and ACCEPT signal is too short.

3. In "Set Signal ASSIGN0" to "Set Signal ASSIGN5", assign functions as needed.

Default assignment setting

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

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

6.3.2 Changing Communication Condition of COM.0 port (Serial)

This is a setting of the COM.0 port for RS-232C communication. Specify the setting values to the same as that for the external device to communicate.

Item	Option	Description
Baud Rate (bps)	1200/ 2400/ 4800/ 9600/ 19200/ 38400/ 57600/ 115200 (Initial value: 9600)	Transmission speed for communication. The higher number the faster communication speed.
Bit Length	7 / 8 (Initial value: 8)	To set the bit number per letter.
Stop Bit	1 / 2 (Initial value: 1)	To set the bit number of the signal that recognizes the end of data.
Parity Check	None/ Odd/ Even (Initial value: Odd)	To set the number of overhead bits to check for proper data transmission.
Flow Control	None/Soft Flow/ Hard Flow (Initial value: None)	To set how to control the handshake flow.

Display color of letters and background on the screen and transparence of dialogue window in SETUP menu can be set from "Color" menu.

6.4.1 Changing Color of Letters and Background

The color of letters, menus, and areas displayed on the screen can be changed. You can select from six preset color patterns. In addition, you can create a new color (as a custom setting) based on the selected color pattern.

Note

The color not displayed in the color setting window cannot be changed including the color of checker area and the color indicating I/O status.

Select a Color Scheme

1. Select "ENVIRONMENT" > "Color" from the menu bar.

2. Select "Color Scheme".

Select one from six patterns; Standard, Casual, Grass, Sepia, Floral, and Midnight.

Note

Note that selecting a pattern clears the custom colors you have set.

OPERATION ENVIRONMENT TYPE INSPECTION	SAVE/READ TOOL	
System Settings Input/Dutput	Camera	Color
Color Scheme	Standard - RUR	K: Type No.000
Details Feat Celor	Casual SET Grass	TUP: Type No.000
Dialog Button/Input Field	Sepia Floral Midnight	Nesory/Gray Scale 1001
Nain Menu	Minnight	
Submenu Selected Menu Item		
Title Bar Wall Paper		
Key Guide		
Information Area Selection		
Window Transparency (SETUP Menu) OX (No) - 80X (Transparent)	0x -	

Setting Colors Individually

The way of setting a custom color of an item is explained below.

1. Select "ENVIRONMENT" > "Color" from the menu bar.

2. Select a base pattern in "Color Scheme".

3. Select an item to change.

The amount of containing Red, Green and Blue of the current color are displayed in the values of 0 to 255.

4. Adjust RGB values to make a desired color.

The larger value makes the brighter color. The smaller value makes the darker color. Changing the value updates the color of "Enter" button. Observe it to adjust the color.

5. When it became the desired color, select "Enter".

If you press the CANCEL key before selecting "Enter" after setting the RGB values, the color will be restored.

Note

Note that selecting Color Scheme again after creating a custom color clears the created custom color.

R (0 - 255)	0
G (0 - 255)	255
B (0 - 255)	030
	Enter

6.4.2 Changing Window Transparency (SETUP Menu)

You can change the transparence of the setting window displayed after selecting the submenu. It is useful to observe an image while making settings.

Note

The setting of transparence here is for SETUP menu only. The transparence in RUN menu needs to be set with the VIEW setting in RUN menu.

- Select "ENVIRONMENT" > "Color" from the menu bar.
- 2. Select "Window Transparency (SETUP Menu)".

Default value is 0%. The larger value, the higher transparence.

3. Select desired transparence.

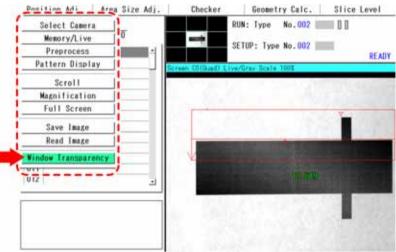
Only highlighting a value updates the transparence of the window. Observe it to set.

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

OPERATION ENVIRONMENT TYPE INSPECTION	SAVE/READ TOOL	\$
System Settings Input/Output	Camera	Color
Color Scheme	Standard •	RUN: Type No.000
Details		SETUP: Type No.000
Font Color		
Dialog) Live/Gray Scale 100%
Button/Input Field		
Main Menu		
Submenu		
Selected Menu Item		
Title Bar		
Wall Paper		
Key Guide		
Information Area		
Selection		
Window Transparency (SETUP Menu)	20% -	
0% (No) - 80% (Transparent)	0%	
	20%	
	40% 60%	
	80%	
	100	

Note

The window transparency (SETUP Menu) can be also changed in the "Image Menu" opened by pressing the F1 key.



6.5 Initializing Environment Settings

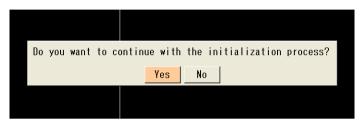
This function initializes the Environment data and restores it to the default settings.

1. Select "ENVIRONMENT" > "Initialize" from the menu bar.

The confirmation message appears.

2. Select "Yes".

Environment data are initialized. If you select "No", initializing is canceled.



Note

Initializing Environment might shows the message below when "Common" is selected for "Template Registration" in "System Settings" > "Operation".

Free space for template areas is used up. You cannot change the setting of "Template Registration" to "Per Checker".

In the case, the settings are initialized except "Template Registration" setting which holds "Common". Refer to page 115 about the reason why you cannot change to "Per Checker".

Changing Configuration (TOOL)

7.1 Overview of TOOL

With "TOOL" in SETUP menu, the following can be performed; settings, information display, and updating of PV500 you use, adjustment support of optical parts and communication test at the introduction. In addition, you can switch the mode to communication with PVWIN, which is software of setting and simulation for PV series.

PVWIN Comm. (supported in Ver.1.30 or later)

This switches the mode to communication with PVWIN, which is software of setting and simulation for PV series.

General Settings

Startup Setting

Specify the Area No. to save the data which is read when PV500 starts up.

To specify a type No. and a layout No. to read at startup, select [ENVIRONMENT]. Refer to page 311 for details.

Network

This is necessary setting to perform Ethernet communication.

Calendar

It adjusts the calendar in PV500.

Note

Be sure to use this function attaching the battery that can be found set with no connection if you open the lid on the back.

Language
 This switch

This switches between languages of the menus.

Initialize

This restores the settings of PV to the default.

SD Property

This is for confirming the property of a SD memory card (such as saved contents or information of a SD memory card).

Eject SD Card

Select this before ejecting a SD memory card from PV.

Information

It displays the version information on your PV500 and memory usage.

Setting Help

This function supports to make setting of optical parts of PV500, to confirm the communication, and its adjustment for introduction.

- Focus Adjustment
 To adjust focus of the lens. Rotate the focus ring of the lens following the displayed message.
 Aperture Adjustment
 To adjust aperture of the lens. Rotate the aperture ring (iris ring) of the lens
- following the displayed message.
- Gray Data Analysis
 To display the grayscale level of the image in the linear area in a graph form.
- Capture Delay Control
 To decide optimum capture conditions by capturing and displaying images
 while changing the condition for each camera.
- I/O Test To check the connections of I/O connector and I/O terminal block with the external devices.
- Communication Test
 To test the communication with the external devices connected to COM.0 port
 and Ethernet port.

Update

It performs upgrading of PV500 and customizing the splash screen.

7.2 General Settings

The settings made in "General" are saved in PV500. You cannot backup the data into the storage space in PV500 or a SD memory card.

► Caution

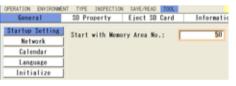
As you press the CANCEL key to return to the upper menu hierarchy from "General", the screen displays a message to save the modified settings. Be sure to select "Yes" to save the data in PV when you modified the settings.

7.2.1 Specifying Data to Read at Startup

Specify the data to read from the storage space in PV500 to execution memory at PV startup. You can also save the data in a SD memory card, however, cannot read it at startup.

Refer to

- For more information about the execution memory and the storage space in PV500, refer to section of What Is a Product Type? (page 51).
- To specify a type No. and a layout No. to read at startup, select [ENVIRONMENT]. Refer to page 311 for details.
- 1. Select "TOOL" > "General" from the menu bar.
- 2. Select "Setup Setting".



3. Enter an area No. where the setting data to read at startup is stored.

Note Note

If there is no data in the specified area No., PV starts in the initial condition with no settings.

Start with Default Settings

Without loading the data in the area No., you can start PV500 with the default settings (execution memory initialized).

- **1**. Press the F1 key and the F3 key on the keypad.
- **2.** Holding the keys pressed, turn on the power of PV500.

Until RUN menu appears, hold the keys pressed.



7.2.2 Changing Network Setting

Set a device name and make TCP/IP setting which is necessary to perform Ethernet communication.

Note

The port number of PV500 depends on type of communication data.

- General output: 8601
- Image output: 8602
- Command* communication: 8604 (*See page 370.)

Changing IP address

- **1.** Select "TOOL" > "General" from the menu bar.
- 2. Select "Network".
- 3. Change "IP Address".

Change the subnet mask and default gateway as necessary. Default setting IP Address: 192. 168. 1. 5 Subnet Mask: 255. 255. 255. 0 Default Gateway: 192. 168. 1. 1

4. After setting is completed, press "Set" button.

Pressing the CANCEL key before the "Set" button clears the change.

Changing Device Name

- 1. Select "Device Name" in "Network" setting window.
- 2. Enter a device name with the software keyboard.
- **3.** After inputting is completed, select the ENTER on the keyboard. The entered name is displayed.
- **4.** Press the CANCEL key to close the "General" setting window. You do not need to press the "Set" button.



7.2.3 Adjusting Calendar Date

Set the date and time of the built-in clock. The date recorded when outputting data is the date of this calendar.

While PV500 is not energized, the information on calendar is saved with the power of the backup battery. To use calendar function, open the battery case lid on the back and connect the battery with PV500. (Before shipment, the battery and PV500 are not connected.)

Refer to

For the information of how to attach a battery, refer to page 295.

Adjusting Calendar Date

- **1**. Select "TOOL" > "General" from the menu bar.
- 2. Select "Calendar".
- 3. Select "Date Format".

For example, the date of August 15th in 2010 is displayed as bellow by format. [YYYY/MM/DD] (default) : 2010/08/15 [MM/DD/YYYY]: 08/15/2010 [DD/MM/YYYY]: 15/08/2010

OPERATION ENVIRONMENT	TYPE INSPECTION	SAVE/READ 100L		SETUP N
General	SD Property	Eject SD Card	Information	Se
Startup Setting Network Calendar Language Initialize	Date Time Date Format Year Month Day Hour Minute		2007/11/15 14:30 TYYY/MA/00 - 2008 8 06 14 30	
	Set			

- 4. Adjust year, month, day, hour, and minute.
- 5. After setting is completed, press "Set" button.

The changed date is saved and the adjusted date and time are displayed on the top of the setting window. Pressing the CANCEL key before the "Set" button clears the change.

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

7.2.4 Switching Language

The displayed language can be switched.

1. Select "TOOL" > "General" from the menu bar.

The confirmation message appears.

2. Select "Language".

Settable languages are displayed.

3. Select a language to use.

4. Press the CANCEL key.

When the confirmation message appears, select "OK" to switch the language on the screen.

OPERATION ENVIRONMEN	TYPE INSPECTION	SAVE/READ TOOL	SETU
System Settings	Input/Output	Camera	Color
Startup Setting Network Calendar Language Initialize	Language		Japanese - Japanese English German French Spanish Italian Simplified Chinese Korean
Selectab Japanese English German	e Languages e	s(for Ver.2.0	Traditional Chinese
French Spanish Italian			
	d Chinese		

Traditional Chinese

7.2.5 Initializing General Settings

Item		Value after initialization
Startup setting	Start with Memory Area No.:	0
Network	IP Address	192.168.1.5
	Subnet Mask	255.255.255.0
	Default Gateway	192.168.1.1
	Device Name	ImageCheckerPV500

This menu initializes the configuration. The items and their values to be initialized are listed below.

Language and the calendar (date and time) are not initialized.

1. Select "TOOL" > "General" from the menu bar.

2. Select "Initialize" > "Initialize General Settings".

The confirmation message appears.

3. Select "Yes" to initialize it.

Initialization is executed. At the moment, the initialized values are saved in PV.

	ab Property Eject ab card Information
Startup Setting Network	Initialize General Settings
Calendar	<u> </u>
Language	
Initialize	
	The year want to continue with the initialization process
	Do you want to continue with the initialization process

Information

INSPECTION

Note Select "No" to cancel.

4. Press the CANCEL key twice.

The confirmation message appears.

The initialized values are saved in PV at the time of initialization. You can either "Yes" or "No". (Even if you select "No", the values are not restored.)

Note

When you changed a value of another item after initialization, select "Yes" to save the changed value in PV.

"SD Property" shows information of a SD memory card when attaching it in the slot. "Eject SD Card" prepares to eject a SD memory card.

7.3.1 Displaying Information of SD Memory Card

You can confirm the information of a SD memory card attached to the SD memory card slot of PV500. The information includes capacity and free space of the SD memory card, the saving date of the files, and their size.

 Select "TOOL" > "SD Property" from the menu bar.

The information is displayed.

2. Select the file list.

The files saved in the place are listed.

Note

To go up to the upper hierarchy, select "..". A file can be added while the information is displayed. Selecting "Update" shows the latest status.

OPERATION ENVIRONMENT	TYPE INSPECTION	SAVE/READ	TOOL		
General	SD Property	Eject SD	Card	Informa	tio
Volume Label Path					
VPanasonic MEW Visi	ion\PV500				1
SD Capacity 1,0	15,283,712 By	te			-
SD Free Space 1.00	01,046,016 By	te			
File Name					
Screen]
File Name	Size(K8)	Updated	Date	
	<di< td=""><td>r> 20</td><td>08/01/09</td><td>12:46:58</td><td>-1</td></di<>	r> 20	08/01/09	12:46:58	-1
	<di< td=""><td></td><td></td><td>12:46:58</td><td></td></di<>			12:46:58	
Screen	<di:< td=""><td>r> 20</td><td>08/01/09</td><td>12:46:58</td><td></td></di:<>	r> 20	08/01/09	12:46:58	
Result	<di< td=""><td></td><td></td><td>13:20:44</td><td></td></di<>			13:20:44	
Image	<di< td=""><td>r> 20</td><td>08/01/09</td><td>15:59:16</td><td></td></di<>	r> 20	08/01/09	15:59:16	
					ш
					3
I				Update	

7.3.2 Preparing to Eject SD Memory Card (Eject SD Card)

If you forcibly eject a SD memory card while the device is accessing its memory, the SD memory card and PV500 might be damaged. Be sure to prepare to eject the card by following the procedure described below before withdrawing it from the slot.

1. Select "TOOL" > "Eject SD Card" from the menu bar.

The confirmation message appears.

2. Select "Yes".

When it is ready for ejection, the message saying "The SD card can be ejected safely." appears. Select "OK".

Now, the preparation to eject the card is complete. Push the SD memory card into the inserting direction and remove the ejected card from the slot.

7.4 Setting Help

This function supports to make setting of optical parts of PV500, to confirm the communication, and its adjustment for introduction.

- Focus Adjustment: To adjust focus of the lens. Rotate the focus ring of the lens following the displayed message.
- Aperture Adjustment: To adjust aperture of the lens. Rotate the aperture ring (iris ring) of the lens following the displayed message.
- Gray Data Analysis: To display the grayscale level of the image in the linear area in graph form.
- Capture Delay Control: To decide optimum capture conditions by capturing and displaying images while changing the condition for each camera.
- I/O Test: To check the connections of I/O connector and I/O terminal block with the external devices.
- Communication Test: To test the communication with the external devices connected to COM.0 port and Ethernet port.

7.4.1 Adjustment of Focus and Aperture

This feature makes it easy to properly adjust the focus and the aperture of the lens. Focus and aperture can be adjusted by the same procedure.

- Adjust the position of the camera to display the inspection object or the object with feature on the monitor screen.
- 2. Select "TOOL" > "Setting Help".

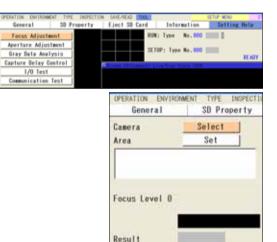
The Setting Help menu appears.

3. Select "Focus Adjustment" or "Aperture Adjustment".

The window for focus adjustment (or aperture adjustment) appears.

- **4**. From "Camera", select a camera image to adjust focus or aperture.
- 5. Select "Area" and set an inspection area on a captured object or a position where feature of the object exists.

The place where the feature of the object exists is the position where the difference of brightness is observed.





- 6. Rotate the focus ring (or aperture ring) of the lens following the displayed message.
- 7. Rotate the ring until "Result" field shows "OK".

A level bar showing consistent percentage is displayed in the "Focus Adjustment Level" area.

8. When "OK" is displayed, stop turning the ring and then press the ENTER key.

Now you completed the adjustment.

Calmora	Select
	OK
Turn the Foo one end dire (Press the E	
ocus Level	n
Focus Level	0
Focus Level	0



7.4.2 Gray Data Analysis

This function graphs gray values in the pixels on a horizontal or vertical line. You can observe the gray data on a preprocessed or binarized image.

- **1**. Adjust the position of the camera to display the inspection object or the object with feature on the monitor screen.
- 2. Select "TOOL" > "Setting Help".

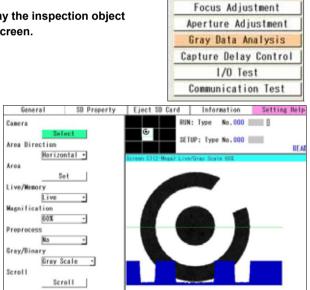
The Setting Help menu appears.

3. Select "Gray Data Analysis".

The Gray Data Analysis window appears.

4. Set an area on the position where you want to observe its gray data from "Area" and "Area Direction".

When you completed the area setting, the graph of gray data appears in blue. The larger blue area indicates the brighter pixel (gray value is higher), and the smaller area the darker pixel (gray value is lower).



5. Change the other items as necessary to change the type or size of the image.

Live/Memory:	To switch the image between Live and Memory.
Magnification:	To change the display size of an image.
Preprocess:	To confirm the gray data of a preprocessed image.
Gray/Binary:	To switch between Gray image and Binary image (slice level A-Z).
Scroll:	To move the displaying area when the magnification of an image is set to high.

7.4.3 Capture Delay Control

This function helps to decide optimum capture conditions* by capturing and displaying images while changing the conditions for each camera.

*) Shutter speed, Camera gain, Capture delay, FLASH delay, FLASH span

1. Select "TOOL" > "Setting Help".

The Setting Help menu appears.

2. Select "Capture Delay Control".

A live image and the capturing conditions appear.

3. Specify a camera to display on the screen window from "Select Camera.

4. Change the capturing conditions.

An image is captured under the changed conditions and the displayed image is updated.

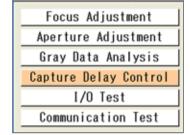
Then, the setting window shows the gray value of the entire screen.

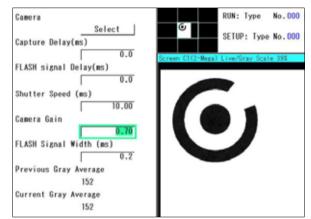
The current gray average and the previous gray average are displayed.

5. When you decide the optimum capturing conditions, enter the values in "Camera".

Note

To set values in "Camera", select "TYPE" > "Type Setting".





7.4.4 I/O Test

This function checks the connections by forcibly outputting signals and monitoring input signal of the I/O terminal or I/O connector.

1. Select "TOOL" -> "Setting Help".

The Setting Help menu appears.

2. Select "I/O Test".

The list of output signals and input signals (from the external device) of PV500 is displayed.

3. Select a signal to carry out an output test.

In the cell of the signal you selected, "X" is displayed. This symbol indicates that the specified signal is ON.

4. Check the signal you turned on is input correctly from the external device.

5. Input a signal from the external device to PV500.

In the cell of the signal you input, "X" is displayed in the same way as the output signals.

Note

After processing output test, closing the I/O test window while the signals are turned on turns off the signals.

Foci	us Adjustment
Apert	ure Adjustment
Gray	Data Analysis
Captur	e Delay Control
	1/0 Test
Comm	unication Test

tput				Input	
COM		FLAD		STAD	STAT
COM		FLAT		STA2	STA3
E0M		FLAZ		TYPE	013P
COM		FLA3		RENT	ACK
RENO		REN1		R/S	ASNO
REN2		REN3		ASN1	ASN2
REDY		ERRO		ASN3	ASN4
ACPT		ERR1		ASN5	RESV
ISLT		TACT		COM	EOK
TRB		RUN		N.C	SN AC
0 10	X	01 1	X	1N 0	IN 1
01 2	X	01 3	X	1N 2	1N 3
01 4		01 5		IN 4	IN 5
0T 6		017		IN 6	18.7
8 10		01.9		IN 8	IN 9
0110		0T11		1N10	1011
DT 12		0113	1	1N12	1N13
0114		0115		1N14	1015
CIM		COM		COM	COM
NP 1		Nat		N.C	N.C

7.4.5 Communication Test

This function tests the communication with the external devices connected to COM.0 port and Ethernet port.

Selecting a Port

- Select "TOOL" > "Setting Help". The Setting Help menu appears.
- 2. Select "Communication Test".

The Communication Test window appears.

3. Select a port to carry out communication test in "Select Port".

After you select a port, PV500 can receive commands from the external device.

Foc	us Adjustment
Apert	ture Adjustment
Gray	Data Analysis
Captur	re Delay Control
	1/0 Test
Conm	unication Test

Select Port COM.0 . Input Ethernet	
	Clear

Receive and Send Test of Command

- Select a port in the Communication test window and send a command from the external device. The received command is displayed in "Input" field. To clear "Input" field, press the "Clear" button.
- 2. Tilt the ENTER key up/down to select "Output". A software keyboard is displayed.
- **3**. Enter characters, such as response to a command and output data, to output to the external device.
- 4. Tilt the ENTER key up/down to select "Send".

The entered characters are sent to the external device from the specified port. Check if the device receives them correctly.

Select Port COM.0 .	
Input	
XPR SYS_TIME1**	Clear
Output	
	Send

7.5.1 Displaying PV Information

It displays the version information of your PV500 and memory usage.

 Select "TOOL" > "Information" from the menu bar.

The information of PV500 is displayed.

OPERATION ENVIRONMENT TYPE INSPECTION S	AVE/READ	TOOL	
General SD Property E	ject SD	Card	Informat
Mode I			PV500
Version			Ver.
Free Space for Setting Data		8,320	6,516 Bytes
Free Space for Templates Camera 0+1		20,963	3,496 Bytes
Free Space for Templates Camera 2+3		20,963	3,496 Bytes
Free Storage Space in PV500		497,81	1,456 Bytes
SD Total Capacity	1	,015,283	3,712 Bytes
SD Free Space		998,670	0,336 Bytes
Device Name		ImageC	heckerPV500

Model	PV500 (fixed)
Version	Version of PV500 you are using 1.nn
Free Space for Setting Data	Free space in the memory for setting data which sets up to 256 product types. (except the memory for template)
Free Space for Templates Camera 0+1	Free space in the memory for template of Matching checker created for Camera 0 and Camera 1.
Free Space for Templates Camera 2+3	Free space in the memory for template of Matching checker created for Camera 2 and Camera 3.
Free Storage Space in PV500	Free space in the Storage Space in PV500 which sets up to 100 data.
SD Total Capacity	This is displayed only when a SD memory card is attached.
SD Free Space	
Device Name	"ImageCheckerPV500" This can be changed. Refer to page 326 on how to change it.

7.5.2 Version Upgrading of PV500

By using the file we provide, you can upgrade your PV500. Upgrading requires a SD memory card.

Preparing a Version Upgrade File

- Obtain a version upgrade file.
 Download the file for upgrading from our website.
- 2. Decompress the downloaded ZIP file.
- **3.** Prepare a SD memory card and save the decompressed version-upgrade file (*.PRG) in the path below.

Drive: ¥Panasonic MEW Vision¥PV500¥Update¥

4. Attach the SD memory card of the step 3 to the PV500 you want to upgrade.

Now you completed the preparation of the version upgrade file.

Version Upgrading

1. Select "TOOL" > "Update" from the menu bar.

Update window is displayed.

2. Select "Firmware".

The list of the version upgrade files saved in the SD memory card is displayed.

Note

- If the file list is not displayed, check the following conditions.
- The SD memory card is attached correctly?
- The version upgrade files are saved in the correct place?

3. Select a desired version upgrade file.

When the confirmation message appears, select "YES" to start upgrading. Selecting "No" cancels upgrading and the screen returns to the previous one.

► Caution

Do not turn off the power of PV500 during the upgrading. If you turn off the power during the upgrading, the system might be damaged and might not be able to start or function correctly.

4. Reboot the PV500 following the displayed message after the operation is complete.

A splash screen of PV500 is the blue screen showing the product name and the version at startup. The screen can be changed to another one. Changing the screen requires a SD memory card.

Preparing a File

- **1.** Prepare an image to display as a splash screen.
 - Modify and save the image file to meet the following conditions.
 - 24-bit bitmap file
 - Image size: Max. 1024 (w) x 768 (h) pixels
- 2. Prepare a SD memory card and save the image to display as "Logo.bmp" in the path below.

Drive: ¥Panasonic MEW Vision¥PV500¥Logo

3. Attach the SD memory card of the step 2 to the PV500.

Now you completed the preparation of the image file to use for a splash screen.

Changing Splash Screen

 Select "TOOL" > "Update" from the menu bar.

Update window is displayed.

2. Select "Splash Screen" > "Change".

When the confirming message appears, select "YES" to execute the change. After the change is completed, a message is displayed.

OFEATION EXPREMENT TYPE NOTECTION SAME/HED 10000 SD Property Eject SD Card Information Setting Help Update Firmesce Splash Screen Oblig Splash screen will be changed. Yes Ko

Note

If you cannot change it, the following can be considered as reasons. Check the conditions.

- A nonqualified file is saved. (A different file format or too large file size.)
- The file is saved in the wrong place.
- The file name is not "Logo.bmp".
- A SD memory card is not available.

3. As the message appears telling that the change is completed, select "OK".

The changed splash screen will be displayed after the next startup.

Initializing Splash Screen

Delete the custom splash screen and replace it with the original image.

- 1. Select "Splash Screen" in "Update" window.
- 2. Select "Delete".

When the confirmation message appears, select "YES" to start initializing.

3. As the message appears telling that the process is completed, select "OK".

The initial splash screen will be displayed after the next startup.

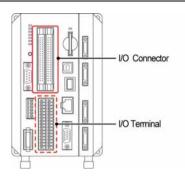
Chapter 8

Operation and Data Output through I/O Terminals

8.1 Main Items that can be Communicated through I/O Interface

PV500 is provided with I/O interfaces as below.

- I/O connector (MIL connector type) Input: 32 pins, Output: 32 pins
- I/O terminal block
 Input: 14 pins, Output: 15 pins



Input

The operations shown in the table below can be executed by input from the external devices.

		Connector	Terminal Block	Command* ³
Execute inspection		STA0-3	STA0	%S
Execute reinspection		ASN0-5*1	ASN0-2*2	%R
Execute type switch		TYPE+IN0-7	TYPE+IN0-7	%X
Set template		RENT+IN0-15	ASN0-2*2+IN0-7	%A
Switch layout		DISP+IN0-4	DISP+IN0-4	%I
Switch between RUN	/STOP	RUN/STOP	ASN0-2*2	%RM
Reset statistics data		ASN0-5*1	ASN0-2*2	%Q
Reset error signal		ASN0-5*1	ASN0-2*2	%E
Save setting data	Storage Space in PV500	ASN0-5*1+IN0-6	ASN0-2*2+IN0-6	%MW
	SD memory card	ASN0-5*1+IN0-6	ASN0-2*2+IN0-6	%CW
Read setting data	Storage Space in PV500	ASN0-5* ¹ +IN0-6	ASN0-2* ² +IN0-6	%MR
	SD memory card	ASN0-5* ¹ +IN0-6	ASN0-2*2+IN0-6	%CR
Operate image Save in a SD memory card memory of PV (backup)		ASN0-5 ^{*1} ASN0-2 ^{*2}		%SS
	Delete	ASN0-5*1	ASN0-2*2	%SR
Print screen		ASN0-5*1	ASN0-2*2	%PS
Save the latest inspection image in a SD memory card or PC etc. through Ethernet		ASN0-5*1	ASN0-2*2	
Abort inspection/proc	ess	ASN0-5*1	ASN0-2*2	%CC
Abort Save/read Setti	ing Data	ASN0-5*1	ASN0-2*2	%CD

*1: Up to six functions are available because six points of ASN0 to 5 are assigned functions. ASN0 to 2 are common function with I/O terminal block.

*2: Up to three functions are available because three points of ASN0 to 2 are assigned functions. They are common functions with ASN0 to 2 of I/O connector.

*3: Command to control with interface of RS-232C and Ethernet. Refer to page 370 for details.

Output

The data shown in the table below can be output from PV500 during inspections. "Total Judgement" is output without condition, however, outputting the other data is selective.

	Connector	Terminal Block
Total Judgement	RSLT	RSLT
Scan Count	OUT0-15	OUT0-7
Judgement (JDC)	OUT0-15	OUT0-7
Numerical calculation result	OUT0-15	OUT0-7

Note To set whether to output or not, select "ENVIRONMENT" > "Input/Output" > "Parallel I/O Output".

8.2 Specification of I/O Interface

8.2.1 I/O Connector

Pin Arrangement

Input

	•	IN			
		START0 III III START2 3 4 START3 TYPE 5 6 DISPLAY REENTRY 7 8 ACKNOWLEDGE RUN/STOP 9 10 ASSIGN0 ASSIGN1 11 12 ASSIGN2 ASSIGN3 13 14 ASSIGN4 ASSIGN5 15 16 (RESERVE) COMMON 17 18 COMMON NC 19 20 NC IN 0 21 22 IN 1 IN 2 23 24 IN 3 IN 4 25 26 IN 5 IN 6 27 28 IN 7 IN 8 29 30 IN 9 IN10 31 32 IN11 IN12 33 34 IN13 IN14 35 36 IN15 COMMON 37 38 COMMON NC 39 40			
No.	Signal		No.	Signal	
1	START 0 *	Image capture with Camera 0	2	START 1	Image capture with Camera 1
3	START 2	Image capture with Camera 2	4	START 3	Image capture with Camera 3
5	TYPE *	Type Switch	6	DISPLAY *	Layout Switch
7	REENTRY	Template Setting	8	ACKNOWLEDGE	Data reception completion signal at handshake
9	RUN/STOP	Switch between Run/Stop	10	ASSIGN 0 *	Function assignment 0-5
11	ASSIGN 1 *	Function assignment 0-5	12	ASSIGN 2 *	(select from 15 functions)
13	ASSIGN 3	(select from 15 functions)	14	ASSIGN 4	
15	ASSIGN 5		16	RESERVED	Spare (Unavailable)
17	COMMON	Common for input	18	COMMON	Common for input
19	NC	Unconnected	20	NC	Unconnected
21	IN 0 *	Input data 0-15	22	IN 1 *	Input data 0-15
23	IN 2 *		24	IN 3 *	-
25	IN 4 *		26	IN 5 *	-
27	IN 6 *		28	IN 7 *	-
29	IN 8		30	IN 9	-
31	IN 10		32	IN 11	-
33	IN 12		34	IN 13	-
			36	IN 15	
35	IN 14		30	CI VII	
35 37	IN 14 COMMON	Common for input	38	COMMON	Common for input

Note

Four pins of Common (No.17, 18, 37, and 38) are common for all input signals of I/O connector.

► Caution

The signals shown with * mark in the table are also provided for I/O terminal. Use one of I/O connector and I/O terminal block. PV500 might be damaged by connecting to the both terminals and inputting different signals.

Output

No.

1

3

5

7

9

11

13

15

Signal

COMMON

COMMON

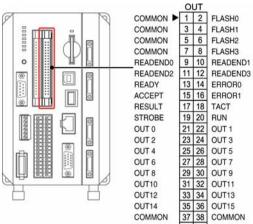
COMMON

COMMON

READ END 0

READ END 2

READY ACCEPT



HESUL1 17 18 1AC1 STROBE 19 20 RUN OUT 0 21 22 OUT 1 OUT 2 23 24 OUT 3 OUT 4 25 26 OUT 5 OUT 6 27 28 OUT 7 OUT 8 29 30 OUT 9 OUT10 31 32 OUT 11 OUT12 33 34 OUT 13 OUT14 35 36 OUT 15 COMMON 37 38 COMMON NC 39 40 NC			
	No.	Signal	
FLASH 0 designated common	2	FLASH 0	Flash signal for Camera 0
FLASH 1 designated common	4	FLASH 1	Flash signal for Camera 1
FLASH 2 designated common	6	FLASH 2	Flash signal for Camera 2
FLASH 3 designated common	8	FLASH 3	Flash signal for Camera 3
Image capture with Camera 0 complete	10	READ END 1	Image capture with Camera 1 complete
Image capture with Camera 2 complete	12	READ END 3	Image capture with Camera 3 complete
Ready completion signal	14	ERROR 0	Error signal 0
Signal of acceptance the next signal • TYPE • DISPLAY • REENTRY*1 • ASSIGN*2	16	ERROR 1	Error signal 1
Total Judgement	18	TACT	Inspection data read timing
Data output complete	20	RUN	Running status (On when running)
Output data 0-15	22	OUT 1	Output data 0-15
	24	OUT 3	
	26	OUT 5	

7BOperation and Data Output through I/O Chapter 8

		REENTRY*1			
		ASSIGN*2			
17	RESULT	Total Judgement	18	TACT	Inspection data read timing
19	STROB	Data output complete	20	RUN	Running status (On when running)
21	OUT 0	Output data 0-15	22	OUT 1	Output data 0-15
23	OUT 2		24	OUT 3	_
25	OUT 4	—	26	OUT 5	
27	OUT 6	—	28	OUT 7	
29	OUT 8	—	30	OUT 9	
31	OUT 10	—	32	OUT 11	
33	OUT 12	—	34	OUT 13	
35	OUT 14		36	OUT 15	
37	COMMON	Common for output	38	COMMON	Common for output
39	NC*	Unconnected	40	NC*	Unconnected
*NC	= No connectio	on			

Note

The output commons (No.37, 38) are for No.9 to 36. When you use Flash signals (Flash 0-3), connect with respective designated commons (Pin No.1, 3, 5, 7).

*1: It cannot be accepted when ReadEnd signal is Off.

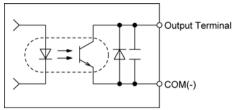
*2: Excepting when assigning function of "Abort Inspection/Process".

Output Circuit

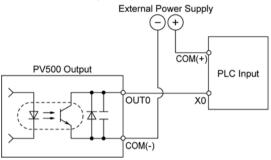
In the case of product number: ANPV0502ADN, ANPV0504ADN

NPN Output

Output load voltage: 5 to 24 V DC Maximum load current: 24mA/ terminal

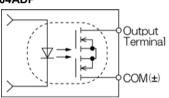


Connection Example

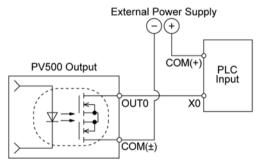


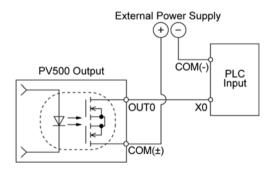
In the case of product number: ANPV0502ADP, ANPV0504ADP

PNP output (PhotoMos output) Output load voltage: 5 to 24 V DC Maximum load current' 24mA/ terminal



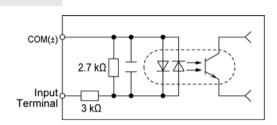
Connection Example



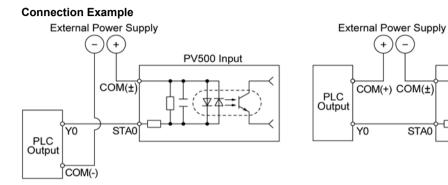


Input Circuit

Rated input voltage: 24 V DC Input voltage range: 21.6 to 26.4 V DC



PV500 Input



How to Wire

Connect them using the discrete wires supplied with the product. The special tool is required to connect the wires.

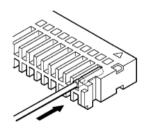
Connector and special tool by Panasonic Electric Works Co., Ltd.		Product No.	
Connector (included) (product No: AFP2801)	Contact	AXW7221	(For AWG#22, 24)
	Housing	AXW1404A	
	Semi-cover	AXW64001A	
Special tool		AXY52000	

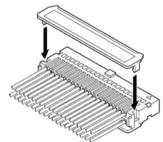
Applicable wire

Size	Cross section area	Outer insulation diameter	Rated current
AWG#22	0.3 mm ²	φ1.5 - φ1.1	3A
AWG#24	0.2 mm ²	_	

- **1.** Bend the contact from the carrier, and set it in the pressure welding tool.
- Insert the wire without removing its insulation until it stops, and lightly grip the tool. The wire is welded.
- 3. Insert the welded wire into the housing.

4. Attach the cover after inserting necessary wires. Now you completed wiring.





To Rewire

You can pull out the contact using "contact puller" attached to the tool.



8.2.2 I/O Terminal Block

► Caution

All input signals are also available for I/O connector. Use one of I/O connector and I/O terminal block. Connecting to the both terminals might damage PV.

Refer to

The input/output circuit is the same as the I/O connector. See page 344.

Pin Arrangement

Inpu	ut		Out	put	
					CUT COM REN0 REN0 REN7 REN0 REN7 REN0 REN7 REN0 REN7 REN0 REN7 REN0 REN7 REN0 ACPT REN0 COM REN0 COM REN0 COM REN0 COM REN0 COM REN0 COM REN0 COM REN0 COM COM REN0 COM COM REN0 COM COM COM COM COM COM COM COM
No.	Signal (indication)	Description	No.	Signal (indication)	Description
1	COMMON (COM)	Common for input	1	COMMON (COM)	Common for output
2	START 0 (STA0)	Image capture with Camera 0	2	READ END 0 (REN0)	Image capture with Camera 0 complete
3	COMMON (COM)	Common for input	3	READY0 (REDY)	Ready completion signal
4	TYPE (TYPE)	Type Switch	4	ERROR 0 (ERR0)	Error signal 0
5	DISPLAY (DISP)	Layout Switch	5	ACCEPT (ACPT)	Signal* acceptance (*Type, Display, Reentry, Assign, Run/Stop)
6	ASSIGN 0 (ASN0)	Function assignment	6	ERROR 1 (ERR1)	Error signal 1
7	ASSIGN 1 (ASN1)	0-2 (select from 15	7	RESULT (RSLT)	Total Judgement
8	ASSIGN 2 (ASN2)	functions)	8	TACT	Reading timing of inspection data
9	IN 0	Input data 0-7	9	OUT 0	Output data 0-7
10	IN 1		10	OUT 1	_
11	IN 2		11	OUT 2	_
12	IN 3		12	OUT 3	_
13	IN 4		13	OUT 4	_
14	IN 5		14	OUT 5	_
15	IN 6		15	OUT 6	_
16	IN 7		16	OUT 7	

Wiring with Terminal Block

► Caution

Be sure to cut the power of PV500 before wiring. Wiring while the power is supplied might cause damage of PV500 and the connecting external device.

About Terminal Block Socket

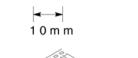
Terminal block socket (included):

Applicable size of wire:

Manufactured by PHOENIX CONTACT Model number: FMC1.5 / 16-ST-3.5 AWG#24 - 16, 0.2 - 1.5 mm²

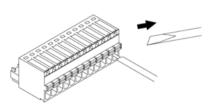
How to Wire

1. Remove the wire shield.

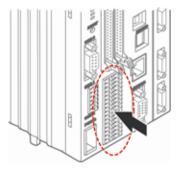


2. Push the orange part into the socket with a slotted screwdriver.

3. Insert the lead wire all the way into it pressing the orange part.



- Release the screw driver.
 The lead wire is connected.
 Connect the lead wire with the pins as necessary.
- 5. After wiring is complete, attach it to the I/O terminal block.



Input Signal

Note

The signals with asterisk (*) are accepted only when ACCEPT of output signal is ON.

START0 - 3 (STA0-STA3): Inspection Start Signal

This is start signal of an inspection. Inputting this signal starts capturing an image. The signals of START0 - START3 correspond to CAMERA0 - CAMERA3 respectively. Use START 0 to use the common trigger when starting capturing images with all connecting cameras simultaneously. To set trigger, select "TYPE" > "Type Setting" > "Camera" > "Camera Trigger" in SETUP menu.

Type (TYPE): Type Switch (*)

Use this signal to switch product types by a signal from the external device. Inputting the type number (0 - 255) to switch to for "IN0 - 7" and turning on a TYPE signal executes switching types.

Display (DISP): Layout Switch (*)

Use this signal to switch layouts displayed on the monitor by a signal from the external device in RUN menu.

Specifying a layout number (0 -31) to input data "IN 0 - 4" and turning on DISPLAY signal switches the layout.

Acknowledge: Data Reception Completion Signal of the External Device during Handshake

Use this signal with output STROBE signal (which is a data output completion signal during handshake) when outputting result data output from OUT1 - 15 to the external device while performing handshake. During handshake, PV500 turn on STROBE signal after outputting data. The external device receives data at rising edge of STROBE ON signal. Turn on Reception completion signal after reception is complete. PV 500 receives the reception completion signal with ACKNOWLEDGE terminal.

Reentry: Template Setting (*)

Use this signal to update the template (base image) of Matching checkers by inputting signals from the external device.

Specifying a checker number (0 - 999) to set for "IN0 -9" and a template number (0 - 63) for "IN10 - 15", and turning on REENTRY signal executes template setting.

Note

Even when setting "Template Registration" to "Common" and using Common template, the procedure of template setting is the same as the above.

However, executing template setting requires attention because the template image is overwritten automatically when a Smart Matching checker in another product type uses the same template due to common template for all types.

Run/Stop: Run/Stop

Use this signal to switch between Run and Stop of PV500 by a signal from the external device. The status change of signal from OFF to ON (or rising edge of the signal) switches between RUN and STOP.

However, this signal cannot be accepted when you select the following menus in SETUP menu; "TOOL" > "General", "Setting Help", and "Update".

ASSIGN 0 - 5 (ASN0-5): Function Assignment (* partly)

Use this signal to perform the function shown in the table below by a signal from the external device. To assign a function to Assign signal, select "ENVIRONMENT" > "Input/Output" > "Parallel I/O" in SETUP menu.

Template Setting (*):	The same as REENTRY
Switch Run/Stop:	The same as RUN/STOP
Save Data in PV (*):	All product type data currently registered in "execution memory" will be saved in "memory for store" of PV. Specify a storing area number (0 - 99) with "IN0 - IN6".
Save Data in SD (*):	All product type data currently registered in "execution memory" will be saved in a SD memory card. Specify a storing area number (0 - 99) with "IN0 - IN6".
Read Data from PV (*):	The setting data registered in the storage space in PV500 will be called up to "execution memory". Specify a reading area number (0 - 99) with "IN0 - IN6".
Read Data from SD (*):	The product type data registered in a SD memory card will be called up to "execution memory" of PV.
Reinspect:	Input this to reinspect without capturing an image. Enter a block number (0 - 9) to execute with "IN0 - IN3".
Reset Statistics (*):	Input this to clear the statistics data and scan count.
Reset Error (*):	ERROR 0 and ERROR 1 will be turned off.
Save Image Memory in SD (*):	Backs up all images saved in the image memory to a SD memory card. Creates a folder named one of "00" to "99" which does not exist in "Panasonic MEW VIsion¥PV500¥Image¥Backup" in a SD memory card and saves images in the folder.
Output Latest Image(*):	Outputs the latest inspection image. The destination (SD memory card or PC connected with Ethernet cable) and the file name can be set from "ENVIRONMENT" > "Input/Output" > "Image Output" menu.
	 Note In "ENVIRONMENT" > "Input/Output" > "Image Output", set "Output Conditions" to "Command Reception". Image Receiver needs to be activated on the destination PC when "Destination" is set to "Ethernet".
Clear Image Memory (*): Print Screen (*):	All image data registered in the Storage Space in PV500 will be cleared. The currently displayed screen (entire contents the monitor displaying) will be captured and saved in a SD memory card or a PC through Ethernet. You can specify destination from "ENVIRONMENT" > "Input/Output" > "Print Screen".
Abort Inspection/Process	 Cancels the following active operations, and restores into the previous status before the operation. Cancellation of the operation of a serial command which has been received Cancellation of the status waiting for Individual trigger input Cancellation of output in the status waiting for result output after an
	 inspection is complete Cancellation of image saving from Image Memory to a SD memory card Cancellation of template re-registration
Abort Save/read Setting Data	Cancels saving or reading the setting data.

IN0 - 15: Input data

These are signals to input the values for switching type, reading/saving setting data when you execute the functions. Specify values in binary data as follows.

Example 1) Specifying No.6	IN7	IN6	IN5	IN4	IN3	IN2	IN1	IN0
	0	0	0	0	0	1	1	0
Example 2) Specifying No.237	IN7	IN6	IN5	IN4	IN3	IN2	IN1	IN0
	1	1	1	0	1	1	0	1

Output Signal

READY (REDY): Inspection start ready completion signal

Use this as condition signal to input START signal when inspecting in "Serial" mode as inspection process mode. READY signal turns on when PV can receive START signal and turns off when it starts capturing an image.

Use "READ END" signal as ready completion signal to inspect in "Parallel" mode.

READ END 0 - 3 (REN0-3): Image capture completion signal

The signals of READ END 0 - READ END 3 correspond to CAMERA0 - CAMERA3 respectively. Use this as condition signal to input START signal when inspecting in "Parallel" mode as inspection process or inspecting with "Individual trigger" which inputs START signal individually. Receiving a START signal for inspection, READ END signal turns off when capturing an image and turns on after capturing is complete.

When connecting multiple cameras and capturing images with "Individual" trigger, all READ END signals of connecting cameras turn on after all cameras finished capturing.

Use "READY" signal as ready completion signal when inspecting with common trigger (, starting capturing images with all connecting cameras simultaneously) in "Serial" mode.

FLASH 0 - 3: Flash synchronization signal

The signals of FLASH0 - FLASH3 correspond to CAMERA0 - CAMERA3 respectively. When the specified time of FLASH delay passes after START signal turns on, FLASH signal is output in the specified length. Whether turning on FLASH signal or turns off at the time of output, you can select for every FLASH signal from ENVIRONMENT > "Camera" > "FLASH Polarity". This setting is common to all product types.

Note

Delay time and output width of FLASH signal can be set for each product type and each FLASH signal from "TYPE" > "Type Setting" > "Camera" in SETUP menu.

RESULT (RSLT): Total Judgement

It outputs a result of Total Judgement set in Judgement. The signal turns on if the judgement is OK, turns off if it is NG or error. The signal is output automatically when Total Judgement is set. Otherwise, the signal is always off.

ACCEPT (ACPT): Available for receiving signals

It turns on when PV can receive some of the signals of TYPE, DISPLAY, REENTRY and ASSIGN. When PV500 receives the signals, ACCEPT signal is turned off, and when the operation is finished, the signal is turned on.

TACT (TACT): Result read timing

The signal turns on when outputting RESULT signal, ERROR0 signal, and the data using OUT 0 - 15 at the timing of output.

It turns on when PV starts outputting a result, and turns off after set "Output signal guarantee time" passes. Obtain a result with the external device at rising edge of TACT signal.

When data is output in multiple times, perform handshake with STROBE signal described below.

► Note

- To set Inspection Process, Serial or Parallel, select as follow.
 - SETUP menu > "ENVIRONMENT" > "System Settings" > "Operation" > "Inspection Process"
- To set image capturing trigger, Common or Individual, select as follow.
 "SETUP menu" > "TYPE" > "Type Setting" > "Camera" > "Camera Trigger"
- To set "Output signal guarantee time", select "ENVIRONMENT" > "Input/Output" > "Parallel I/O Output".

STROBE: Result read timing

Use this signal to output result data with OUT1 - 15 to the external device in multiple times. Each time result data is output, STROBE signal turns on.

When Handshaking is employed:

Use the signal with ACKNOWLEDGE signal in pairs.

PV500 turn on STROBE signal after outputting data. The external device receives data at rising edge of STROBE ON signal. Turn on Reception completion signal after reception is complete. PV 500 receives the reception completion signal with ACKNOWLEDGE terminal.

When Handshaking is not employed:

Inspection data are output at intervals of set "Output signal guarantee time". STROBE signal turns on ach time outputting the data.

Receive data with the external device after rising edge of STROBE ON signal and in the output signal guarantee time.

Note

To set "Output signal guarantee time", select "ENVIRONMENT" > "Input/Output" > "Parallel I/O Output".

RUN: Operate signal

It turns on the device is operating.



The monitor shows "RUN" when it is operating, and "STOP" when it is stopped in the upper right.

ERROR 0 (ERR0): Error in executing an inspection or outputting a result

It turns on when an error occurs on result output or template setting (when REENTRY signal is input) during and inspection. At the timing of outputting of RESULT signal, ERROR 0 signal is turns on.

ERROR 1 (ERR1): Command error

It turns on when an error occurs in operations after inputting the signals which are marked with (*) in the table of input signal including TYPE and DISPLAY.

While the error signal is ON, inputting the signals again operates correctly and turns off the error signal.

Note

- As the same as the above, ERROR 0 signal or ERROR 1 signal is output when an error occurs by inputting the command of the same function through RS-232C interface or Ethernet interface.
- ERROR 0 signal and ERROR 1 signal can be reset forcibly by inputting error reset signal assigned to one of ASSIGN 0 to 5, or by inputting the designated command. See "Resetting Error Signal": page 380.

8.2.4 Cause of Turning On ERROR 0 Signal and ERROR 1 Signal

Turning on the signals of ERROR 0 and ERROR 1 indicates that processes such as executed inspection or type switching have not completed correctly.

Check if PV500 makes the causes of turning on the error signals. And then, to prevent those causes, adjust the settings of PV500 or recheck the signal and the command that the external device sends to PV500.

Cause of Turning on ERROR 0 Signal

ERROR 0 signal turns on when an error occurs while the device executes an inspection or template setting.

Cause	Error Code	Solution, etc
Communication error (communication timeout or sum check error) occurred during PLC communication.	E0111	Connect and set correctly.
Values exceeded the following ranges during calculation. Effective range of values during calculation = -2147483648 to $+2147483647$ (-2^{31} to $(2^{31} - 1)$)	E0151	Check the expression of Numerical Calculation or Judgement which shows "E" sign in the Checker List.
Denominator became "0" in the division that is specified as a numeric calculation.	E0152	
Any item that does not exist is referred to the Numeric calculation, Judgement. (If the referred item is deleted although it existed when it was set.)	E0153	
Position adjustment for a detect trigger is unset when you use "Detect Trigger (common).	E0160	Register a Position Adjustment for the detect trigger.
 While PV500 stops the operation, a signal or a command to execute one of the following is input or sent. Start executing an inspection Execute template setting of Smart Matching 	E0200	Operate (run) PV500.
 The command specifying a block number is sent when execution mode is set to "Execute All" or "Automatic Switch". 	E0201	Send an inspection start command which specifies no block number.
The command specifying a camera is sent when "Camera Trigger" of "Camera" setting is set to "Common". The command specifying no camera is sent when "Camera Trigger" of "Camera" setting is set to "Individual".		Send a command matching the setting of "Camera Trigger".
The error when execution mode is set to "User-Defined".	E0202	Specify block numbers correctly.
 The specified block number does not exist. 		
 The inspection start command which specifies no block number was sent. 		
 The different block numbers are specified when inputting inspection start signal of cameras while "Camera Trigger" of Camera is set to "Individual". 		
Image capturing error occurred.	E0203	 Connect and set correctly. If the error reoccurs, try the following procedures. Cut the power and reconnect the camera cable. Replace the cable.
No camera is connected.		
Disconnection of the camera cable, loose connection of the camera connector.		
 No image exists in Inspection image memory when executing reinspection (without capturing any image after PV starting up). The following occurred when "Camera Trigger" is set to "Individual" 		
• Not all of image capturing signals were completed to input within the specified "Timeout" from the first capture start.		
 The specified camera is invalid. (Such as disconnection of the camera, setting "Unused" in PV500, or specifying other than 01-15) 		
• The 2nd to 4th commands specified the camera which has already captured an image when the 1st to 3rd commands are input.		

Cause	Error Code	Solution, etc
During continuous inspection, the signal to execute "Reinspection" is input or the command is sent.	E0204	You cannot reinspect during continuous inspection.
When you make Template setting with the following conditions;		
• It was executed when SETUP menu was displayed.	E0230	Operate PV500.
It was executed when Detect trigger was processing or Continuous Inspection was used.		Stop Detect trigger and Continuous Inspection, and then execute Template setting.
While "Area Display" is set to "Yes", the command for Send 2 (%A) was sent when Send 1 was supposed to. While "Area Display" is set to "Yes", the command for Send 1 (%Accc,??) was sent when Send 2 was supposed to. While "Area Display" is set to "No", the command "%A" was sent.		Enter a command correctly.
 The specified number of checker or template is not create. Other number than 000-999 for checker number, or 00-63 for template was specified. 	E0231	Specify a correct checker number or template number.
 Template cannot be set because no image has been captured after PV500 started up when you select "Use the Last Image" for "Template Setting. 	E0232	Execute an inspection, or change the setting to "Capture New Image" to execute Template setting.
 No feature on the image of template registration area. An error occurs in Position adjustment when you use it. 	E0233	Check the captured image.
Parallel Handshake Timeout occurred. (No ACKNOWLEDGE signal indicating that the external device has received data was input to PV500 within the Timeout.)		Input ACKNOWLEDGE signal within Handshake Timeout.

Cause of Turning on ERROR 1 Signal

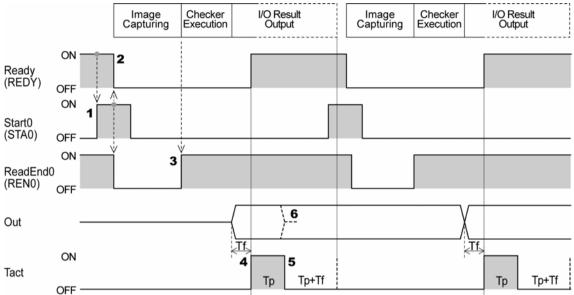
Cause	Error Code	Solution, etc
The following errors when sending a command to PV500.	E0100	
BCC (Block check code) error		
 An undefined command was sent. (including the case of sending a part of command such as only delimiter(CR)) 		
Communication error (communication timeout or sum check error) occurred during PLC communication.	E0111	Connect and set correctly.
While PV500 stops the operation, a signal or a command to execute one of the following is input or sent.	E0200	Operate (run) PV500 and execute again.
 Type switch Save the setting data (in the storage space in PV or a SD memory card) 		
 Read the setting data (from the storage space in PV or a SD memory card) 		
Save images saved in the save image memory to a SD memory card		
Clear the save image memory		
Print screen		
Reset statistics		
Layout change Dead or write personators		
Read or write parameters	E0210	Specify a type number correct
 The specified product number does not exist. Other number than 000-255 was specified for a product number. 	E0210	Specify a type number correct
Timeout of Type Switch/ Read Setting Data When waiting for Individual Trigger input*, image capturing of the rest of the cameras or Abort Inspection/Process is not executed in 10 seconds after sending the signal or command to execute above operations. (This condition does not apply when Individual Trigger Timeout is set to "Yes")	E0211	Input the trigger signals of the rest of cameras or abort inspection/process.
* The status where the device is waiting for the rest of camera triggers after receiving some of the camera triggers.		
Other number than 00-99 was specified as an area number when saving or reading setting data to or from PV or a SD memory card.	E0212	
When reading setting data from a SD memory card;		
No SD memory card is attached or cannot be accessed.No data file in the designated area of a SD memory card.	E0213	Check attachment of the SD memory card or presence of data file.
The data file is not data of PV500.The data file is incompatible. (Data of the later version,	E0214	Prepare a correct data file.
etc.) The number and types of cameras connected to PV500 is 		
different from the Camera setting of the data file.		
 When saving setting data in a SD memory card; No SD memory card is attached, the card cannot be accessed, or used up its capacity. The SD memory card is write protocted. 	E0216	Correctly attach a SD memory card which is writable and has enough free space.
The SD memory card is write-protected.	E0047	
 When aborting save/read setting data, The command to abort is sent other than when saving/reading setting data. 	E0217	

Cause	Error Code	Solution, etc
When switching layout;	-	-
 Although PV500 is operating (RUN), displaying SETUP menu cannot switch layout. 	E0245	Switch to RUN menu,
• Other number than 00-31 is specified for layout number.	E0246	Specify a correct layout number
 No layout has been registered in the specified layout number. 		
When sending parameter write command;		
 Because PV500 shows SETUP menu, parameters cannot be written. 	E0250	Switch to RUN menu.
 Specification of the parameter is wrong. (e.g. Undefined parameter is specified.) 	E0251	Specify correct parameters.
• The specified parameter does not exist. (e.g. The number of uncreated checker is specified as a parameter.)	E0252	
The specified parameter value is out of the settable range. (e.g. Maximum value of slice level is being set to over 256.)		
 The specified values led to the status of "Maximum value < Minimum value" when entering them. 		
 When specifying the moving distance of the marker, a part of the circumscribing rectangle of the marker (the intersection point when Shape is Cross line) after move was out of the nine screens where checker area is settable. 		
When outputting the latest inspection image to a SD memory card	d or Etherr	net interface(Output Latest Image
 No SD memory card is attached, the card cannot be accessed, or used up its capacity. 	E0255	Correctly attach a SD memory card which is writable and has enough free space.
The SD memory card is write-protected.	50050	
 Output Condition* of Image Output is not set to [Command Reception]. *"ENVIRONMENT" > "Input/Output" > "Image Output" > "Output Conditions" 	E0256	Set Output Condition to [Command Reception].
There is no image captured.	E0257	Capture an image.
When saving Image memory of PV500 in a SD memory card;		
 No SD memory card is attached, the card cannot be accessed, or used up its capacity. The SD memory card is write-protected. 	E0260	Correctly attach a SD memory card which is writable and has enough free space.
When saving Image memory of PV500 in a SD memory card, there is no blank folder. (All of 00-99 are used.)		Delete all or some folders of 00 99 in the "Backup" folder of the SD memory card.
When saving Print screen in a SD memory card or a PC through I	Ethernet;	
 No SD memory card is attached, the card cannot be accessed, or used up its capacity. 	E0265	Correctly attach a SD memory card which is writable and has enough free space.
The SD memory card is write-protected.	50000	3 .
 Ethernet communication cannot be established (with connection problems including disconnection). Image Receiver is not activated. 	E0266	Correctly connect Ethernet. Activate Image Receiver, and se it to "CONN: Standby".
When sending the command prohibiting/permitting keypad operat	tion	1
The command was sent in SETUP MENU.	E0270	Switch to RUN menu.
Specification of the parameter is wrong. Other number than 0 and 1 is specified.	E0271	Specify correct parameters.

8.3.1 Typical Operations in Inspections

Common Trigger

In serial processing mode



Tf: 400µs (fixed), Tp (1-1000ms): Data output guarantee time (default: 10 ms)

- 1. Make sure that REDY signal is ON and then turn on STA0 signal for more than 1 ms.
- 2. PV500 turns off REDY signal and REN0 signal, and starts capturing an image.
- 3. After image capturing is completed, PV turns on REN0 signal and executes checkers.
- 4. As the inspection ends, a result is output through I/O interface and TACT signal and REDY signal are turned on after the period of "Tf".

When PLC communication or synchronous output (general output and image output) is operated, REDY signal turns on after the operation is complete. After REDY signal turns ON, the device can receive the next STA signal. Obtain a result after more than 1 ms of wait time when TACT signal turns on.

Note

The time from when TACT signal turns on till when the result output (OUT signal) is determined varies according to the condition of the connected load or ambient temperature.

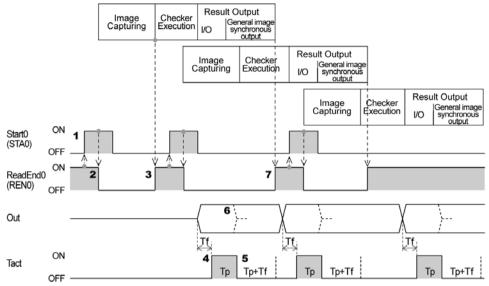
5. TACT signal is turned on for the time of "Tp", and then turned off for the time of "Tp + Tf".

While the signal is off, result of the next inspection is not output.

6. Out signal keeps on status until the next output (Hold), or turns off when TACT signal turns off (Reset).

To select "Hold" or "Reset", select "ENVIRONMENT" > "System Settings" > "Operation" > "Parallel I/O Output Reset Condition".

In parallel processing mode



Tf: 400µs (fixed), Tp (1-1000ms): Data output guarantee time (default: 10 ms)

1. Make sure that REN0 signal is ON and then turn on STA0 signal for more than 1 ms.

2. PV500 turns off REN0 signal and starts capturing an image.

Note

The delay time mentioned on the right may occur from the input of STA signal until the start of image capture (REN signal is OFF) when displaying a live image.

2-mega camera: Max. 34 ms Quad-speed camera: Max. 9 ms Ultra small camera: Max. 17 ms

3. After image capturing is completed, PV turns on REN0 signal and executes checkers.

After REN0 signal turns on, PV500 can receive STA0 signal (or capture and image). At the timing when it starts capturing the next image, input STA0 signal.

4. As the inspection ends, a result is output through I/O interface and TACT signal is turned on after the period of "TV".

Obtain a result after more than 1 ms of wait time when TACT signal turns on.

The time from when TACT signal turns on till when the result output (OUT signal) is determined varies according to the condition of the connected load or ambient temperature.

5. TACT signal turns on for the time of "Tp", and then turns off for the time of "Tp + Tf".

You cannot output the next result while the signal is off and the device is in the status of waiting for output.

6. Out signal keeps on status till the next output (Hold), or turns off when TACT signal turns off (Reset).

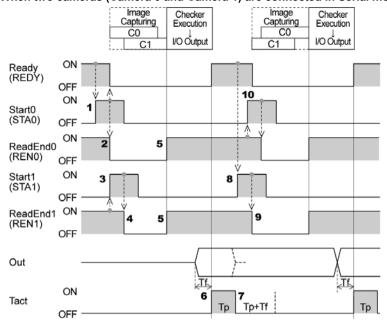
To select "Hold" or "Reset", select "ENVIRONMENT" > "System Settings" > "Operation" > "Parallel I/O Output Reset Condition".

7. After the second image capturing is completed, PV executes checkers. If the first data has been output at the time, REN0 signal is turned on. If it has not, PV waits until the data is output and turns on REN0 signal.

After REN0 signal turns on, PV500 can receive STA0 signal (or capture and image). At the timing when it starts capturing the next image, input STA0 signal.

Setting "Image Output" to "Async.(inspection first)" turns on REN0 signal and allows capturing the third image after the second image capturing or the first synchronous result output (general output through I/O and synchronously) whichever completed later, before outputting the general result and the image of the first inspection is completed.

Individual Trigger



When two cameras (Camera 0 and Camera 1) are connected in Serial mode:

Tf: 400µs (fixed), Tp (1-1000ms): Data output guarantee time (default: 10 ms)

- 1. To start capturing an image of the first camera (C0 above), make sure that REDY signal is ON and then turn on STA signal (STA0 for the example above) for more than 1 ms.
- 2. PV500 turns off REDY signal and REN0 signal, and starts capturing an image.
- To start capturing an image of the second camera (C1 above), make sure that REN signal for the second camera (REN1 for the example above) is ON and then turn on STA signal for more than 1 ms.

When you employ individual trigger timeout, a timeout error occurs if the time from STA signal input of the first camera to the input of the last camera exceeds the timeout. And then, inspection is terminated and ERROR 0 signal is output.

- 4. PV500 turns off REN1 signal and starts capturing an image.
- 5. After all connecting cameras complete capturing all images, turn on REN signal (REN0 to 1 for the example above) and execute checkers.
- As the inspection ends, PV outputs a result through I/O interface and turns on TACT signal after the period of "Tf".

Obtain a result after more than 1 ms of wait time when TACT signal turns on.

The time from when TACT signal turns on till when the result output (OUT signal) is determined varies according to the condition of the connected load or ambient temperature.

7. TACT signal turns on for the time of "Tp", and then turns off for the time of "Tp + Tf".

You cannot output the next result while the signal is off and the device is in the status of waiting for output.

- 8. To start capturing an image of the first camera (C1 for the example) in the second inspection, make sure that READY signal is ON and then turn on STA signal for more than 1 ms.
- 9. PV500 turns off REDY signal and REN1 signal, and starts capturing an image.
- 10. To start capturing an image of the second camera (C0 for the example), make sure that REN signal for the second camera is ON and then turn on STA signal for more than 1 ms.

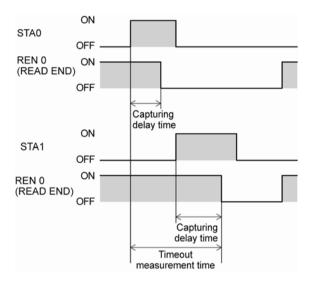
Afterwards, inspections are continued in the same way as above.

Note on Displaying Live Image

When Live image is displayed, a delay time occurs until starting image capture after inputting the START signal.

Note that the timeout period is measured including this delay time. The delay time varies depending on cameras.

- 2-mega camera: Max. 34 ms
- Quad-speed camera: Max. 9 ms
- Ultra small camera: Max. 17 ms

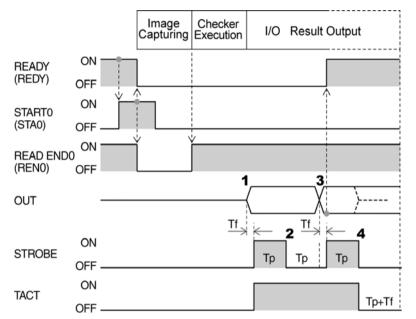


When the Handshake Function Is Set to "No"

Inspection data are output at intervals of set "Output signal guarantee time (Tp)". STROBE signal turns on each time outputting the data.

Receive data with the external device after rising edge of STROBE ON signal and before the next STROBE signal turns on.

The following is an example of outputting data dividing into three times in Serial mode.



Tf: 400µs (fixed), Tp (1-1000ms): Data output guarantee time (default: 10 ms)

1. As the inspection ends, the first data (OUT signal) is output through I/O interface and turned on STROBE signal and TACT signal.

Obtain the first result after more than 1 ms of wait time when STROBE signal turns on.
Note

The time from when STROBE signal turns on till when the result output (OUT signal) is determined varies according to the condition of the connected load or ambient temperature.

2. STROBE signal turns off after the time of Tp passes.

3. As the time of Tp passed from STROBE signal turns off, the second data is output and STROBE signal and READY signal turn on(*).

Obtain the second result after more than 2 ms of wait time when STROBE signal turns on.
Note

When synchronous output is operated in addition to I/O output, including data output to COM.0 port and Ethernet port, and inspection image output, READY signal stays OFF until the operation is competed.

4. STROBE signal and TACT signal turn off after the time of Tp passes. Setting "Parallel I/O Output Reset Condition" to "Reset" resets OUT signal at this timing.

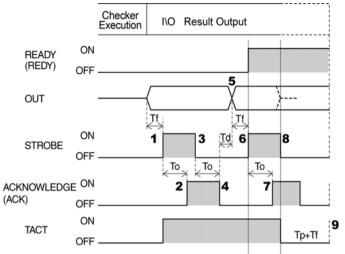
5. I/O result output is complete after the time of "Tp+Tf" passes from TACT signal turns off.

Note

You cannot output the next result while the time of "Tp+Tf" is passing in Parallel mode, and the device is in the status of waiting for output.

When the Handshake Function Is Set to "Yes"

Use STROBE signal (PV500 -> the external device) and ACKNOWLEDGE signal (The external device -> PV500) in pairs.



Tf: 400µs (fixed)、Tp: Data output guarantee time, 1-1000ms (default: 10 ms)

To: Timeout period, 4 - 20000 ms (default: 5000 ms) Exceeding this time causes a timeout error, terminates output processing, and outputs ERROR 0 signal.

- 1. As the inspection ends, the first data is output through I/O interface and turned on STROBE signal and TACT signal.
- 2. As for an external device, obtain the first result after more than 1 ms of wait time(*) when STROBE signal turns on, and turn on ACK signal.

Be sure to turn on ACK signal in the time of "To" after turning on STROBE signal.

(*) The time from when Strobe signal turns on till when the result output (Out signal) is determined varies according to the condition of the connected load or ambient temperature.

- 3. PV500 checks that ACK signal is ON and turns off STROBE signal.
- 4. Check STROBE signal if OFF with the external device and turn off ACK signal in the time of "To".
- 5. PV500 outputs the second (last) data in 100µsec (Td) after turning off ACK signal.
- 6. As the time of "Tf" passed from data output, turn on STROBE signal and READY signal. ▶ Note

When synchronous output is operated in addition to I/O output, including data output to COM.0 port and Ethernet port, and inspection image output, READY signal stays OFF until the operation is competed.

7. As for an external device, obtain the second result after more than 2 ms of wait time(*) when STROBE signal turns on, and turn on ACK signal.

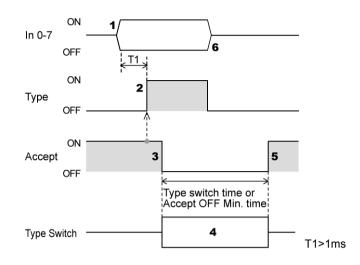
Be sure to turn on ACK signal in the time of To after turning on Strob signal.

8. PV500 checks that ACK signal is ON and turns off STROBE signal and TACT signal. Setting "Parallel I/O Output Reset Condition" to "Reset" resets OUT signal at this timing.

Check STROBE signal is OFF with the external device and turn off ACKNOWLEDGE signal. If the time from turning on of TACT signal is less than "Tp", wait until the time passes and turn off TACT signal.

I/O result output is complete after the time of "Tp+Tf" passes from TACT signal turns off.
 Note

You cannot output the next result while the time of "Tp+Tf" is passing in Parallel mode, and the device is in the status of waiting for output.



1. Specifying the number of the product type that you want to call using In0-7.

Input IN0-7 more than 1 ms before TYPE signal input. When "Type Switching Signal" is set to "PLC Communication" in PLC Communication Setting, input the product number to switch in the specified register of PLC.

How to specify product number to into-7								
IN7	IN6	IN5	IN4	IN3	IN2	IN1	IN0	
off	off	off	off	off	off	off	off	
off	off	off	off	off	off	off	ON	
off	off	off	off	off	off	ON	off	
off	off	off	off	off	off	ON	ON	
off	off	off	off	off	ON	off	off	
			:					
ON	ON	ON	ON	ON	ON	off	off	
ON	ON	ON	ON	ON	ON	off	ON	
ON	ON	ON	ON	ON	ON	ON	off	
ON	ON	ON	ON	ON	ON	ON	ON	
	off off off off off ON ON ON	off off off off off off off off off off off off ON ON ON ON ON ON	off off off off off off off ON ON ON ON ON ON ON ON ON ON ON ON	off off off off off off off <	off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off off	off off <td>offONONONONoffoffONONONONONoffoffONONONONONoffoffONONONONONonoff</td>	offONONONONoffoffONONONONONoffoffONONONONONoffoffONONONONONonoff	

How to specify product number to IN0-7

- Check the ACCEPT signal ON and then input the TYPE signal (Type switch execution signal). 2.
- PV500 checks that ACKNOWLEDGE signal is ON and turns off STROBE signal 3.
- PV500 executes type switch. 4.
- After type switching completed, ACCEPT signal turns on. 5.

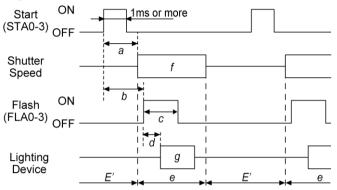
However, when "ACCEPT OFF Min." is set, ACCEPT signal turns on after whichever longer of the type switch time or Accept OFF Min. time pasts.

6. Turns off TYPE signal and IN0-7 signals before inputting a signal, such as START, to PV500.

8.3.4 FLASH Output Timing

Note

When you turn on the light by inputting FLASH signal sent from PV500, the light continuously flashes while display image of PV500 is set to "Live". This is because the Flash signal is output continuously along with the display timing of the live image. It is advisable to display "Memory" image when you use the light using Flash signal.



а	Image capture response	Response time for START signal to the start of image capturing. START signal response time (1 ms or less) + Capture delay *1) (0 to 999.9 ms) = 1000.9 ms (Max)
b	FLASH signal response time	Response time for START signal to the start of FLASH signal output *2) *3). START signal response time (1 ms or less) + FLASH signal delay *1) (0 to 999.9 ms) = 1000.9 ms (Max)
С	FLASH span *1)	Set the value with PV500 in accordance with a connecting lighting. (0.2 - 999.9 ms *4))
d	Lighting response time	Response time for FLASH signal of a lighting *3). Set the value with a lighting. (It varies depending on the delay time setting of a lighting.)
e	Lighting range	Lighting tolerance time between light emission start and the end. If it lights out of the range (E'), brightness of captured images vary every inspection.
f	Shutter speed *1)	Set the value with PV500. 0.03 to 1000.00 ms (30 μs to 1000 ms)
g	Lighting time	Set the value with a lighting. The time from the emission start to the end of lighting must be less than "Lighting range" (e).

• *1)

Set it for each "Camera No. to Set" of Types.

• *2)

Depending on the internal circuit of a connecting device, the response time could be longer than the maximum time (1000.9 ms). Check on the system you actually use.

• *3) For your imformation

When using our digital power sourse for LED lighting (ANB86001/ANB86003),

- Setting of "Capture delay" in PV500 to "0 ms" makes "b" = 1 ms or less

- Setting of "Llight Delay Time" of the digital power sourse to "10 μs" makes "d" = 100 μs or less

• *4)

In PNP-output-type product (PhotoMos output type, the end of the product number is "P"), actual signal span against the set Falsh span is as listed below due to the feature of PhotoMos relay. The signal span changes depending on the setting of "Flash Polarity".

When FLASH polarity is set to "ON at Low": [Output signal span] = [set signal span] - [approx. 120µs(0.12ms)] When FLASH polarity is set to "ON at High": [Output signal span] = [set signal span] + [approx. 40µs]

Example)

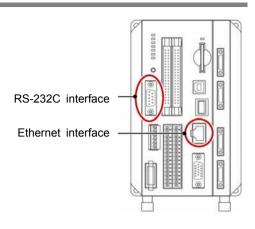
Set Signal Span		Output	t Signal Span
		[FLASH Polarity] = ON	[FLASH Polarity] = OFF
Example 1	0.2 ms (200µs)	0.08 ms (80µs)	0.24 ms (240µs)
Example 2	10 ms	9.88 ms	10.04 ms

Chapter 9

Control with Communication Port

PV500 is provided with the following communication ports.

- COM 0 port: RS-232C interface
- Ethernet port: Ethernet interface



9.1.1 RS-232C Interface

Using COM.0 port, PV500 communicates with the external device through RS-232C. Outputting inspection result data and sending/receiving commands can be performed.

There are two types of modes for communication available, "General Purpose Communication" and "PLC Communication". The communication details differ depending on the modes. Use one of them according your purpose.

Item		Specifications
Connector		D-sub9 pin
Communication	n method	Full duplex
Synchronous n	nethod	Asynchronous
Baud rate [*] 1 ⁾		1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps (Initial value: 9600)
Transmission of	ode	ASCII
Transmission	Bit length	7-bit, 8-bit (Initial value: 8-bit)
format	Stop bit	1-bit, 2-bit (Initial value: 1-bit)
	Parity check	None/Odd/Even (Initial value: Odd)
	Flow control	None/Soft Flow/ Hard Flow (Initial value: None)
	Delimiter	CR

Communication Specification of RS-232C

*1) When Baud Rate is "115200 bps", the communication may not be carried out stably in accordance with the device to communicate with. In the case, set Baud Rate to "57600 bps" or lower.

Refer to

For information how to set communication speed and transmission format, refer to Chapter 6.3.2 Changing Communication Condition of COM.0 port (Serial), page 318.

Connector Specification

9-pin D-SUB socket,	No.	Signal
M2.6 lock screw	1	FG
	2	SD
	3	RD
1. 0	4	RS
6	5	CS
	6	
	7	SG
5 9	8	
	9	+5V

Connecting with a PC and a PLC

Connecting with a PC

Connect them with the dedicated cable, AFB85853, which is sold separately. The arrangement of the cables is shown on the right.

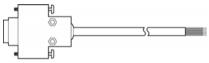
Note

Although the broken lines in the right figure are also connected in AFB85853, the connections of the broken lines are not necessary when you make a cable (or do not use AFB85853).

Connecting with a PLC

Connect them with a separately-sold cable, AIP81842 (D-SUB9 pin, discrete wire) as below.

AIP81842



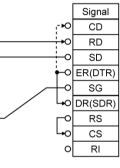
Note

About the broken line in the connecting example, please refer to an instruction manual of PLC to connect it as necessary.

_	PV500	COM.0		PC-AT C	ompatible
[Pin	Signal		Pin	Signal
[1	FG	ГО	1	CD
	2	SD	o	2	RD
[3	RD	o	3	SD
[4	RS	o−,ξ-o	4	ER
	5	CS	\sim	5	SG
[6		o, 💥 🔎	6	DR
[7	SG	~~~X~~	7	RS
[8		o∕∕`、∖—o	8	CS
[9	+5V	o- ``o	9	RI

 When "Flow Control" is "None" or "Soft Flow" PV500 COM 0

1 1000 00			
Pin	Signal	Wire/marking	
1	FG	Brown / Black	0
2	SD	Brown / Red	o
3	RD	Yellow / Black	~
4	RS	Yellow / Red	<u>о</u> -т
5	CS	Green / Black	o≁_
6		_	0
7	SG	Green / Red	<u>مــــــــــــــــــــــــــــــــــــ</u>
8		_	0
9	+5V	_	0



PLC

PLC Signal

> CD RD SD

ER(DTR)

-0 SG +0 DR(SDR) -0 RS

cs

RI

ю

 \mathbf{c}

0

0

When "Flow Control" is "Hard Flow"

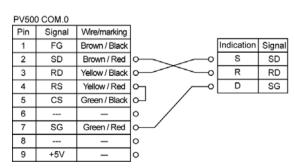
F V 500 C C	/101.0		
Pin	Signal Wire/marking		
1	FG	Brown / Black	0
2	SD	Brown / Red	o
3	RD	Yellow / Black	~
4	RS	Yellow / Red	<u>∽</u>
5	CS	Green / Black	⊶ _∖
6		_	0
7	SG	Green / Red	\sim
8		_	0
9	+5V	_	0

Connections with Panasonic PLC (FP series)

FPΣ COM port: RS232C 1 channel type FP-X COM port: RS232C 1channel type

PV50	D COM.0					
Pin	Signal	Wire/marking				
1	FG	Brown / Black			Indication	Signal
2	SD	Brown / Red	·		SD	SD
3	RD	Yellow / Black	0	~0	RD	RD
4	RS	Yellow / Red	<u>с</u>	г°	RS	RS
5	CS	Green / Black	പ	Lo	CS	CS
6		-	0		SG	SG
7	SG	Green / Red	0			
8		-	0			
9	+5V	-	0			

FP0 COM port



9.1.2 Ethernet Interface

Ethernet communication is performed with an external device. There are two types of mode for communication available, "General Purpose Communication" and PLC Communication" (on Ver.1.50 or later). Outputting inspection result data, image data, and sending/receiving commands can be performed. The product of Ver.1.40 or later can communicate with the designated setting software PVWIN.

Note

- Note that incorrect setting of the connection to the existing LAN might cause malfunction in the • devices on the network. Consult your network administrator before connecting.
- One PV500 cannot be operated by multiple PCs on the network.
- Depending on the network condition, delay might be caused in the communication. It is advisable to use I/O interface or RS-232C interface for the operation that requires speedy response such as inspection trigger input.

Communication Specification of Ethernet

Item	Specifications
Connector	RJ-45
Media	10BASE-T / 100BASE-TX / 1000BASE-T
Protocol	General Purpose Communication: TCP / IP PLC Communication: UDP / IP

Note

According to the network adapter of your PC, 1000BASE-T communication may not be available. When you use Ethernet communication with 1000BASE-T, please check the maximum frame size (which is the data size that can be sent or received in one communication) available in the network environment. In some cases, the network adapter complying with 1000BASE-T also requires a setting change. For details including how to set, please contact a manufacturer of network adapters.

About Baud Rate

PV500 automatically adjusts the baud rate according to the speed of the device to communicate. (Auto negotiation)

You can know the current baud rate by the position and color of LED of Ethernet port that lights when communicating.

LED	Color	Baud Rate
Upper	Yellow	10 megabits
Lower	Green	100 megabits
-	Orange	1000 megabits (1 gigabit)
	Upper	Upper Yellow Lower Green

About Port Number

Port number differs depending on communication mode and communication data.

- Data Output General Purpose • 8601 Communication:
- Data Output PLC Communication: 1 - 65534(Except 8600 - 8699, 9090) Image output: 8602 8604
- Command send/ receive:

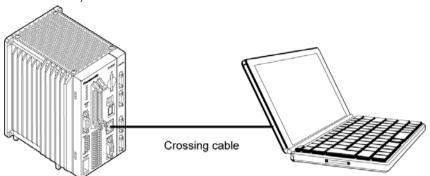
Refer to

Commands: Refer to Chapter 9.2.

Connecting PV500 with PC

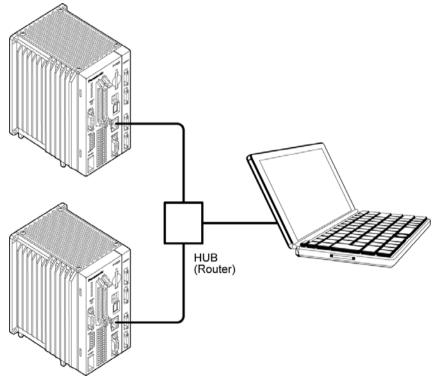
Communicating between a PV500 and a PC

Connect them with a commercially available crossing cable. (STP crossing cable of category 5e or more is recommended.)



Communicating between a PV500 and Multiple PCs

Connect them with a commercially available straight cable (STP straight cable of category 5e or more is recommended.) through a hub or a router, which supports 1000BASE-T, 100BASE-TX, and 10BASE-T.



Note

Do not use the same IP addresses for the PV500 and the PC on the network.

9.2.1 List of Commands

The commands described in this chapter are the common commands for the ports to control PV500 through RS-232C interface and Ethernet interface.

Note

Port number of Ethernet interface to send/ receive commands for PV500 is "8604".

List of Commands

The commands and the modes permitting the commands are listed below.

			-	nand Per				
		Command	RUN I RUN	Menu STOP	SETU RUN	P Menu STOP	Parallel Processing	Continuous Inspection
Inspection sta	art Common Trigger	%S	Yes		Yes		Yes	Yes
·	Individual Trigger	%S	Yes		Yes		Yes	
Stop repeatin	g inspection	%S	Yes		Yes		Yes	Yes
Stop Detect t	rigger execution	%S	Yes		Yes			Yes
	ction (to inspect on the bry image without ew image)	%R	Yes		Yes			
Switch produ	ct type	%X	Yes		Yes		Yes	Yes
Save the setting data	Storage space in PV500	%MW	Yes		Yes		Yes	Yes
-	SD memory card	%CW	Yes		Yes		Yes	Yes
Read the setting data	Storage space in PV500	%MR	Yes		Yes		Yes	Yes
	SD memory card	%CR	Yes		Yes		Yes	Yes
Abort save/re (Cancel)	ad setting data	%CD	Yes		Yes		Yes	Yes
Image	Save (in a SD card)	%SS	Yes		Yes		Yes	Yes
memory	Clear	%SR	Yes		Yes		Yes	Yes
Print screen		%PS	Yes		Yes		Yes	Yes
Reset statisti	cs	%Q	Yes		Yes		Yes	Yes
Switch betwe	en RUN/STOP	%RM	Yes	Yes	Yes	Yes*1	Yes	Yes
Reset error si	ignal	%Е	Yes	Yes	Yes	Yes	Yes	Yes
Key emulating	g	%K	Yes	Yes	Yes	Yes	Yes	Yes
Keypad	Invalid/Valid	%BS	Yes	Yes			Yes	Yes
Operation	Confirm Status	%BC	Yes	Yes	Yes	Yes	Yes	Yes
Cancel Inspe	ction/ Process	%CC	Yes	Yes	Yes	Yes	Yes	Yes
Switch layout		%I	Yes				Yes	Yes
Set a templat	e	%A	Yes					
Parameter	Read	%PR	Yes	*2	Yes	*2	Yes	Yes
	Read pairs (Maximum/minimum values)	%PRP	Yes		Yes		Yes	Yes
	Change	%PW	Yes				Yes	Yes
	Change pairs (Maximum/minimum values)	%PWP	Yes				Yes	Yes

*1 This cannot be executed when you select "TOOL" > "General", "Setting Help", or "Update".

*2 Only operation status (parameter: SYS_RUN) and screen status (parameter: SYS_EDIT) can be read.

"SEND" described in this chapter indicates the commands given from external devices to PV500. On the other hand, "Receive" indicates the responses for the sent commands from PV500 to external devices.

About Block Check Code

All command messages are added with a block check code, which checks an error using horizontal parity to improve reliability of transmission data. This manual describes a block check code as "BBC".

As a block check code of PV500, a code that is given by removing a terminal code from Exclusive OR (8-bit) of a command message and converting it into ASCII code (two letters) is used.

If you do not employ block check, add it to "**" (2AH2AH) instead of a block check code.

Example) When reading execution time

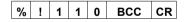
Command message s S т М Е 1 % Ρ Υ R I 50H 52H 20H 53H 59H 53H 5FH 54H 49H 25H 4DH 45H 31H Obtain Exclusive OR 25H Command message including BBC % Ρ R S Υ S т М Е 1 2 5 CR I BCC About Response at Error

When sending a command message from the external device, an error response message containing 3-digit error code may be returned. This message is returned when the sent command is wrong or PV500 cannot receive the command.

The response differs depending on commands except the following common responses. Refer to the descriptions of each command.

Error Response Message Common to Commands

- This message is sent when Block Check Code (BCC) error occurred or an undefined command (unrecognizable command) is received.
- ERROR 1 signal turns on.



- Receive buffer overflow of PV500. This might occur when inputting multiple commands in a row from • the external device to PV500. If you receive this error response, decrease commands to send to PV500.
- ERROR 1 signal turns on.

Inspection start

d	%	S	В	CC CR		BCC	= 76	or **
eive	%	S	\$	BCC(52)	CR			
	Erre	or (l	ERF	ROR 0 signal	= ON)			
	%	S	!	Error code	e (3-digit)	BCC	CR	
	Erro	20 20 20 20 20 20)0)1)2	"Camera T Execution • No cam	is stopped. rigger" in " mode is "U era is conne ecified came	Camera" ser-Defir ected.	ied".	

mode		
Send	% S ?	BCC CR ? = 0 - 9 (Block No. to execute)
Receive	% S \$	BCC(52) CR
		DR 0 signal = ON) Error code (3-digit) BCC CR
	Error code 200	Operation is stopped
	201	 Execution mode is NOT "User-Defined" in PV500. "Camera Trigger" in "Camera" is set to "Individual".
	202	The specified block is invalid (the number which does not/ cannot exist was specified)
	203	No camera is connected.The specified camera number is set to "Unused" in PV500.
Example:	Starts the ins	spection of block No.2.
	Send	% S 2 * * CR
	Receive	% S \$ 5 2 CR

% S \$ 5 2 CR

witch" executi	vidual trigger in "Execute All" or "Automatic on mode
Send	S , a a BCC CR aa = 0 - 15: Specifying a camera to capture an image
	Specifies a value in decimal notation of 4-bit data which specifying cameras; Bit 0 = camera 0, Bit 1 = camera 1, Bit 2 = camera 2, Bit 3 = camera 3. $\boxed{Bit3}$ Bit 2 Bit 1 Bit 0 \uparrow \uparrow \uparrow \uparrow Camera 3 Camera 2 Camera 1 Camera 0
	Example) Specify Camera 0:: $\begin{array}{c c c c c c c c c c c c c c c c c c c $
	Specify Cameras 0 and 1:Bit3Bit 2Bit 1Bit 00011
Receive	% S \$ BCC(52) CR Error (ERROR 0 signal = ON)
	% S ! Error code (3-digit) BCC CR
	Error code 200 Operation is stopped 201 "Camera Trigger" in "Camera" is set to "Individual".
	 Execution mode is "User-Defined". The 2nd to 4th command specified different block from of the 1st to 3rd command.
	 The specified camera is invalid. (Such as disconnection of the camera, setting "Unused" in PV500, or specifying other than 01-15) A command specifying the camera which has already captured an image is sent.
Example:	Starts an inspection specifying camera 0 and camera 2.
	Send % S , 0 5 * * CR
	Receive % S \$ 5 2 CR

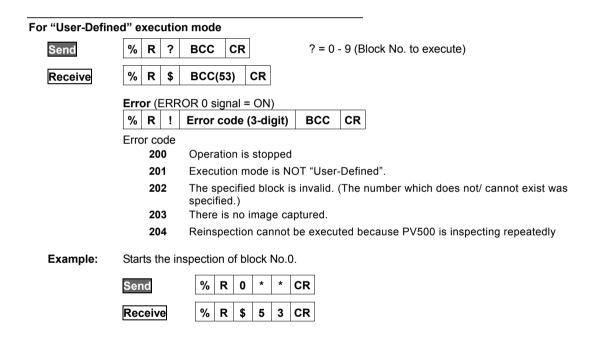
When	using	Individual	trigger in	"Use-Defined	" execution
mode					

Send	%S?,	a a BCC CR
?	P = 0 – 9 (Bloc a = 0 – 15: Specifying a Specifies a v data which s	k No. to execute)a camera to capture an imagevalue in decimal notation of 4-bitspecifying cameras; Bit 0 =it 1 = camera 1, Bit 2 = camera 2,
Receive	% S \$ Error (ERR	Camera 2 Camera 1 Camera 0 BCC(52) CR OR 0 signal = ON)
	% S ! Error code 200 201 201 202 202	Error code (3-digit) BCC CR Operation is stopped • "Camera Trigger" in "Camera" is set to "Individual". • "Camera Trigger" in "Camera" is set to "Individual". • Execution mode is NOT "User-Defined" in PV500. • The specified block is invalid. (The number which does not/ cannot exist was specified.) • The 2nd to 4th command specified different block from of the 1st to 3rd command. • The specified camera is invalid. (Such as disconnection of the camera, setting "Unused" in PV500, or specifying other than 01-15) • A command specifying the camera which has already captured an image is sent.
Example:	Starts an ins Send Receive	spection specifying camera 1 and block No.9. % S 9 , 0 2 * * CR % S \$ 5 2 CR
Stop in continu trigger	uous inspect	ion, stop in execution of detect
Send	% S	BCC(76) CR

No response

Reinspection (Executes inspection without capturing an image)

For "Execute All	" or "Autom	atic Switch" execution mode									
Send	% R B	CC CR BCC = 77 or **									
Receive	% R \$	BCC(53) CR									
	Error (ERR	rror (ERROR 0 signal = ON)									
	% R !	Error code (3-digit) BCC CR									
	Error code										
	200	Operation is stopped									
	201	Execution mode is "User-Defined".									
	203	There is no image captured.									
	204	Reinspection cannot be executed because PV500 is inspecting repeatedly									



Type Switch

Send	% X	?	?	? BCC	CR	??? =	• 000	- 255 (Product type No.)	1		
Receive	% X	\$	BC	C(59) CI	R						
	Error (ERROR 1 signal = ON)										
	% X	!	Error code (3-digit) BCC CR								
	Error code 200 Operation is stopped										
	s not exist. pecified for a product num	nber.									

211 When waiting for Individual Trigger input*, image capturing of the rest of the cameras or Abort Inspection/Process is not executed in 10 seconds after sending the command to execute Type Switch. (This condition does not apply when Individual Trigger Timeout is set to "Yes")

* The status where the device is waiting for the rest of camera triggers after receiving some of the camera triggers.

Saving Setting Data

Saving in the	Storage Space in PV500
Send	% M W ? P BCC CR ?? = 00 - 99 (Storage area No. of PV)
Receive	% M W \$ BCC(1B) CR
	Error (ERROR 1 signal = ON)
	% M W ! Error code (3-digit) BCC CR
	Error code
	200 Operation is stopped.
	212 Other number than 00-99 was specified for a saving area number.
Saving in a SI) memory card
Send	% C W ? BCC CR ?? = 00 - 99 (Storage area No. of a SD memory card)
Receive	% C W \$ BCC(15) CR
	Error (ERROR 1 signal = ON)
	% C W ! Error code (3-digit) BCC CR
	Error code
	200 Operation is stopped
	212 Other number than 00-99 was specified for a saving area number.
	• No SD memory card is attached or cannot be accessed.
	Capacity of the SD memory card is used up.
	 The SD memory card is write-protected.

Reading Setting Data

Reading from	the Storage Space in PV500
Send	% M R ? BCC CR ?? = 00 - 99 (No. of storage area saving the data to read)
Receive	% M R \$ BCC(1E) CR
	Error (ERROR 1 signal = ON)
	% M R ! Error code (3-digit) BCC CR
	Error code 200 Operation is stopped
	 211 When waiting for Individual Trigger input*, image capturing of the rest of the cameras or Abort Inspection/Process is not executed in 10 seconds after sending the command to execute Type Switch. (This condition does not apply when Individual Trigger Timeout is set to "Yes") * The status where the device is waiting for the rest of camera triggers after receiving some of the camera triggers. 212 Other number than 00-99 was specified for a saving area number.
	a SD memory card
Send	% C R ? BCC CR ?? = 00 - 99 (No. of storage area of SD memory card saving the data to read) ??
Receive	% C R \$ BCC(10) CR
	Error (ERROR 1 signal = ON)
	% C R ! Error code (3-digit) BCC CR
	Error code
	200 Operation is stopped
	211 When waiting for Individual Trigger input*, image capturing of the rest of the cameras or Abort Inspection/Process is not executed in 10 seconds after sending the command to execute Type Switch. (This condition does not apply when Individual Trigger Timeout is set to "Yes") * The status where the device is waiting for the rest of camera triggers after receiving some of the camera triggers.
	212 Other number than 00-99 was specified for a saving area number.
	 No SD memory card is attached or cannot be accessed. No data file in the designated area of a SD memory card
	214 • The data file is not data of PV500.
	The Data file is incompatible. (Data of the later version, etc.)
	 The number and types of cameras connected to PV500 is different from the Camera setting of the data file.

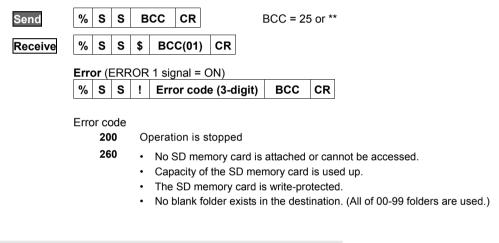
Abort Save/Read Setting Data										
Send	%	С	D	В	сс	CR				
Receive	%	С	D	\$BC		C(06)	CR			
Error (ERROR 1 signal = ON)										
	%	С	D	!	Erre	or cod	e (3-c	ligit)	BCC	CR
	Erro	or co	ode							

- Saving or reading setting data is not executed.
 - · Aborting failed.

Saving Images Stored in the Image Memory of PV into a SD Memory Card

217

Data is saved into free area of the SD memory card. (A destination number cannot be specified.)



Clearing the Image Memory Stored in PV

Execute "SAVE/READ" -> "Clear Image Memory" in SETUP menu.

Send	%	S	R	В	сс	CR		BCC = 24 or **
Receive	%	s	R	\$	вс	C(00)	CR	

Print Screen

It is output into the place specified from "ENVIRONMENT" -> "Input/Output" -> "Print Screen" -> "Destination". This command cannot specify the destination.

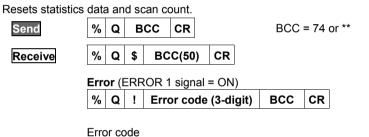
Send	%	Ρ	s	В	сс	CR		I	BCC = 2	6 or **
Receive	%	Ρ	S	\$	вс	C(02)	CR			
	Erre	or (ERF	ROR	1 sig	nal =	ON)			
	%	Р	s	!	Erre	or cod	de (3-c	ligit)	BCC	CR
	L	1								

200 Operation is stopped

265

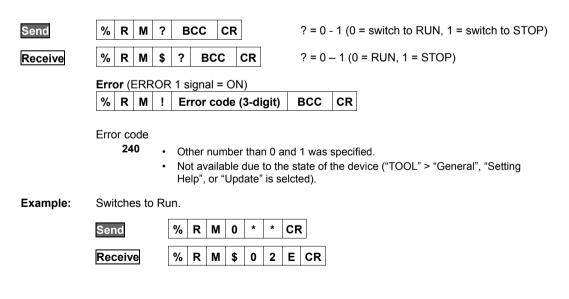
- No SD memory card is attached or cannot be accessed.
 - · Capacity of the SD memory card is used up.
 - The SD memory card is write-protected.

Resetting Statistics Data



200 Operation is stopped

Switch between Run/Stop



Resetting Error Signal

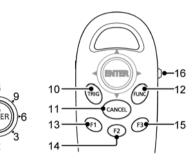
To turns off ERROR 0 and ERROR 1.

Send	%	Ε	В	сс	CR		BCC = 60 or **
Receive	%	Ε	\$	BC	C(44)	CR]

Keypad Operation (Key Emulation)

This is a command that performs the same operations of the keypad.

Send	%	Κ	s	?	?	BCC	CR
	s = (On	•	•	ch c	of th	e shift ke	y; 0 =
	?? =	= 01	- 1	6 (S	See	the right	figure
Receive	No	resp	ons	e			



Setting Invalid/Valid of Keypad operation

This is a command for prohibiting/permitting keypad operation in RUN MENU.

When keypad operation has been set to "Invalid", the keypad cannot be used. A message "Keypad is invalid" is shown in the key guide space on the window. Even when setting to "Invalid", key emulate commands can be received.

Send	% B \$? BCC CR ? = 0-1 (0 = Valid. 1 = In	nvalid)
Receive	% B S \$ BCC(10) CR	
	Error (ERROR 1 signal = ON)	
	% B S ! Error code (3-digit) BCC CR	
	Error Code 270 Not available because SETUP MENU is displayed.	_

271 Other number than 0.1 and 1 is specified.

Reading Keypad Operation Status

Send	%	В	С	В	СС	CR		BCC = 24 or **
Receive	%	В	С	\$?	BCC	CR	? = 0-1 (0 = Valid. 1 = Invalid)

Canceling Inspection/ Processing (Cancel specific operation)

Cancels the following active operations, and restores into the previous status before the operation.

- Cancellation of the operation of a serial command which has been received
- Cancellation of the status waiting for Individual trigger input
- Cancellation of output in the status waiting for result output after an inspection is complete
- Cancellation of image saving from Image Memory to a SD memory card
- Cancellation of template re-registration

Send	%	С	С	В	сс	CR		BCC = 25 or **
Receive	%	С	С	\$	вс	C(01)	CR	

Layout Switcl	า	
Send	% I ?	BCC CR ?? = 00 - 31 (Layout No.)
Receive	% I \$	BCC(48) CR
	Error (ERR	OR 1 signal = ON)
	% I !	Error code (3-digit) BCC CR
	Error code	
	200	Operation is stopped
	245	 Although PV500 is operating (RUN), displaying SETUP menu cannot switch layout.
	246	Other number than 00-31 is specified for layout number.
		 No layout has been registered in the specified layout number.

Smart Matching Template Setting

Set a template of Smart Matching.

Note

A template that can be set with the command is one of Smart Matching in "Checker" menu. In Smart Matching used in Position Adjustment and Area Size Adjustment, a template cannot be re-registered.

Refer to

For information on the conditions when re-registering templates: page 116 w

When "Area Disp	olay" is set t	o "No" for Template Setting
Send	% A c	c c , ? ? BCC CR ccc = 000 - 999 (Checker No.)
		?? = 00 – 63 (Template No.)
Receive	% A \$	BCC(40) CR
	Error (ERR	OR 0 signal = ON)
	% A !	Error code (3-digit) BCC CR
	Error code	
	200	Operation is stopped
	230	 Although PV500 is operating (RUN), displaying SETUP menu cannot switch layout.
		 Because PV500 is processing Detect trigger or Continuous Inspection, Template setting cannot be executed.
		The command (%A) when "Area Display" is set to "Yes" was sent.
	231	The specified checker number or template number has not be created.
		 Other number than 000-999 for checker number, or 00-63 for template was specified.
	232	Template cannot be set because no image has been captured after PV500 started up when you select "Use the Last Image" for "Template Setting".
	233	No feature on the image of template registration area.
		An error occurs in Position adjustment when you use it.
Example:	Re-registers	s a template No.1 of checker No.5.
	Send	% A 0 0 5 , 0 1 * * CR
	Receive	% A \$ 4 0 CR

When "Area Disp	olay" is set to	"Yes" for Template Setting	
Send1	% A C 0	c c , ? ? BCC CR	ccc = 000 - 999 (Checker No.)
			?? = 00 – 63 (Template No.)
Receive1	% A \$	BCC(40) CR	
Receiver	70 A V		
Send2	% A BC	C CR	BCC = 64 or **
Receive2	% A \$	BCC(40) CR	
	Error (ERRO	PR 0 signal = ON)	
	% A ! I	Error code (3-digit) BCC CR	
			4
	Error code		
	200	Operation is stopped	
	230	 Although PV500 is operating (RUI Template Setting. 	N), displaying SETUP menu cannot execute
			tect trigger or Repeat start, Template setting
		cannot be executed.	
			was sent when Send 1 was supposed to.
		 The command for Send 1 (%Acc supposed to. 	c,??) was sent when Send 2 was
	231		template number has not be erected
		•	template number has not be created. hecker number, or 00-63 for template was
		specified.	
			image has been captured after PV500
		started up when you select "Use the	e Last Image" for "Template Setting".
	233	 No feature on the image of templa 	0
		 An error occurs in Position adjustr 	nent when you use it.
Example:	Re-registers	a template No.1 of checker No.5.	
	Send1	% A 0 0 5 , 0 1 *	* CR
	Receive1	% A \$ 4 0 CR	
	Send2	% A 6 4 CR	

0 CR

\$

Α

4

%

Receive2

Read Out Command

This is a command that reads out the settings of PV500 and inspection results. For the information of readable data, refer to the pages after page 380.

When reading of Total judgement																								
Send	%	Ρ	R		Pa	arar	net	er	B	сс	С	R												
Receive	%	Ρ	R	\$	Pa	arar	net	er	=			Dat	ta			всо	c c	R						
	Erro	or (E	ERR	OR	1 si	igna	ul = (ON)																
	%	Ρ	R	!	Er	ror	cod	le (3	-dig	jit)	В	CC	(CR										
Example:	Rea	ds d	out I	Exe	cutic	on ti	me	1.																
	Sen	d																						
	%	Ρ	R		S	Y	S	_	Т	I	М	Е	1	B	всс	; C	R							
	Rec	eiv	е																					
	%	Ρ	R	\$	S	Y	S	_	Т	I	М	Е	1	=	5	3		2	5	вс	С	CR]	
When reading tv Minimum value)		dat	a (s	uch	as	Max	kim	um	valu	ie a	nd													
Send	%	Ρ	R	Ρ		P	araı	net	er	в	СС	CR	2											
Receive	%	Ρ	R	Ρ	\$	Pa	araı	net	er	=		Da	ata	1		,	0)ata	a 2		E	зсс	CF	2
	Erro	or (E	ERR	OR	1 si	igna	ul = (ON)																
	%	Ρ	R	Ρ	!	Er	ror	cod	le (3	-diç	git)	В	CC	; (CR									
Example:	Rea	ds	out	the	max	kimi	um :	and	min	imu	ım ۱	alu	es	of s	lice	leve	el gro	up	"A'	' .				
	Send	d																						
	%	Ρ	R	Ρ		в	L	v	:	Ρ	Α	I	R	Α	в	CC	CR							
	Rece	eive																						
	%	Ρ	R	Ρ	\$	В	L	v	:	Ρ	Α	I	R	Α	=	8	0		,	2	5	5	всс	CR
															Ī	Mir	imun	า		Мах	kimu	ım		

Error codes for Read Out command

200 Operation is stopped.

- 251 Specification of the parameter is wrong. (Undefined parameter is specified.)
- **252** The specified parameter does not exist. (e.g. You tried to read out the setting value of an uncreated checker.)

Write Command

This is a command that changes the setting value of PV500. Writing is available only when being in RUN mode and displaying RUN menu. For the information of writable data, refer to the next page.

hen writing or	na af i	ιαια		ICII	a5 .	Sy	Sten	IRe	yısı	ler, i	Пах	linu											
lue, or minim)																				
Send	%	Ρ	w		Ρ	Par	ame	ter	=			Da	ta		E	всс	;	CR					
Receive	%	Ρ	w	\$	Ρ	ar	ame	ter	E	всс	C	R											
	Erre	or (E	ERR	OR	1 s	sigr	nal =	ON)														
	%	Ρ	W	!	E	rro	r co	de (3-di	git)	E	зсс	. (CR									
Example:	Writ	es t	he v	/alu	e "3	3.14	4" in	Sys	tem	Reg	giste	er 0.											
	Ser	d			%	Ρ	W		S	Y	S	:	R	Ε	G	0	=	3		1	4	BCC	; C
	Rec	eiv	е	ſ	%	Ρ	w	\$	S	Y	S	:	R	Е	G	0	B	сс	С	R			
hen writing tw		data	ı (sı	ıch	as	ma	axim	um	valı	le a	nd												
hen writing tw inimum value		data	ı (sı	ıch	as	ma	axim	um	valı	ue a	nd												
		data P	ı (sı W	ıch P	as		axim Para			Je a	nd	Di	ata	1		,		Dat	a 2			BCC	CR
inimum value)		•		as \$			met	ter	=	nd	-	ata R	1		3		Data	a 2			BCC	CR
inimum value) Send) %	P P	w	P P	\$		Para	imet	ter ter	=		-		1		,		Data	a 2			BCC	CR
inimum value) Send) %	P P	w	P P	\$	sigr	Para Para	imet imet ON	ter ter	= B	scc	C			CR	3		Dat	a 2			BCC	CR
inimum value) Send) % Erre %	P P Dr (E P es a	W W ERR W	P P OR P	\$ 1 s !	sigr E	Para Para nal = Erroi alue	imet imet ON	ter ter) de (3	= B 3-di	BCC git)	E	R	; (CR	<u> </u>	0" i			rica		BCC	
inimum value Send Receive) % Erre % Writ	P P or (E P es a 10. 0	W ERR W A ma CAC	P P OR P axim Cnni for	\$ 1 s ! num n:LF cha	sigr E N Va	Para Para nal = Erroi alue R	ON ON of "1	ter) de (3	= B 3-dig and	sCC git)	C	R BCC	; (n va	CR lue d	of "5	-	n Nu	ime		Il Ca		on
inimum value Send Receive) % Erre % Writ No. Par	P P or (E P es a 10. (ame Cnr	W ERR W A ma CAC	P P OR P axim Cnni for	\$ 1 s ! num n:LF cha	sigr E N Va	Para Para nal = Erroi alue R	ON ON of "1	ter) de (3	= B 3-dig and	sCC git)	C	R BCC	; (n va	CR lue d	of "5	-	n Nu	ime		Il Ca	alculatio	on
inimum value Send Receive) % Erre % Writ No. Par "CA	P P or (E P es a 10. (ame Cnr	W ERR W A ma CAC	P P OR P axim Cnni for	\$ 1 s ! num n:LF cha	sigr E PAI ang	Para Para nal = Erroi alue R ging	Imen ON coor of "1	ter) de (3	= B 3-dig and	sCC git)	C	R BCC mun min	; (n va	CR lue d	of "5	-	n Nu	ime		Il Ca	alculatio	on
inimum value Send Receive) % Erre % Writ No. Par "CA Ser	P P or (E P ess a 10. (anne Cnr	W W ERR W a ma CAC CAC	P P COR P Aaxin for PA	\$ 1 s ! num n:LF cha IR"	sigr E PAI ang	Para Para nal = Erroi alue R ging	Imen ON coor of "1	ter) de (3 00"	= B 3-dių and	sCC git) I a n m a	E ninin and r	R BCC nun min	n va	CR lue c m va	of "5 alue	s in	n Nu i Nui 2	mei		Il Ca	alculatio	on

Minimum Maximum

CR

Error codes for Write command

200 Operation is stopped.

Receive

W P \$ C A C 0 1 0

- 251 Although PV500 is operating (RUN), displaying SETUP menu cannot write.
- 251 Specification of the parameter is wrong. (Undefined parameter is specified.)
- The specified parameter does not exist. (e.g. The number of uncreated checker is specified as a parameter.)
 - The specified parameter value is out of the settable range. (e.g. Maximum value of slice level is being set to over 256.)
 - The specified values led to the status of "Maximum value < Minimum value" when entering them.
 - (When specifying the moving distance of marker)
 A part of the circumscribing rectangle of the marker (the intersection point when Shape is Cross line) after move was out of the nine screens where checker area is settable.

BCC

Details of Read out/write Command Parameter

Note

When writing maximum and minimum values in sets using %PWP command, specify maximum values in Data 1 and minimum values in Data 2. When reading two data in sets using %PRP command, the data is output in the same order.

System values

	Parameter	Read	Write	Minimum value	Maximum value	Details
Inspection time	SYS_TIME1	Yes		0.00	99999.00	
Inspection Cycle	SYS_TIME2	Yes		0.00	99999.00	
Total Judgement	SYS_RESULT	Yes		0	1	0:NG 1: OK
Scan Count	SYS_COUNT	Yes		0	2147483647	
Window Status	SYS_EDIT	Yes		0	1	0: RUN menu, 1: SETUP menu
Operation Status	SYS_RUN	Yes		0	1	0: RUN, 1: STOP
Current Type No.	SYS_TYPE	Yes		0	255	
Date	SYS_DATE	Yes	Yes			YYYY/MM/DD (4-digit of year/ 2-digit of Month/ 2-digit of Day)
Time	SYS_TIME	Yes	Yes			HH:MM:SS (2-digit of Hour: 2-dgit of Minute: 2-digit of Second)
System Register 0 to System Register 7	SYS:REG0	Yes	Yes	-99999999.999	9999999.999	Up to 3-digit is available after decimal point.

Slice Level

The symbol of "?" shown in parameters is a slice level group (A - Z)

	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.

Checker

The symbol of "nnn" shown in parameters is a checker number (000 - 999).

Line	Parameter	Read	Write	Minimum value	Maximum value	Details
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	Data 1 = Min. Data 2 = Max.
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	Data 1 = Min. Data 2 = Max.
Binary Window	Parameter	Read	Write	Minimum value	Maximum value	Details
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	Data 1 = Min. Data 2 = Max.

Gray Window	Parameter	Read	Write	Minimum value	Maximum value	Details
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	Data 1 = Min. Data 2 = Max.
Binary Edge	Parameter	Read	Write	Minimum value	Maximum value	Details
OK Judge. Max.	BECnnn:MAX	Yes	Yes	0	256	
OK Judge. Min.	BECnnn:MIN	Yes	Yes	0	256	
OK Judge. Max and Min.	BECnnn:LPAIR	Yes	Yes	0	256	Data 1 = Min. Data 2 = Max.
Gray Edge	Parameter	Read	Write	Minimum value	Maximum value	Details
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	Data 1 = Min. Data 2 = Max.
Feature Extraction	Parameter	Read	Write	Minimum value	Maximum value	Details
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	Data 1 = Min. Data 2 = Max.
Smart Matching	Parameter	Read	Write	Minimum value	Maximum value	Details
Search Count 1st step	SMCnnn:CNT.1	Yes	Yes	1	256	
Search Count 2nd step	SMCnnn:CNT.2	Yes	Yes	1	256	
Search Count 3rd step	SMCnnn:CNT.3	Yes	Yes	1	256	
Search Count 4th step	SMCnnn:CNT.4	Yes	Yes	1	256	
Search Count 5th step	SMCnnn:CNT.5	Yes	Yes	1	256	
Search Count 6th step	SMCnnn:CNT.6	Yes	Yes	1	256	
Max. OK No. of Subtracted Objects	SMCnnn:DCNTMAX	Yes	Yes	0	128	
Flaw Detection	Parameter	Read	Write	Minimum value	Maximum value	Details
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	Data 1 = Min. Data 2 = Max.

Connector (Binary Window)	Parameter	Read	Write	Minimum value	Maximum value	Details	
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	Data 1 = Data 2 =	
Individual Judge. Max. *1)	CBWnnn:MAX.ss	Yes	Yes	0	62500		
Individual Judge. Min. *1)	CBWnnn:MIN.ss	Yes	Yes	0	62500		
Individual Judge. Max. and Min. *1)	CBWnnn:LPAIR.ss	Yes	Yes	0	62500	Data 1 = Data 2 =	
Connector (Gray Window)	Parameter	Read	Write	Minimum value	Maximum value	Details	
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	Data 1 = Data 2 =	
Individual Judge. Max. *1)	CGWnnn:MAX.ss	Yes	Yes	0	255		
Individual Judge. Min. *1)	CGWnnn:MIN.ss	Yes	Yes	0	255		
Individual Judge. Max. and Min. *1)	CGWnnn:LPAIR.ss	Yes	Yes	0	255	Data 1 = Data 2 =	Max.
Connector (Gray Edge)	Parameter	Read	Write	Minimum value	Maximum value	Deta	ils
Max. Judge. Pitch	CGEnnn:PMAX	Yes	Yes	0	999999999.9		
Min. Judge. Pitch	CGEnnn:PMIN	Yes	Yes	0	999999999.9		
Max. and Min. Judgement Pitch	CGEnnn:PPAIR	Yes	Yes	0	999999999.9	Data	1 = Min. 2 = Max.
Max. Distance Difference Judgement	CGEnnn:UMAX	Yes	Yes	0	999999999.9		
Min. Distance Difference Judgement	CGEnnn:UMIN	Yes	Yes	0	999999999.9		
Max. and Min. Distance Difference Judgement	CGEnnn:UPAIR	Yes	Yes	0	999999999.9		1 = Min. 2 = Max.
Smart Edge (Circle)	Parameter	Read	Write	Minimum value	Maximum value	Deta	ils
Max. Measurement *2)	SECnnn:LMAX	Yes	Yes	0	999999999.9	99	
Min. Measurement *2)	SECnnn:LMIN	Yes	Yes	0	999999999.9		
Max. and Min. Measurement *2)	SECnnn:LPAIR	Yes	Yes	0	999999999.9		1 = Min. 2 = Max.
Max. Standard Deviation	SECnnn:SMAX	Yes	Yes	0	999999999.9	99	
Min. Standard Deviation	SECnnn:SMIN	Yes	Yes	0	999999999.9		
Max. and Min. Standard Deviation	SECnnn:SPAIR	Yes	Yes	0	999999999.9	Data	1 = Min. 2 = Max.
Max. Circularity	SECnnn:CMAX	Yes	Yes	0	999999999.9	99	
Min. Circularity	SECnnn:CMIN	Yes	Yes	0	999999999.9		
Max. and Min. Circularity	SECnnn:CPAIR	Yes	Yes	0	999999999.9		1 = Min. 2 = Max.
Max. Unused Edge Count	SECnnn:NMAX	Yes	Yes	0	3597		

*1) "ss" in the parameters of Individual Judgement is cell numbers.

*2) "Measurement": Radius, Width or Diameter (Determined by the selection of "Detect Mode".)

Smart Edge (Line)	Parameter	Read	Write	Minimum value	Maximum value	Details
Max. Measurement *1)	SELnnn:LMAX	Yes	Yes	-999999999.999	999999999.999	
Min. Measurement *1)	SELnnn:LMIN	Yes	Yes	-99999999.999	99999999.999	
Max. and Min. Measurement *1)	SELnnn:LPAIR	Yes	Yes	-999999999.999	999999999.999	Data 1 = Min. Data 2 = Max.
Max. Standard Deviation	SELnnn:SMAX	Yes	Yes	0	999999999.999	
Min. Standard Deviation	SELnnn:SMIN	Yes	Yes	0	999999999.999	
Max. and Min. Standard Deviation	SELnnn:SPAIR	Yes	Yes	0	999999999.999	Data 1 = Min. Data 2 = Max.
Max. Linearity	SELnnn:LIMAX	Yes	Yes	0	99999999.999	
Min. Linearity	SELnnn:LIMIN	Yes	Yes	0	99999999.999	
Max. and Min. Linearity	SELnnn:LIPAIR	Yes	Yes	0	999999999.999	Data 1 = Min. Data 2 = Max.
Max. Unused Edge Count	SELnnn:NMAX	Yes	Yes	0	2998	

*1) "Measurement": Deviation, Distance or Width (Determined by the selection of "Detect Mode".)

Geometry Calculation

···· , ····						
Geometry Calculation	Parameter	Read	Write	Minimum value	Maximum value	Details
Max. X Coord. (IP X, Center X)	GGCnnn:XMAX	Yes	Yes	-999999999.999	999999999.999	
Min. X Coord. (IP X, Center X)	GGCnnn:XMIN	Yes	Yes	-999999999.999	999999999.999	
Max. and Min. X Coord.(IP X, Center X)	GGCnnn:XPAIR	Yes	Yes	-999999999.999	999999999.999	Data 1 = Min. Data 2 = Max.
Max. Y Coord. (IP Y, Center Y)	GGCnnn:YMAX	Yes	Yes	-999999999.999	999999999.999	
Min. Y Coord. (IP Y, Center Y)	GGCnnn:YMIN	Yes	Yes	-999999999.999	999999999.999	
Max. and Min. Y Coord.(IP Y, Center Y)	GGCnnn:YPAIR	Yes	Yes	-999999999.999	999999999.999	Data 1 = Min. Data 2 = Max.
Max. Standard Deviation	GGCnnn:SMAX	Yes	Yes	0	999999999.999	
Min. Standard Deviation	GGCnnn:SMIN	Yes	Yes	0	999999999.999	
Max. and Min. Standard Deviation	GGCnnn:SPAIR	Yes	Yes	0	999999999.999	Data 1 = Min. Data 2 = Max
Max. Angle (Line Angle, Pedal Angle, Major Axis Angle)	GGCnnn:AMAX	Yes	Yes	-999999999.999	999999999.999	
Min. Angle (Line Angle, Pedal Angle, Major Axis Angle)	GGCnnn:AMIN	Yes	Yes	-999999999.999	999999999.999	
Max. and Min. Angle (Line Angle, Pedal Angle, Major Axis Angle)	GGCnnn:APAIR	Yes	Yes	-999999999.999	999999999.999	Data 1 = Min. Data 2 = Max
Max. Distance	GGCnnn:DMAX	Yes	Yes	0	99999999.999	
Min. Distance	GGCnnn:DMIN	Yes	Yes	0	999999999.999	
Max. and Min. Distance	GGCnnn:DPAIR	Yes	Yes	0	999999999.999	Data 1 = Min. Data 2 = Max.
Max. Intersecting Angle	GGCnnn:CAMAX	Yes	Yes	0	360.000	
Min. Intersecting Angle	GGCnnn:CAMIN	Yes	Yes	0	360.000	
Max. and Min. Intersecting Angle	GGCnnn:CAPAIR	Yes	Yes	0	360.000	Data 1 = Min. Data 2 = Max.

Geometry Calculation	Parameter	Read	Write	Minimum value	Maximum value	Details
Max. Radius	GGCnnn:RMAX	Yes	Yes	0	99999999.999	
Min. Radius	GGCnnn:RMIN	Yes	Yes	0	99999999.999	
Max. and Min. Radius	GGCnnn:RPAIR	Yes	Yes	0	999999999.999	Data 1 = Min. Data 2 = Max.
Max. Major Axis	GGCnnn:LAMAX	Yes	Yes	0	99999999.999	
Min. Major Axis	GGCnnn:LAMIN	Yes	Yes	0	99999999.999	
Max. and Min. Major Axis	GGCnnn:LAPAIR	Yes	Yes	0	999999999.999	Data 1 = Min. Data 2 = Max.
Max. Minor Axis	GGCnnn:SAMAX	Yes	Yes	0	99999999.999	
Min. Minor Axis	GGCnnn:SAMIN	Yes	Yes	0	99999999.999	
Max. and Min. Minor Axis	GGCnnn:SAPAIR	Yes	Yes	0	999999999.999	Data 1 = Min. Data 2 = Max.

Slice Level

The symbol of "?" shown in parameters is a slice level group (A - Z)

	Parameter	Read	Write	Minimum value	Maximum value	Details
Max. Slice Level	BLV:H?	Yes	Yes	0	255	
Min. Slice Level	BLV:L?	Yes	Yes	0	255	
Max. and Min. Slice Level	BLV:PAIR?	Yes	Yes	0	255	Data 1 = Min. Data 2 = Max.

Numerical calculation

The symbol of "nnn" shown in parameters is a numerical calculation number (000 - 999).

	Parameter	Read	Write	Minimum value	Maximum value	Details
Max. Judgement	CACnnn:MAX	Yes	Yes	-2147483648	2147483647	
Min. Judgement	CACnnn:MIN	Yes	Yes	-2147483648	2147483647	
Judge. Max. and Min.	CACnnn:LPAIR	Yes	Yes	-2147483648	2147483647	Data 1 = Min. Data 2 = Max.

Marker

As the marker position should be read/write with a set of X and Y coordinates, use "%PRP" command or "%PWP" command.

Coordinate values to be read is in units of 0.5 pixels, and the moving distance to be written is in pixel. It is not possible to read or write with the values after calibration.

"c" of "MRKcg" in the parameters is camera numbers (0-3), and "g" is marker numbers (0-7).									
	Parameter	Read	Write	Minimu	Maximu	Details			
				m value	m value				
Central Coordinate	MRKcg_CXY	Yes		-1600	3199	Data 1 = X coordi. *1)			
(Read))				-1200	2399	Data 2 = Y coordi. *1)			
Central Coordinate	MRKcg:MOV		Yes	-4799	4799	Data 1 = Distance X *2)			
Moving Distance (Write)	E			-3599	3599	Data 2 = Distance Y *2)			

*1) The number of digits of the coordinate values of response to the read command is as below.

• Positive value: Max. 6 digits (Integar portion: Max. 4 digits, Decimal point: 1 digit, Decimal portion: 1 digit)

Example											
4	2	8		0							
	4	2	8		0						

Negative value: Max. 7 digits (Sign: 1 digit, Integar portion: Max. 4 digits, Decimal point: 1 digit, Decimal portion: 1 digit)

*2) Specify values with the following number of digits to write the moving distance. Example

- Positive value: Max. 4 digits (Integar portion: Max. 4 digits)
- Negative value: Max. 5 digits (Sign: 1 digit, Integar portion: Max. 4 digits)

—	4	2	8	-	0

0 1

> 1 2 0 0

390

9.3 PLC Communication

9.3.1 Overview and Communication Specifications

PLC Communication is a mode that performs communication between PV and a specific PLC via a RS232C or Ethernet interface with an exclusive protocol. The following communications are available.

Data Output

PV500 writes the inspection results and data to the specified register of PLC as the beginning. The PLC does not need a communication program to receive data.

Switching Product Types

When switching product types, at the timing of TYPE signal input, PV500 refers to the value that has been stored in a specified register of PLC and switches the product type to the reference number.

When inputting a TYPE signal to switch the type, you can select the value in a register of PLC or the value specified by the parallel I/O input.

Note

All the commands described in Chapter 9.2 can be also accepted when selecting PLC Communication.

Usable PLCs for PLC Communication

The following list shows the PLC models available for PLC communication via a RS232C or Ethernet interface.

Manufacturer	Model (series) name	RS232C	Ethernet
Panasonic Electric Works Co.,	FP series	Available *1)	Available *2)
Ltd.	FP2 ET-LAN unit		Available
Mitsubishi Electric Corporation (MELSEC)	A series	Available	
	Q series	Available	Available *3)
	FX series (FX1N)	Available	
	FX-2N series (FX2N, FX3U, FX3UC)	Available	
OMRON Corporation	C series, CV series, CS1 series	Available	
Allen-Bradley	SLC500	Available	
Fuji Electric FA Components & Systems Co., Ltd.	MICREX-SX SPH series	Available	

*1) TOOL port, COM port, FP2-MCU (RS232C communication block), FP2-CCU

*2) Applicable unit: FP-X COM5 communication cassette, FP Web Server 2 unit

*3) Applicable unit: QJ71E71-100 (PLC communication with a PLC unit with a built-in Ethernet port is not possible.)

Note

- When Baud Rate is "115200 bps", the communication via RS232C interface may not be carried out stably in accordance with PLC to communicate with. In the case, set Baud Rate to "57600 bps" or lower.
- PLC communication via Ethernet interface is performed with UDP/IP.

Specifications of PLCs

Note

In accordance with specification of PLCs, some of the registers in "Usable range" of "Usable device" listed below could not be used. Please confirm the specifications of PLC before use.

FP series / FP series (ET-LAN unit) by Panasonic Electric Works Co., Ltd.

Protocol: MEWTOCOL

Usable device	Data output/ Type switch		DT	
	Data output completion notice Register*		WR	(Usable Range: 0 to 999)
		Bit	0-15 ((0-F)

• Sum check: Yes (type: BCC)

Q series / Q series Ethernet unit by Mitsubishi Electric

- Corporation
 - Protocol:

Usable device

- RS232C interface: "Format 4", 4C frame compatible for QnA
- Ethernet interface: 3E frame compatible for QnA
- However, communication is only available with Ethernet unit QJ71E71-100.

Data output/ Type switch		D	
Data output completion notice	Register*	М	(Usable Range: 0 to 99999)
	Bit	Inva	lid

- Make the following setting with PLC.
 - When using RS-232C Interface
 - Sum check: Yes (type: BCC)
 Write at RUN time: "Enable"
 - When using Ethernet interface
 - Communication data code: Binary code communication
 - Initial timing setting: Always wait for OPEN
 - Send frame setting: Ethernet(V2.0)
 - Write at RUN time: "Enable"

A series by Mitsubishi Electric Corporation

Protocol: "Format 4", 1C frame compatible for A

•	Usable device	Data output/ Type switch		D
		Data output completion notice	Register*	M (Usable Range: 0 to 999)
			Bit	Invalid

- Make the following setting with PLC.
 - Sum check: Yes (type: BCC)
 - Modification in RUN mode: Available

FX series by Mitsubishi Electric Corporation

- CPU: FX1N, Communication adapter: FX1N-232-BD
- Protocol: Special protocol for FX1N Register for specifying communication format: Store "0" in D8120. (Reboot the PLC after the setting.)
 Usable device
 Data output/ Type switch Data output/ completion notice
 Register*
 M
 (Usable Range: 0 to 9999)

Data output completion notice Register* M (Usable Range: 0 to 9999) Bit Invalid

Sum check: Yes

With PLC, you cannot select to perform sum check. Automatically "Yes" is selected.

FX-2N series by Mitsubishi Electric Corporation

- CPU: FX2N, FX3U, FX3UC Communication adapter: FX2N-232-BD, FX3U-232-BD, FX3U-232-ADP
- Protocol: Special protocol for FX2N Register for specifying communication format: Store "0" in D8120. (Reboot the PLC after the setting.)

• (Jsable device			
	Data output/ Type switch		D	
	Data output completion notice	Register*	Μ	(Usable Range: 0 to 9999)
		Bit	Invalid	

 Sum check: Yes With PLC, you cannot select to perform sum check. Automatically "Yes" is selected.

C, CV, and CS1 series by OMRON Corporation

- Protocol: Host link
- Usable device

•				
	Data output/ Type switch		D / DM	
	Data output completion notice	Register*	CIO / IR	(Usable Range: 0 to 999)
		Bit	0-15 (0-F)	

- Make the following setting with PLC.
 - Sum check: Yes
 - Station No.: "0"
- Communication is not available when PLC is in "Run" mode. Change to "Monitor" mode to communicate.

SLC series by Allen-Bradley

Usable device

Data output/ Type switch		N7 (Only ii	nteger registers)
Data output completion notice	Register*	N7	(Usable Range: 0 to 254, only integer registers)
	Bit	0-15 (0-F)	· ·

- Make the following setting with PLC.
 - Duplicate Detect: OFF
 - ACK Timeout (*20 ms): 20
 - Control Line: NO HANDSHAKING
 - Error Detect: CRC
 - NAK Retries: 3
 - ENQ Retries: 0
 - Embedded Responses: AUTO DETECT

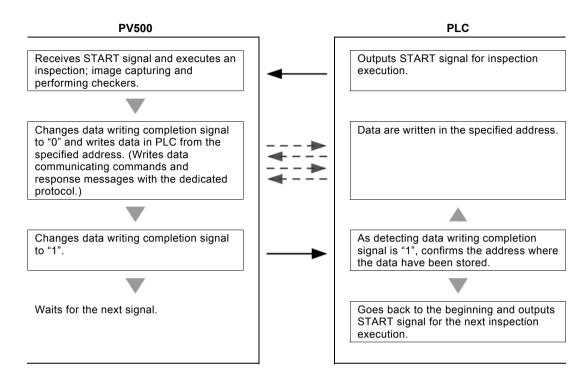
MICREX-SX (SPH series) by Fuji Electric FA Components & Systems Co., Ltd.

Usable device

Data output/ Type switch		%MW3	
Data output completion notice	Register*	%MW3	(Usable Range: 0 to 15360)
	Bit	0-15 (0-F)	

• Sum check: Yes (type: BCC, the calculation method developed by Fuji is used.)

Data Output Flaw



About Data that can be Output

When PV500 executes inspection, the data set to output are output in the following order.

- 1. Scan Count
- 2. Total Judgement
- 3. Judgement result:
- 4. Numerical Calculation:

Up to 1000 points combining judgements and numerical calculations.

In the following cases, the data of Judgement and Numeric Calculation are not output to PLC.

- PV sets data to output, but no data exist.
 - The setting data exist, but data are set to not to be output.

Output format of Scan count:

Output Data	Differs depending on the setting of Output bit width.			
	 Range (16 bits) between 0 and 32767 			
	 Range (32 bits) between 0 and 2147483647 			
Number of Data	1			
Values to be Output	Normal	0 to 2147483647		
	Overflow (when exceeding the specified "Bit Width")	0		

Output format of Judgement data:

Output Data	A Judgement is output in 4-bit (digit) unit Four data of Judgement per word from PLC are saved starting with LSB. When the outputting data is other than multiples of four, hexadecimal E is			
Number of Data		output. Up to 1000		
Number of Data				
Values to be Output	ОК	1 in hexadecimal form (0001 in binary form)		
	NG	0 in hexadecimal form (0000 in binary form)		
	Error	E in hexadecimal form (1110 in binary form)		
	Unset	Data are not output. (But if the Judgement data No.s before and after the unset data No. are set to output, E is output in 16-digit form (1110 in binary form).)		

Output format of Total Judgement:

Output Data	Regardle	Regardless of output bit width, it is output in the last bit using one word.	
Number of Data	1		
Values to be Output	OK	1 in hexadecimal form (0001 in binary form)	
	NG	NG 0 in hexadecimal form (0000 in binary form)	
	Error	E in hexadecimal form (1110 in binary form)	
	Unset	E in hexadecimal form (1110 in binary form)	

Output format of Scan Count and Numerical Calculation:

The values that can be output are only integers. Actual values with value after decimal point are rounded to whole number and output.

Output Data	Differs depending on the setting of Output bit width.			
	 Range of 16-bit: -32768 to 32767 			
	 Range of 32-bit: -2147483648 to 2147483647 			
Number of Data	Numerical Calculation: Up to 1000			
Values to be Output	Normal	Calculation results: -2147483648 to +2147483647		
	Overflow (when exceeding the specified "Bit Width")	0 (including the overflowing numeric calculations and the results)		
	Error	0		
	Unset	Data are not output.		

Example of Output

Output Condition - Output Data:

- Scan count: 1234 times
- Total Judgement: OK
- Judgement: JDC000=OK, JDC001=unset, JDC002=NG, JDC003 or later=Unset
- Numerical Calculation: CAC000=215.3, CAC001=unset, CAC002=-2184.0, CAC003 or later=Unset

Data	Register No.	Value (Hex.)	Description	Details
Scan Count	500	04D2	"1234" is stored.	Scan Count
			Bit 15 Bit 0	
Total Judgement	501	0001	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1	ок
Judgement	502	E01E	1 1 1 0 0 0 0 0 0 0 1 1 1 1 0	JDC000 - 002
Numerical	503	00D7	"215" is stored.	CAC000
calculation	504	F778	"-2184" is stored.	CAC002

Output Result: Output Data = 16 bit, the top of Output Registers = 500

Concept:

- The number of scans is stored in the start register.
 When specifying "32-bit" for "Bit Width", the number of scans is stored.
- Four Judgment data are stored per word. Data is output up to Judgement specified with the largest number. For unset judgement data within the range, "E" is output such as JDC000. Also, when the number of output data is "3" which is not multiples of 4 like this example, "E" is stored in each part which cannot make a word.
- Four Judgement data are stored per word.
 For unset judgement data, "E" is output when the data before and after are set such as JDC001.
 Also, as the number of output data is "3" which cannot make a word, "E" is stored in each of the upper four bits.
- Only the data of Numeric Calculation that are set to output are output. (In the case where the data of CAC000 or CAC002 is out of the range between -32768 and +32767, "0" is stored in the registers No.503 and 504.)
- Negative numbers are output in the complement number of 2.
- When specifying "32-bit" for "Output data";
- Four Judgement data are stored per word as the same as when you select "16-bit".
- Each data of Scan Count and Numerical Calculation uses two words (32-bit). In the case, the data is output from of lower 16-bit to upper 16-bit, and data of lower word (16-bit) is stored in the register of smaller number.

Setting PLC Communication

Make setting to output data in PLC Communication.

When using RS-232C Interface

Refer to

For the information of how to set Baud Rate and transmission format, refer to page 318.

- Select "ENVIRONMENT" > "Input/Output" > "General Output" from the menu bar.
- 2. Select "Serial (COM.0)" for "Destination".
- 3. Set "Protocol" to "PLC Communication".
- Set "Scan Count", "Total Judgement", "Judgement", and "Numerical Calculation" to "Output" as necessary.
- 5. Select a destination in "PLC Type".
- 6. Press "Set" button of "PLC Communication Setting".

The PLC communication setting menu is displayed.

OPERATION ENVIRONMENT T	PE INSPECTION	SAVE/READ	TOOL		SETUP MENU
System Settings Inp	ut/Output	Camer	a	Color	Passwor
Parallel 1/0 Parallel 1/0 Output Serial General Output Inage Output Save Inaze Menory Print Screen	BCC No. of Dig Decimal Di Unused Dig PLC Type PV Sta	 ement Calculation its git	P N. N. N. N. D. D. D. D. D. D. D. D. D. D. D. D. D.	o	ation •

PLC Туре	Panasonic: FP
Specify Station No.	Station Home
Station No.	1
Start Register	00000
Bit Width (bit)	16 🗳
Timeout (ms)	5000
Data Output Completion Notice	No 👱
Output Register	0
Output Bit	0
Type Switching Signal	PLC Communication 🕙
Type No. Register	0

7. Only when selecting "Panasonic: FP" for PLC Type, set "Specify Station No.".

Station Home (Default):

A command which specifies no station number is issued. Example) %EE#WDD0001 · · · · ·

Specify Station No. (Station No.: 1 - 99):

A command for a PLC with the specified station number is issued. Specify the same number of the station number that is set for the PLC to communicate in "Station No.". Example) When Station No. is 99 %99#WDD0001 · · · · ·

8. In "Start Register", specify the first register number of the PLC that PV500 outputs data into.

0 to 99999 are available.

Note

Not all addresses 0 to 99999 can be used in destination PLC. As the address allowed to be written by the external device (PV500) varies depending on PLC, please make sure the address with the instruction manual of PLC.

9. Select 16-bit or 32-bit to output Scan count and Numerical calculation data in "Bit Width".

When output data exceeds the value which can be output in the selected Bit Width, "0" is output.

10. Set time for "Timeout".

20 - 20000 ms (default: 5000)

Note

When PV500 writes data in the specified address of PLC, it sends and receives commands and response messages in the dedicated protocol between PV500 and PLC. The value set here is Timeout in the message communication in this case.

If PLC sends no response in the time of Timeout, a Timeout error occurs.

11. To notice to PLC that data output is complete, set "Data Output Completion Notice" to "Yes".

Specify an address to make the specified bit to "1" and the bit.

Output register: 0 - 99999:	Be sure not to use the same register of the register for writing data.
Output bit: 0 - 15:	Specifying "15" makes the highest order bit "1".

Note

For Mitsubishi PLC, enter interface No. to output register. (Output bit is invalid.)

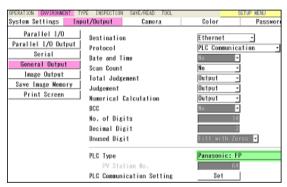
When using Ethernet interface

Refer to

Refer to page 326 for details of network settings.

1. Select "ENVIRONMENT" -> "Input/Output" -> "General Output" from the menu bar.

- 2. Select "Ethernet" for "Destination".
- 3. Set "Protocol" to "PLC Communication".
- Set "Scan Count", "Total Judgement", "Judgement", and "Numerical Calculation" to "Output" as necessary.



5. Select a destination in "PLC Type".

6. Specify the network setting of the selected "PLC Type".

The network setting consists as listed below.

- PV Station No.
- IP Address
- Port No.
- Specify Station No.
- Station No.

Note

Items to be specified vary depending on the selected PLC type. For the detail, refer to the network setting for each PLC type in the next section.

PLC Type Panasonic: FP IP Address 192 168 1 10 9094 Port No. Specify Station No. Station Home Station No. 00000 Start Register Bit Width (bit) 16 5000 Timeout (ms) Data Output Completion Notice Output Register Output Bit 0 Type Switching Signal Parallel I/O Type No. Register

7. Make settings items after "Start Register".

Refer to "When using RS232C interface" (p.397) for details.

When PLC Type is Panasonic: FP

- After selecting the PLC type, press "Set" button of "PLC Communication Setting". The setting window for Panasonic FP series is displayed.
- 2. Assign the IP address to the PLC.
- 3. Specify the port number of the PLC.

Input the same number as the port number set on the PLC to communicate. Available port No. on PV500: 1 to 32767 (except 8600 to 8699 and 9090) PLC Type Panasonic: FP PV Station No. 64 PLC Communication Setting Set

PLC Type	Panasonic: FP
IP Address	192 168 1 10
Port No.	9094
Specify Station No.	Specify Station No. 🕒
Station No.	01

4. Select whether to limit the PLC to communicate by setting "Specify Station No." or not.

Station Home (Default):

A command which specifies no station number is issued. Example) %EE#WDD0001 · · · · ·

Specify Station No. (Station No. 1 - 99)

A command for a PLC with the specified station number is issued. Specify the same number of the station number that is set for the PLC to communicate in "Station No.". Example) When Station No. is 50 %50#WDD0001 · · · · ·

When PLC Type is Panasonic: FP (ET-LAN unit)

- After selecting the PLC type, specify the PV station No. in "PV Station No.".
 Selectable station No.: 1 – 64
- 2. Press "Set" button of "PLC Communication Setting".

The setting window for Panasonic FP series (ET-LAN unit) is displayed.

3. Assign the IP address to the PLC.

4. Specify the port number of the PLC.

Input the same number as the port number set on the PLC to communicate. Available port No. on PV500: 1 to 32767 (except 8600 to 8699 and 9090)

5. Specify the station number of the PLC.

Settable Range: 1 - 64

Specify the station number of the PLC to communicate. The number specified in the step 1 "PV Station No." cannot be used.

PLC Type	Panasonic: FP(ET-LAN unit)
PV Station No.	64
PLC Communication Setting	Set

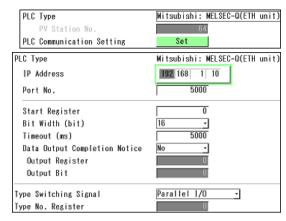
PLC Type	Panasonic: FP(ET-LAN unit)
IP Address	192 168 1 10
Port No.	9094
Station No.	1

When PLC Type is Mitsubishi: MELSEC-Q (Ethernet unit)

Set to communicate with Ethernet unit QJ71E71-100.

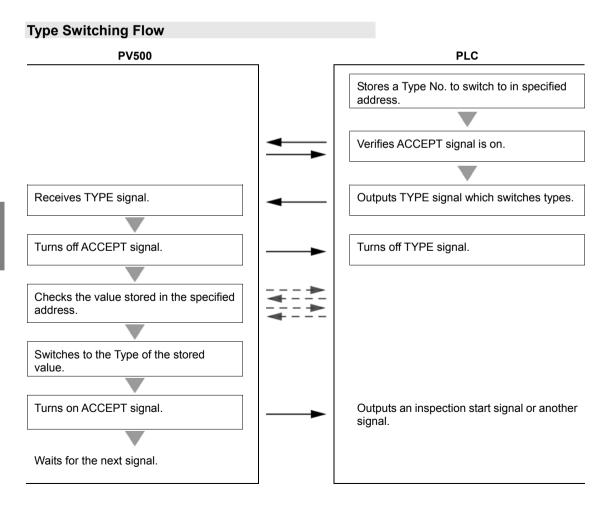
- After selecting the PLC type, press "Set" button of "PLC Communication Setting". The setting window is displayed.
- 2. Assign the IP address to the PLC.
- **3.** Specify the port number of the PLC.

Default: 5000 Input the same number as the port number set on the PLC to communicate. Available port No. on PV500: 1 to 65534 (except 8600 to 8699 and 9090)



9.3.3 Switching Types by PLC Communication

When outputting data through PLC communication, you can switch product types by using the protocol of PLC communication.



When Switching Types through PLC Communication

- Select "ENVIRONMENT" > "Input/Output" > "General Output" from the menu bar.
- 2. Set "Protocol" to "PLC Communication".
- **3.** Select a destination in "PLC Type", and select "PLC Communication Setting".
- **4.** Select "PLC Communication" for "Type Switching Signal".

Setting of "Parallel I/O" (default) switches to Type No. specified to IN0 - 7 of I/O terminals when inputting Type signal. PLC Type Mitsubishi: MELSEC-Q IP Address 192 168 1 10 5000 Port No. 0 Start Register Bit Width (bit) 16 • 5000 Timeout (ms) Data Output Completion Notice No • Output Register Output Bit Type Switching Signal PLC Communication Type No. Register 0

5. Select a register to input a Type to switch in "Type No. Register".

0 to 99999 are available. Be sure not to use the same address for data output.

Chapter 10

PVWIN

10.1 About PVWIN

PVWIN is software of setting and simulation for PV series. Almost all items set in PV500 can be also set with PVWIN.

In PVWIN, the program can be simulated off-line with PV500. For this, you can adjust the set programs by simulating them to confirm they obtain the expected results on the images captured with a camera and saved in a PC.

For details of PVWIN, refer to the HELP file that can be available after installing the software into your PC.

Downloading PVWIN

To use PVWIN, download the file from our web site. Downloading the software requires registration of your information (for free), MAC address of PV500, and MAC address of your PC.

http://panasonic-denko.co.jp/ac/e

("Machine Vision" > "PV500" > "Software")

Hardware Requirements of PVWIN

PC	Compatible computer for IBM PC/AT
OS	Windows Vista®, Windows® XP *1
Hard Disc Capacity Requirement CPU	70 MB or more *(excluding storage for the setting data or images) Pentium III 700 MHz or more
Memory Amount	512 MB or more
Display resolution	1024 x 768 or more
Display color	High Color (32-bit) or more
Communication format	USB 2.0, Ethernet (1000BASE-T/100BASE-TX/10BASE-T)*2

(for PVWIN Ver.2.0)

*1: For 32-bit Edition only.

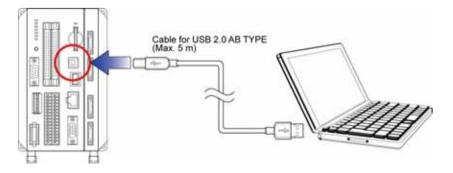
*2: Available only when the communicating PV500 is Ver.1.4 or later.

Connecting PV500 with PC

Connect PV500 and the PVWIN-installed PC with a USB cable or an Ethernet cable. About connection with an Ethernet cable, refer to page 368.

Connecting with USB Cable

Use a USB cable (for 2.0, AB type) of which length is 5m or less.



10.2 Communication

10.2.1 Upload and Download of Setting Data

In PVWIN, setting data is called Project File. Project files can be downloaded to PV500 (PVWIN to PV500) or uploaded from PV500 (PV500 to PVWIN).

Note

After downloading a project file from PVWIN to PV500, be sure to save the data in PV500. Turning off the power of PV500 without saving data removes the downloaded project file from the PV500.

When PV500 is in RUN menu

Operate uploading or downloading from PVWIN. (No need to operate from PV500.)

When executing upload, the currently inspecting data are uploaded.

When executing download, the data are overwritten on the currently inspecting data. After downloading is complete, inspections will be executed with the setting data of the downloaded project file.

When communication error occurs

When a communication error occurs, the notice is displayed on the screen of PVWIN or PVWIN and PV500. Execute again after solving the problem described on the message.

When PV500 is in SETUP menu

To upload or download the data in SETUP menu, PV500 requires being in the status where it can communicate with PC. Other than the status, you cannot upload and download the data.

When executing upload, the data currently loaded on SETUP menu are uploaded. When executing download, the data are overwritten on the data currently loaded on SETUP menu. Even when PV500 is RUN mode in SETUP menu, the data are overwritten on the data on the screen and the processing does not affect on the running data.

1. Select "TOOL" > "PC Communi." from the menu bar.

The PV500 becomes to be able to communicate with PC and the current communication status is displayed under the menu.

OPERATION	ENVIRONMENT	TYPE	INSPECTION	
PC Communi.		General		
Standby				

2. Execute communication from PVWIN.

The display changes to "Transmitting..." and a project file (setting data) is downloaded or uploaded. Pressing the CANCEL key during the communication stops the transmitting and the display changes to "Terminating..." and eventually to "Standby".

When communication error occurs

When the devices cannot communicate, the display shows "Communication Error". (When the next transmission is executed, the display changes to "Transmitting...")

When a communication error occurs, the notice is displayed on the screen of PVWIN or PVWIN and PV500. Execute again after solving the problem described on the message. The error occurring during download initializes (deletes all) the setting data loaded on PV500. And the error during upload initializes the contents of the project file being set on PVWIN.

3. After transmission is complete, press the CANCEL key to cancel the communication mode.

10.2.2 Reading the Latest Image of PV500

The latest image of PV500 can be read out on the camera window of PVWIN by a command from PVWIN. Regardless of the displayed menu (SETUP/RUN) and running status of PV500, reading the image can be executed.

When the image receiving software Image Receiver is running on the PC where PVWIN is running, you cannot read out the latest image.

1. Execute an inspection in RUN menu of PV500.

The inspected image can be read with PVWIN. When no inspection is executed, PVWIN cannot read because there is no image to read.

2. Execute image reading from PV500 with PVWIN.

The latest image of PV500 is read out.

Note

When "Detect Trigger (Common)" is used as Camera Trigger, the device reads the image of when detect trigger is executed. When no detect trigger is executed, image cannot be read because there is no image to read. (Although a memory image is displayed even when no detect trigger is executed, the memory image cannot be read.)

When communication error occurs

When a communication error occurs, the message is displayed on the screen of PVWIN or PVWIN and PV500. Execute again after solving the problem described on the message.

10.2.3 Uploading Images in Storage Space in PV500

This is the function that efficiently saves the images stored in the storage space in PV500 (Ver.1.40 or later) into a PC by a command from PVWIN (Ver.1.10 or later). To use this function, "PC Communi." menu of PV500 needs to be selected in SETUP menu.

Go to SETUP menu and select "TOOL" > "PC Communi." from the menu bar.

The PV500 becomes to be able to communicate with PC and the current communication status is displayed under the menu.



2. Execute communication from PVWIN.

Specifying the destination of images with PVWIN starts communication. The display of PV500 changes to "Transmitting..." Pressing the CANCEL key during the communication stops the transmitting and the display changes to "Terminating..." and eventually to "Standby".

When communication error occurs

When the devices cannot communicate, the display shows "Communication Error". (When the next transmission is executed, the display changes to "Transmitting...") When a communication error occurs, the notice is displayed on the screen of PVWIN or PVWIN and PV500. Execute again after solving the problem described on the message.

3. After transmission is completed, press the CANCEL key to cancel the communication mode.

About File Name

Images are saved in the specified folder as the following name.

"Cn_NNN.bmp" •	Cn_: C	amera No.	C0_	to C3_
----------------	--------	-----------	-----	--------

• NNN: Image No. 000 -

10.2.4 Downloading images into Test Image Memory of PV500

This is the function that downloads the images stored in a PC into the Test Image Memory of PV500 (Ver.1.40 or later) by a command from PVWIN (Ver.1.10 or later).

Other than the images uploaded from PV500, images that meet the following conditions can be downloaded.

- 256-color bitmap format
- Size of 4 MB or less
- Go to SETUP menu and select "TOOL" > "PC Communi." from the menu bar.

The PV500 becomes to be able to communicate with PC and the current communication status is displayed under the menu.

OPERATION	ENVIRONMENT	TYPE	INSPECTION
PC Communi.		Gen	eral
Standby			

2. Execute communication from PVWIN.

Specifying the destination of images with PVWIN starts communication. The display of PV500 changes to "Transmitting..." Pressing the CANCEL key during the communication stops the transmitting and the display changes to "Terminating..." and eventually to "Standby".

When communication error occurs

When the devices cannot communicate, the display shows "Communication Error". (When the next transmission is executed, the display changes to "Transmitting...") When a communication error occurs, the notice is displayed on the screen of PVWIN or PVWIN and PV500. Execute again after solving the problem described on the message.

3. After transmission is completed, press the CANCEL key to cancel the communication mode.

Chapter 11

Specifications and List of Product Numbers

11.1 General Specification

PV500

		2-Camera type	4-Camera type	
CPU		32-bit RISC CPU & DSP		
Number of camera connections		Up to 2	Up to 4	
Processing resolution		Hor. 640 x Ver. 480 pixels (Quad-s digital camera) Hor. 1600 x Ver. 1200 pixels (2-Me		
Processing function		Gray Scale: 8 bits, 256 gray scale memory) Partial imaging: Up to 2 areas can	e (Binary: 8 groups/product type and	
Interface Serial		RS-232C x 1		
	Parallel input	I/O terminal (Phoenix): Input 14 points, I/O connector (MIL connector type): Input 32 points. 24V DC, Bi-directional photo coupler		
	Parallel output	I/O terminal (Phoenix): Output 15 p I/O connector (MIL connector type) NPN output type (N at the end of th Photo coupler output PNP output type (P at the end of th Photo Mos output	: Output 32 points ne product number): 5 to 24 V DC,	
	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		1ch: XGA (1024 X 768) output		
	Setting	1 ch: For the dedicated keypad		
Rating	Voltage	24 V DC Operating voltage range	: 21.6 to 26.4 V DC (with ripples)	
	Power Consumption	1.5 A or less	2.0 A or less	
Environmental resistance	Operating temperature range	0 to +45 °C (without icing and dew condensation)	0 to +40 °C (without icing and dev condensation)	
	Operating humidity range	35 to 85% RH (without icing and de	ew condensation at 25°C)	
	Noise resistance	1000 V pulse width 50 ns/1 µs (a n	oise simulator was used.)	
	Vibration resistance	10 to 55 Hz, one sweep per minute each in X/Y/Z direction	, amplitude 0.75 mm, 30 minutes	
	Shock resistance	196m/ s^2 , 5 times each in X, Y and	Z directions	
	Insulation resistance (initial)	100 M Ω or more (500 V DC by insulation resistance tester)*1 Input terminals and output terminals - Power terminal and functional earth Input terminals and output terminals - Non-electrifiable metal part Power terminal - Non-electrifiable metal part		
	Voltage resistance (initial)	500 V AC / minute (600 V AC / sec Input terminals and output terminal earth Input terminals and output terminal Power terminal - Non-electrifiable r	s - Power terminal and functional s - Non-electrifiable metal part	
Battery life		Approx. 10 years (at 25°C)	netai part	
Weight		Approx. 1600 g		

*1) Tested with the varistor and the condenser at the primary side of the power supply for the internal circuit removed.

Keypad

Operation keys		ENTER key, TRIG(TRIGGER) key, FUNC(FUNCTION) key, CANCEL key, F1 key, F2 key, F3 key, OPE/SET switch, LOCK key, and SHIFT key
Environmental resistance	Operating humidity range	35 to 85% RH (without icing and dew condensation at 25°C)
	Operating temperature range	0 to + 45°C (without icing and dew condensation)
Weight		ANPVP03: 170g, ANPVP10: 425g

Quad-speed Digital Camera: ANPVC1040

Image sensor		Interline transfer method. 1/3-inch CCD, pixel size: 7.4 μm x 7.4 μm (tetragonal pixel)
Number of effect	tive pixels	Horizontal 659 x vertical 494 pixels
Scanning metho	bd	Non-interlace
Shutter Speed		0.03 to 1000.00 ms (30 μs to 1 s)
Lens mount		C mount
Synchronous M	ethod	Internal synchronous
Picture output		Digital output
•	Power supply voltage	12 V DC +/- 10%
	Power Consumption	235 mA or less
Environmental resistance	Operating ambient temperature	0 to +45°C (without icing and dew condensation)
	Operating ambient humidity	35 to 85% RH (without icing and dew condensation at 25°C)
	Vibration resistance	10 to 55 Hz, 1 sweep per minute, amplitude 1 mm, 30 minutes in each X, Y and Z directions
	Shock resistance	700 m/s ² , 3 times each in X, Y and Z direction
Weight		Approx. 65g (without lens)

2-Mega-pixel Digital Camera: ANPVC1210

Image sensor		Interline transfer method. 1/1.8-inch CCD, pixel size: 4.4 μm x 4.4 μ m $$ (tetragonal pixel)
Number of effect	ctive pixels	Horizontal 1628 x vertical 1236 pixels
Scanning metho	bd	Non-interlace
Shutter Speed		0.03 to 1000.00 ms (30 μs to 1 s)
Synchronous M	ethod	Internal synchronous
Picture output		Digital output
Lens mount		C mount
Rating	Power supply voltage	12 V DC +/- 10%
	Power Consumption	360 mA or less
Environmental resistance	Operating ambient temperature	0 to +40°C (without icing and dew condensation)
	Operating ambient humidity	35 to 85% RH (without icing and dew condensation at 25°C)
	Vibration resistance	10 to 55 Hz, 1 sweep per minute, amplitude 1 mm, 30 minutes in each X, Y and Z directions
	Shock resistance	700 m/s ² , 3 times each in X, Y and Z direction
Weight		Approx. 65 g (without lens)

Ultra Compact Digital Camera: ANPVC1021

Image sensor		Interline transfer method. 1/3-inch CCD, pixel size: 7.4 μm x 7.4 μm (tetragonal pixel)
Number of effect	tive pixels	Horizontal 659 x vertical 494 pixels
Scanning metho	bd	Non-interlace
Shutter Speed		0.03 to 1000.00 ms (30 μs to 1 s)
Synchronous M	ethod	Internal synchronous
Picture output		Digital output
Lens mount		Special mount
Rating Power supply voltage		12 V DC +/- 10%
	Power Consumption	250 mA or less
Environmental Operating ambient resistance temperature		0°C to +45°C (without icing and dew condensation)
	Operating ambient humidity	35 to 85% RH (without icing and dew condensation at 25°C)
	Vibration resistance	10 to 55 Hz, 1 sweep per minute, half amplitude 1 mm (camera head), 30 minutes in each X, Y and Z directions
	Shock resistance	700 m/s ² , 3 times each in X, Y and Z direction
Weight		Camera head: approx. 185 g (without lens) Camera control unit: approx. 65 g
Cable length		Camera head cable (between a camera and a camera control unit): Approx. 3m

XGA Monitor: ANPVM11021

General Specification

General Specific	auon		
Rated power	Power supply voltage	24 V DC Operating voltage range: 21.6 to 26.4 V DC	
	Power Consumption	0.5 A (Max. 1 A)	
Environmental	Operating ambient temperature	0 to +45 °C	
resistance	Operating ambient humidity	35 to 85 %RH (without dew condensation at 25°C)	
	Power noise	1,000 V (P-P) or more, pulse width 50 ns, 1 μ s between power terminals (a noise simulator was used.)	
	Static electricity noise	4000 V or more	
	Vibration resistance	10 to 55 Hz (1 sweep per minute), amplitude 0.75 mm, 30 minutes each in X, Y and Z directions	
	Shock resistance	196 m/s ² , 3 times each in X, Y and Z direction	
Weight		Approx. 1.4kg	

Specification for Display Area

Display eleme	ent	10.4-inch TFT liquid crystal
Number of pix	els	1024(H) x 768(V) pixels
Display color		16,777,216 colors
Effective disp	lay size	210.4(H) x 157.8(V)
Service life of	backlight	Average: 50,000 hours
Input Signal	Picture signal	Analog RGB
	Synchronizing signal	Horizontal/vertical synchronizing signal
	Horizontal operation frequency	48.36 kHz* (Number of all pixels: 1024)
	Vertical operation frequency	60 Hz* (Number of all lines: 768)
	Dot clock	65 MHz
Interface		Analog RGB input, Mini-D-SUB connector 15 pins (female)
Screen adjust	ment	Brightness, display width, vertical and horizontal positions, flicker, gain(R,G,B)

*The specified signals should be used for the monitor. Failure to do so may result in no screen display and noise occurrence on the screen.

PV500V2

2-Camera type	NPN output, Language switch over* ¹	ANPV0502V2ADN	Compliant with CE ^{*3}
	PNP output, Language switch over*1	ANPV0502V2ADP	
4-Camera type	NPN output, Language switch over*1	ANPV0504V2ADN	Compliant with CE ^{*3}
	PNP output, Language switch over*1	ANPV0504V2ADP	

PV500 (V1)

2-Camera type	NPN output, Language switch over* ²	ANPV0502ADN	Compliant — with CE ^{*3}
	PNP output, Language switch over* ²	ANPV0502ADP	
4-Camera type	NPN output, Language switch over*2	ANPV0504ADN	Compliant with CE ^{*3}
	PNP output, Language switch over* ²	ANPV0504ADP	0L

Included item:

- Power cable (ANPVH001) x1, Cable length: 1 m)
- I/O connector (MIL connector type) for discrete cables (AFP2801) x1 (2 sets)

*1 *2:

Supported languages: Japanese, English, German, French, Spanish, Italian, Simplified Chinese, Korean and Traditional Chinese (For PV500V2: Ver.2.0, PV500: Ver.1.6) *3:

Attach the designated ferrite cores on the both sides of a monitor cable and a COM.0 connecting cable. Do not connect with the USB port.

Keypad

Keypad	Cable length: 3m	ANPVP03	Compliant with CE
	Cable length: 10 m	ANPVP10	

Camera

Quad-speed Digital Camera*	Adapted for progressive, C-mount, 120 fps	ANPVC1040	Compliant with CE
2-Mega-pixel Digital Camera*	Adapted for progressive, C-mount, 30 fps	ANPVC1210	
Ultra Compact Double Speed Digital 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: 10 m	ANPVC8110R	-

* Included item: Adapter ring 2.5 mm (1mm x 2, 0.5 mm x 1)

Lens

For Quad-speed Digital Camera	f = 6 mm	With a lock	ANB842NL
	f = 8.5 mm	With a lock	ANB843L
	f = 16 mm	With a lock, compact type	ANM88161
		With a lock	ANB845NL
	f = 25mm	With a lock, compact type	ANM88251
		With a lock	ANB846NL
	f = 50 mm	With a lock, compact type	ANM88501
		With a lock	ANB847L
			ANM8850
For 2-Mega-pixel Digital Camera	f = 16 mm	With a lock	ANPVL162
	f = 25 mm	With a lock	ANPVL252
	f = 50 mm	With a lock	ANPVL502
Adapter ring (for Quad-speed	5 mm adapt	ter ring	ANB84805
Digital Camera and 2-Mega-pixel Digital Camera)	Adapter ring mm)	g set (0.5/ 1/ 5/ 10/ 20/ 40	ANB848
For Ultra small camera	f = 4 mm		ANPVL0401
	f = 12 mm		ANPVL1201
	f = 30 mm		ANPVL3001
Adapter ring	50 mm		ANPVL85001
(For Ultrasmall Camera)	20 mm		ANPVL82001
	10 mm		ANPVL81001
	5 mm		ANPVL80501

Lenses are noncompliant products with CE.

Monitor

XGA Monitor	10.4-inch (with attachment bracket: 4 pcs)	ANPVM11021	Compliant with CE*1
Monitor cable	Cable length: 3m	ANMX83313	Compliant
	Cable length: 5 m	ANMX83315	with CE*1

*1: Ferrite cores (equivalent products to RFC-5 produced by Kitagawa Industries. Co., Ltd.) must be attached to both ends of a monitor cable.

Serial Cable for COM.0 Port

3-line (discrete) cable	D-sub 9 pin (male) — 3-line (discrete wire), cable length: 2 m	AIP81842	Compliant with CE* ¹
D-Sub9 pin crossing cable	D-sub 9 pin (male) — D-sub 9 pin (male), cable length: 2 m	AIP81862N	
PC connecting cable	D-sub 9 pin (male) — D-sub 9 pin (female), cable length: 3 m	AFB85853	

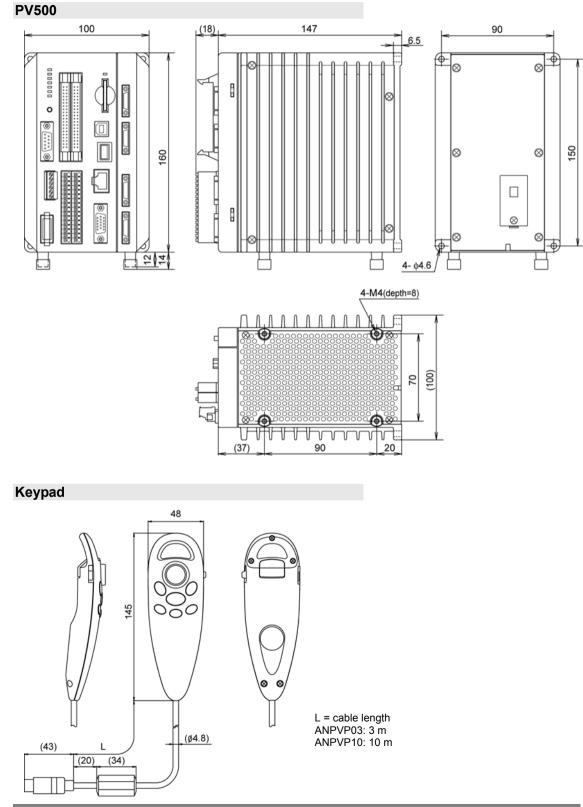
*1: Ferrite cores (equivalent products to ZCAT2035-0930A produced by TDK Corporation) must be attached to both ends of a serial cable

Repair Parts

Backup buttery for PV500	Coin-type lithium buttery	AFPX-BATT	Compliant
Power cable for PV500	Cable length: 1 m	ANPVH001	with CE
Terminal socket	16 pins for I/O port x 2	ANPVH002	non-
	6 pins for COM.1 and COM.2 ports x 1	ANPVH003	<pre>compliant with CE</pre>
I/O connector	Connector for discrete wire: 40 pins, x2	AFP2801	
(MIL connector type)	Connector for flat cable: 40 pins, x2	AFP2802	-

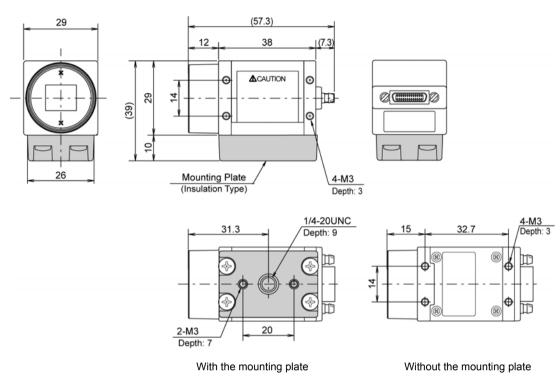
LED	Ring light	outside diameter: Ø 50) red	AULDR2-50RD
	[Direct lighting]	outside diameter: Ø 50	,	AULDR2-70SW
		outside diameter: Ø 70	,	AULDR2-70RD
		outside diameter: Ø 70		AULDR2-70SW
	Options for ring	For AULDR2-50RD/	Polarization plate	AUPL-LDR-50B
	light [Direct lighting]	AULDR2-50SW	Diffusing plate	AUDF-LDR-50B
			Diffusing plate, polarization plate Mounting adapter	AUAD-LDR-50B
		For AULDR2-70RD/	Polarization plate	AUPL-LDR-70A
		AULDR2-70SW	Diffusing plate	AUDF-LDR-70A
	Bar light	Red		AULFL-4215
	[Direct lighting]	White		AULDL-4215-SW
	Surface emitting	outside diameter: Ø 74	4	AULKR-70A
	ring light [Indirect lighting]	outside diameter: Ø 102		AULFR-100
	Surface emitting	light source size: 27 x	27	AULDL-TP2727
	flat light [Indirect lighting]	light source size: 43 x	35	AULDL-TP4335
	[maneet lighting]	light source size: 80 x 100		AULFL-100
	Surface emitting	translucent glass size: 26 x 28		AULFV-34
	coaxial light [Indirect lighting]	translucent glass size: 32 x 36		AULFV-50A
	Power supply	Digital light source (Output: switchover 12	2V/24V / 10W)	ANB86001
		Digital light source (Output: switchover 12	2V/24V / 30W)	ANB86003
	Cable	Extension cable for 12	2V: 3 m	AUCB-3
		Extension cable for 24	V: 3 m	AUFCB-3
		Light control cable (for ANB86001/ANB86003) : 3 m		AUEXCB-B3
Inverter ring	Ø60 ring light			ANMF0064
light	Ø92 ring light			ANMF0104
	Replacement lamp:	Ø60 ring light (for ANMF)	0064)	ANMF0060
	Replacement lamp: Ø92 ring light (for ANMF0104)		ANMF0100	

11.3 Dimensions



Camera

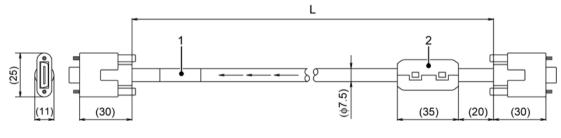
Quad-speed Digital Camera: ANPVC1040 / 2-Mega-pixel Digital Camera: ANPVC1210



Note

The mounting plate can be attached to four sides of camera except lens attaching side and cable connecting side.

Camera Cable: ANPVC8103, ANPVC8105, ANPVC8110



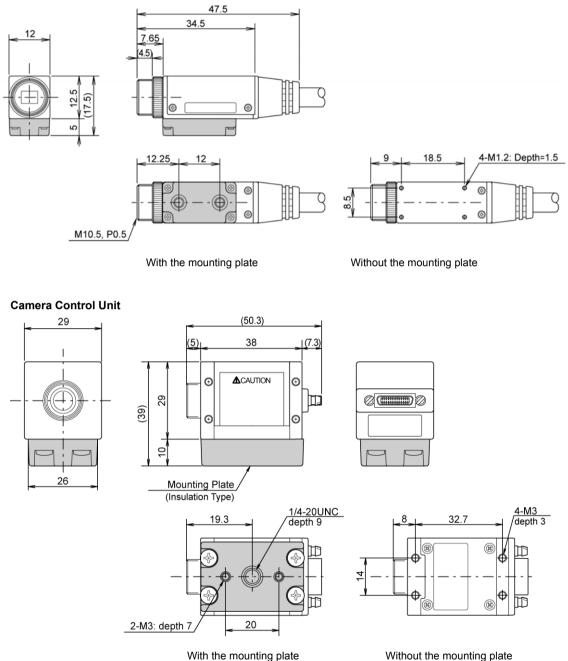
1: Product number label

2: Ferrite core

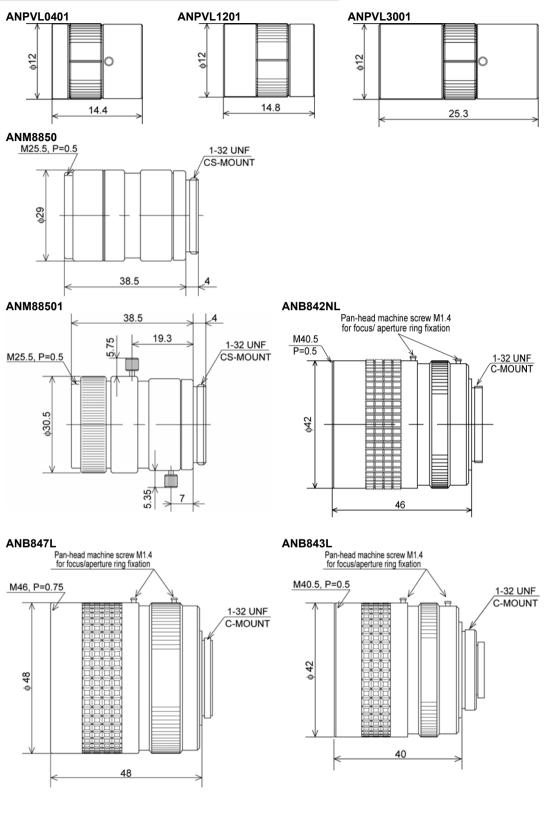
L: Cable length

ANPVC8103: 3 m, ANPVC8105: 5 m, ANPVC8110: 10 m

Ultra Compact Digital Camera: ANPVC1021 Camera Head

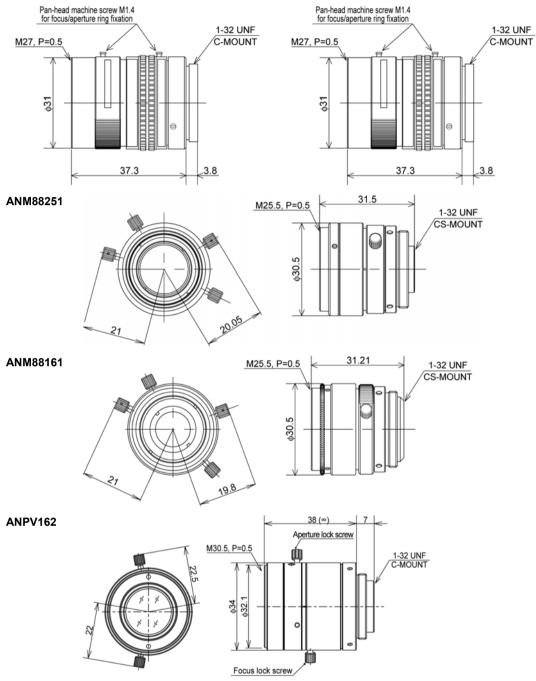




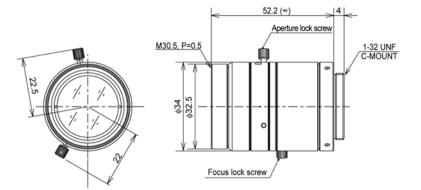


ANB846NL

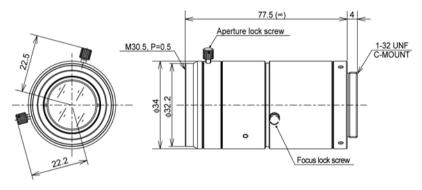




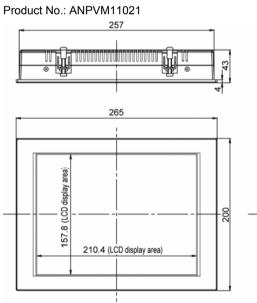
ANPV252



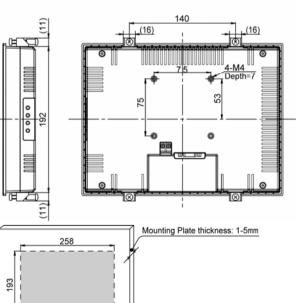
ANPV502



Monitor (10.4-inch)



Cutting Dimensions of the Mounting Plate



Α

ACCEPT OFF minimum time
Asynchronous (image-output first) 314 Asynchronous (inspection first)
···· ····

В

Backup Battery	11
Base Angle	165, 181
Bit width	252, 254
Block check code	
Branch condition	67

С

Calendar adjustment
Camera Trigger
Capture delay
Cause of turning on ERROR 0 signal 352
Cause of turning on ERROR 1 signal 354
Cell Result (Smart Edge Circle)
Cell Result (Smart Edge Line)177
Character alignment and overwrite
permission272
Character/Figure Drawing234
Checker
Сору82
Delete
Draw an area43
Circularity157
Color

COM.0 port

Communication condition	318, 366
Connector Specification	
Common template	114, 115
Common trigger	
Communication test	
Communication with PVWIN	405
Comparison Function	
Compatibility of setting data	
Connection check (I/O test)	
Continuous inspection	
Coordinate axis	63
Coordinate origin	63
Copying Checker	72

D

Data bit
Data R/W
Display Data R/W274
Registerable items 276
Decimal digit 258
Denoising182
Denoising167
Detect trigger (common)58
Differential mode131
Display NG checkers only (Checker List) 83
Display NG checkers only (Pattern) 305
Distance Point - Point 200
Distance Point-Line 198

Е

164, 181
352
65
51, 268

F

FLASH Delay	60
FLASH signal polarity	55
FLASH span	60
Float	140, 144
Full Screen	43

G

Gap	140, 142
General Output	258
Geometric Function	223
Geometry Calculation	198
Gray range mode	132
Group Move	

н

Hide Patterns

I

Ignore Dark Image	121
Image memory	260
Image memory map	261
Image Menu 39, 3	300, 304
Individual trigger	56
Information2	298, 335
Initialize	
All Types	53
Environment	321
Splash screen	337
Inspection Cycle	295
Inspection image	
Output to external devices	262
Save in save image memory	265
Inspection image memory	260
Inspection Process	314
Inspection Time	295
Intersecting Angle	207
Intersecting Point	201
IP address	326

J

JDC (External)	. 225
JRC (Internal)	. 225

Κ

Key guide	35, 36
Keypad is invalid.	381

L

Language	27
Layout	
Delete	06

Register	06
Switch	07
Line scan12	27
Linearity1	75
Low contrast 1	19

Μ

Magnification	
Marker)
Mask area	
Add 47	,
Delete 47	,
Edit 47	,
Measure Deviation 173	3
Measure Diameter 153	3
Measure Radius 153	3
Measure Width(Smart Edge Circle) 153	3
Median198	3
Mounting plate	
cutting dimensions 421	

0

Operation when switching to SETUP	
menu	312
Operators	
Judgement	230
Numerical calculation	222
Optimize Size	43
Output Signal Guarantee Time	253

Ρ

Paralle I/O Reset condition	
Parallel processing	295, 314
Partial imaging	61
Password	313
Pattern Display	85, 304
PC Communication	406, 407
Pin arrangement	
COM.0 port	366
I/O connector	341
I/O terminal block	346
Pitch	140, 147
Plane scan	128
PLC communication	
Output example	396

Usable PLCs	391
Port number	368
Position adjustment	185
Power Cable	
Preprocess Filter List	73
Preset layout	299
Print screen	
PVWIN	404

R

REND OFF minimum time	. 318
Reset Error signal	. 380
Reset statistics data	379
Result No. Assignment 161,	179
RUN mode	
Start	. 294
Stop	. 294
RUN mode in SETUP menu	. 312

S

Save image memory26	30
Back up in SD memory card	66
Clear images26	66
Number of save images	60
SD Memory Card	
Outputting Inspection Results28	57
Save and output image26	30
Serial operation	95
Serial processing	14
Settiing Data R/W 27	71
Setting data	66
Shutter speed	59
Smart Matching Performance12	24
Specification of RS-232C	66
Speed First (Smart Edge Circle)	64
Speed First (Smart Edge Line)18	31
Splash screen	37
Standard deviation	57
Standard Deviation	75
Startup	
Data to read	25
Layout3 [.]	11
Type	

Station No. (PLC Communication)	399
Station No.(PLC communication)	397
Statistical Function	222
Subtraction	123
System register	316

т

Tact signal	350
Test image	
Test image memory	
Timeout	253, 398
Transparency	
RUN menu	303
SETUP menu	320
Trigonometrical Function	223
Туре	
Add	51
Delete	53
Initialize	53
Type switch	
PLC communication	
Send command	
Timing chart	
TYPE signal	

U

82
67
36
65

V

)6
22
21
23
63

W

Width measurement	140, 149
Window sequence order	303

Record of Changes

Manual No.	Date	Revision detail
ARCT1F443E	February 2008	First edition
ARCT1F443E-1	May 2008	Second edition
		Correction of errorrs
ARCT1F443E-2	September 2008	Third edition
		 Revision along with version of the new menu names
	 Addition of the descriptions of the updated items (Ver.1.22). 	
	Addition of the index	
	Correction of errors	
ARCT1F466E	February 2009	First edition
		 Revision along with version upgrade to Ver.1.41
		Correction of errors
ARCT1F466E-1	April 2010	Second edition
	 Revision and addition along with version upgrade to Ver.1.60 	
	Correction of errors	
ARCT1F466E-2 September 2010	Third edition	
		 Revision and addition along with the release of PV500V2
		Correction of errors