

Panasonic[®]

LightPix^{*} AE20 User's Manual

LightPix AE20 User's Manual
ARCT1F406E-3 '07.2

Before Reading This Manual

Thank you for purchasing the Light Pix AE20.

In this manual, information on the hardware (installation, wiring, etc.) and the software (functions, setting procedures, etc.) is described. 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.

Conventions used in the Safety Precautions

Symbols:

The following symbols used in Safety Precautions.

Symbol Explanation:

WARNING

This indicates the existence of a hazard that could result in death of or serious damage to the operator, if the safety instruction is not observed.

CAUTION

This indicates the existence of a hazard that could result in serious bodily injury or property damage, if the safety instruction is not observed.



WARNING

- Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.
- Do not use this product in areas with inflammable gas. It could lead to an explosion.
- Exposing this product to excessive heat or open flames could cause damage to the lithium battery or other electronic parts.



CAUTION

- To prevent abnormal 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.
- Do not dismantle or remodel the product. It could lead to abnormal 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 might cause exothermic heat or smoke generation.
- Do not undertake construction (such as connection and disconnection) while the power supply is on.
- Do not bend the cables forcibly, place a heavy object on them or bring them close to a thermal appliance. This might result in an electric shock and smoke coming from the product.
- Connect the wires or connectors securely. The loose connection might cause abnormal exothermic heat or smoke generation.

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Precautions before Use

Installation Environment

Avoid installing the LightPixAE20 in the following locations:

- Locations with direct sunlight or environmental temperatures exceeding a range of 0°C to +40°C.
- Locations with a relative humidity exceeding a range of 35%RH to 85%RH (without dew condensation at 25°C)
- Locations with a lot of fine particles, iron filings, salt, oily smoke or conductive dusts.
- Locations with an atmosphere containing corrosive gases or flammable gases.
- Locations where the product can contact oil or chemicals.
- Locations near organic solvents (such as benzene, paint thinner, and alcohol) or strongly alkaline materials (such as ammonia and caustic soda)
- Locations within 100 mm of high-voltage wires (or devices), power-driven lines (or devices), radios, transmitters and devices generating large switching surge (be sure to keep more than 100 mm space between the LightPixAE20 and these devices)

Power Supply

- Take care not to generate excessive static electricity from the LightPixAE20.
- When supplying power to the LightPixAE20, do not commonly use the power source for powering the device and be sure to install a protection circuit such as a fuse.
- Use an insulated power supply unit with a built-in protection circuit. The LightPixAE20 power supply unit is a non-insulated circuit. Therefore, 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.

About grounding

- Do not commonly use the ground with other devices.
- Grounding should be as close as the main unit as possible, and keep the distance short.

Noise Countermeasure

- Do not bundle the optional cable connecting between the main unit and the operation unit, and input/output signal cables connecting to the main unit together with motor or power cables. Ensure that they are at least 100m apart. Keep the signal cables as short as possible.
- If the external devices connected to the main unit are connected with directive conduction load (a motor or relay), equip noise absorption elements such as noise killers at the load side.
- Lighting equipment for image process generates signal of extremely high noise level due to high frequency lighting. If you use external lighting, arrange the wiring of power transmission and signal cables carefully.

Before Turning on the LightPixAE20

Pay attentions to the followings when turning on the LightPixAE20 for the first time;

- Confirm no wiring waste or especially any conductive substance coming from installation is on the printed circuit board
- Confirm that the power voltage, power wiring and input/output wiring are correct.
- Confirm that the fixing and terminal screws are securely tightened.
- Do not turn the LightPixAE20 on within 10 minutes after turning the main unit off. This may result in malfunction.

General Cautions

- Do not connect Ethernet to the connector on the operation unit for connecting the optional cable or the port for connecting the operation unit.
- Use the operation unit and finder unit of a product number specified by Matsushita Electric Works, Ltd. A breakdown, damage or destruction by using any other than the specified will not be covered by our guarantee.
- Do not disassemble and remodel the LightPixAE20 or change its internal settings. A breakdown, damage or destruction caused by disassembling, remodeling the LightPixAE20 or not following the instructions described in the manuals will not be covered by our guarantee.
- Do not change or set items that should not be as described in the manual or the specification. Breakdown, damage or destruction resulting from changing or setting them will not be covered by our guarantee.

To USA Customer

- Products sold by Seller are covered by the warranty and patent indemnification provisions in its Terms and Conditions of Sale only.

Chapter 1

Overview of Light Pix AE20

1.1 Overview

LightPixAE20 (hereinafter called “the LightPixAE20”) is an optical sensor system that is integrated with CPU, camera, lens and lighting equipment. We provide eight types of inspection applications. With free designated software, AETOOL, you can download one of the applications to the main unit. AETOOL checks scanning conditions or images and saves the images stored in the main unit as a file (bit map).

Checking the operating image or modifying the scanning conditions can be also with the operation unit and finder unit. In addition, our programmable display GT11 can change settings or control inspection start.



◆ NOTE

This manual describes the operating instructions mainly for the operation unit and finder unit. Refer to the AETOOL help files (available after installation) for further details of the AETOOL.



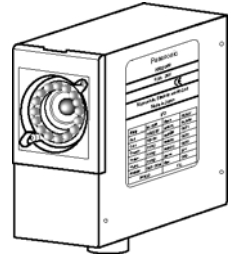
◆ REFERENCE

About the AETOOL: Page 152

1.2 Product Configuration

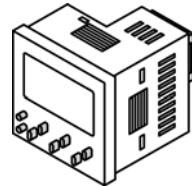
Main Unit

The LightPixAE20 is a device that is integrated with CPU, a camera and lighting equipment. Inspections can be performed by using the main unit only. The LightPixAE20 has parallel I/O and serial RS-232C ports for communication with external devices. You can download one of the eight inspection applications to the main unit to use with AETOOL.



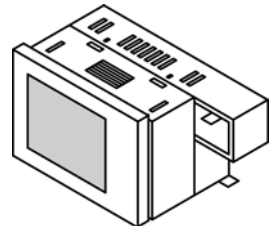
Operation unit

The operation unit has eight buttons and a display area (7-segment negative/positive LCD display). With these buttons, you can make various settings. In the display area, setting items and options are displayed. If the device is connected to the main unit with the provided cable while scanning codes, the detected data, results, and operation status of the main unit are displayed in this area.



Finder Unit

The finder unit is a device that displays the images captured with the main unit. Mount the device onto the operation unit before use. Do not directly connect the finder unit to the main unit.



AETOOL*

The AETOOL is software exclusively for LightPixAE20. Before using this software, install it to the PC connected to the LightPixAE20 with USB cable (AB type). The key features of this software are shown in the table below.

Features	Description
Transferring the inspection application to the main unit	Switches the applications for LightPixAE20 using the program for system transfer that is installed at the same time as when the AETOOL* is installed into PC
Setting up inspection conditions	Carries out all of the operations you can perform with both the operation unit and the finder unit.
Backing up configuration data and downloading backup configuration data	Backups the configuration data, saves files on PC and downloads the data to the main unit. Thus, if you use multiple main units under the same reading conditions, you can copy and use the data in individual main units.
Documenting configuration data	Writes out the backup configuration data in the CSV format.



◆ NOTE

*You can freely download this software from our website.
“<http://www.mew.co.jp/ac/e/fasys/vision/download/>”

1.3 Inspection Applications

There are eight types of inspection applications available for the LightPixAE20. You can download one of the following inspection applications to the main unit before use.

Inspection Applications

Type	Overview	Reference
Color Area	Measures the registered color area	Chapter 4.2
Color Judgement	Selects the color of the object from maximum seven registered	
Color Pattern Matching	In a color extraction image, detects the same image as the saved base image (template)	Chapter 4.3
Gray Pattern Matching	In a gray image, detects the same image as the saved base image (template)	
Edge Detection	Detects the edges of an object and checks whether or not they are placed in the registered base edge position	Chapter 4.4
Peak Detection	Detects the vertices of an object and checks whether or not they are placed in the registered base peak position	Chapter 4.5
Length Measurement	Finds out whether or not the measured max./min. values in the horizontal and vertical directions are equal to the registered base size	Chapter 4.6
Feature Extraction	Counts the objects and judge whether its number is within the range set in advance or not. For counting, the conditions of size (area) and inclination (principal axis angle) can be specified.	Chapter 4.7



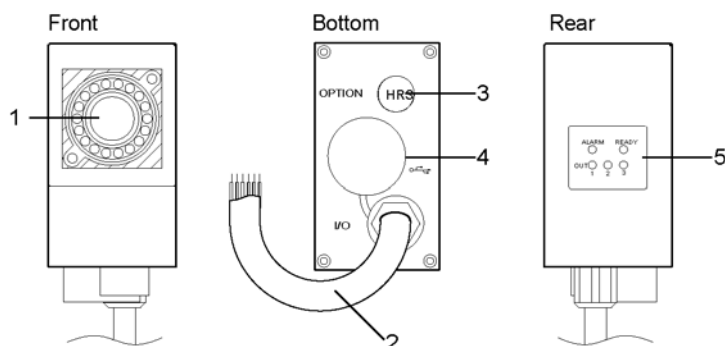
◆ NOTE

Only one inspection application can be transferred to the main unit to use. You cannot transfer multiple applications and use them at the same time.

Chapter 2

Names and Functions of Parts

2.1 About the Main Unit



Designations and Descriptions of Each Part

Designations and Descriptions of Each Part

No.	Name	Description						
1	Capture part	Camera for capturing images, lens and white LED are built in this part.						
2	I/O cable	This external input/output cable used for supplying 24 VDC, inputting scan start TRIGGER signal and outputting inspection result signal.						
3	Optional cable connector (for connection to the operation unit and for RS232C)	<p>Port used for connecting to the operation unit and to external devices such as PLC, our programmable display GT11, etc. through RS-232C communication. Select a proper optional cable for your connecting equipment.</p> <ul style="list-style-type: none">When connecting to operation unit (plus finder unit), use the optional cable ANE2813.When connecting to external devices through RS-232C communication, use the optional cable ANE2803.In the both cases above, use the optional cable ANE2823.						
4	USB port	This port is used for connecting to the PC in which AETOOL is installed. Use a AB type cable for USB2.0 or 1.1 (max. cable length: 5m)						
5	LED indicators	<table><tr><td>OUT1 - 3</td><td>Output state of inspection results. The OUT1-3 LEDs goes on when each signal is output.</td></tr><tr><td>READY</td><td>The READY LED goes on when the main unit performs no process. The LightPixAE20 can receive inspection start signal (TRIGGER signal in RUN or RUN VIEW mode) from the external devices only while the READY signal is being output.</td></tr><tr><td>ALARM</td><td>The ALARM LED goes on when the LightPixAE20 could not finish teaching properly.</td></tr></table>	OUT1 - 3	Output state of inspection results. The OUT1-3 LEDs goes on when each signal is output.	READY	The READY LED goes on when the main unit performs no process. The LightPixAE20 can receive inspection start signal (TRIGGER signal in RUN or RUN VIEW mode) from the external devices only while the READY signal is being output.	ALARM	The ALARM LED goes on when the LightPixAE20 could not finish teaching properly.
OUT1 - 3	Output state of inspection results. The OUT1-3 LEDs goes on when each signal is output.							
READY	The READY LED goes on when the main unit performs no process. The LightPixAE20 can receive inspection start signal (TRIGGER signal in RUN or RUN VIEW mode) from the external devices only while the READY signal is being output.							
ALARM	The ALARM LED goes on when the LightPixAE20 could not finish teaching properly.							



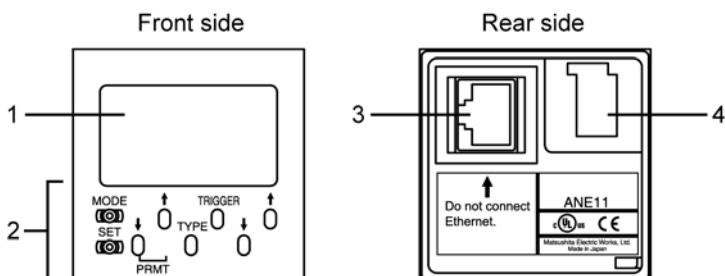
Use only the specified cable and device for the optional cable connector and USB port respectively. Failure to do so may result in product damage.



- If the ALARM signal is output when teaching is finished properly, reboot the LightPixAE20. In the case of frequent output of the ALARM signal, the LightPixAE20 may be broken. Please contact us.
- Expected service life of the white LED built in the main unit is 30,000 hours. (Light intensity drops to 50 % under the conditions of high-speed operation at 25°C while internal trigger is ON.) It is advisable to make regular adjustment for light intensity and carry out a re-teaching, because lower light intensity may negatively affect the measurement results.

2.2 Operation Unit

2.2.1 Operation Unit



Designations and Descriptions of Each Part

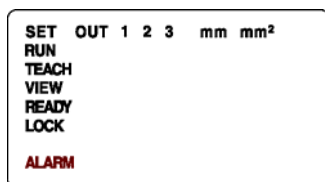
No.	Name	Description
1	Display area	Operation status of main unit, modes, inspection results and setting items are displayed in the display area. Refer to the next page for further details.
2	Operating buttons	Used for operating the main unit. There are eight operating buttons.
3	Port for connecting to the main unit	Used for connecting to the main unit. Use the cable ANE2813 or ANE2823 to connect to the main unit.
4	Connector for finder unit	Used for connecting to the finder unit



Do not connect any other device to the port for the main unit. Failure to do so may result in product damage.

2.2.2 Texts Displayed on the LCD Monitor of the Operation Unit

The display area of the operation unit displays measurement data and setting values and operating status of the LightPixAE20 as a text string.

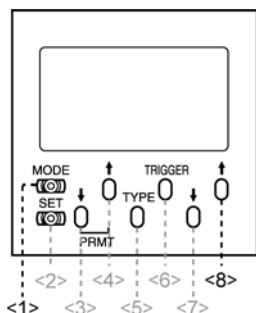


Displayed text	Mode	Description
SET	CONFIGURATION mode	Indicates the LightPixAE20 is in CONFIGURATION mode
RUN	RUN (RUN VIEW) mode	Indicates the LightPixAE20 is in RUN mode.
TEACH	TEACHING mode	Indicates the LightPixAE20 is in TEACHING mode.
VIEW	RUN VIEW mode	Indicates the LightPixAE20 is RUNVIEW mode. In this mode, captured images are displayed on the finder unit.
READY	RUN (RUN VIEW) mode TEACHING mode	Displayed when parallel output signal "READY" is ON.
LOCK	RUN (VIEW) mode	Means the lock function is activated. In this mode, you cannot operate the LightPixAE20.
ALARM (Red)	RUN (VIEW) mode TEACHING mode (May be displayed when the device is in the other modes.)	Displayed when the parallel output signal "ALARM" is ON.
OUT1-3	RUN (RUN VIEW) mode	Represents output state of parallel output signals OUT1-3. The signals that are turned on are displayed. For example, <ul style="list-style-type: none"> OUT 1 2: OUT1 and OUT2 signals are on.
mm	RUN (RUN VIEW) mode	Indicates the unit for the measured data is millimeter. You can check it only if you are using the following applications: <ul style="list-style-type: none"> Gray Pattern Matching Color Pattern Matching Edge Detection Peak Detection Length Measurement
mm ²	RUN (RUN VIEW) mode	Indicates the unit for the measured data is square millimeter. You can check it only if you are using the following applications: <ul style="list-style-type: none"> Color Area Color Judgement Feature Extraction

2.2.3 Lock Function

The LightPixAE20 comes with a built-in Lock function that helps you avoid accidental operation of the operation unit (if connected). As long as this function is activated, the current operation mode and settings of the LightPixAE20 are not changed even if the operating buttons are accidentally pressed.

Buttons to be used for setting the Lock function



To lock the operation unit:

1. Press the buttons 1 and 8 on the operation unit at the same time for approximately three seconds.

The word "Lock" appears on the LCD display (refer to the previous page for details of displayed texts).

To unlock the operation unit:

1. Press the buttons 1 and 8 on the operation unit at the same time for approximately three seconds.

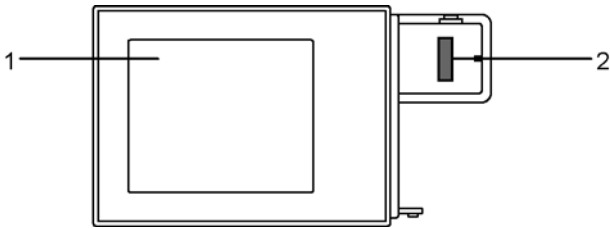
The word "Lock" disappears.



◆ NOTE

Even when locking the operation unit, you can input signals from AETOOL or external devices, or change settings and switch modes via RS-232C communication.

2.3 Finder Unit



Designations and Descriptions of Each Part

No.	Name	Description
1	Image display area	A captured image is displayed when the LightPixAE20 is in RUN-VIEW mode. (Images are not displayed in RUN mode.)
2	Connecting connector	Used for connecting the operation unit.



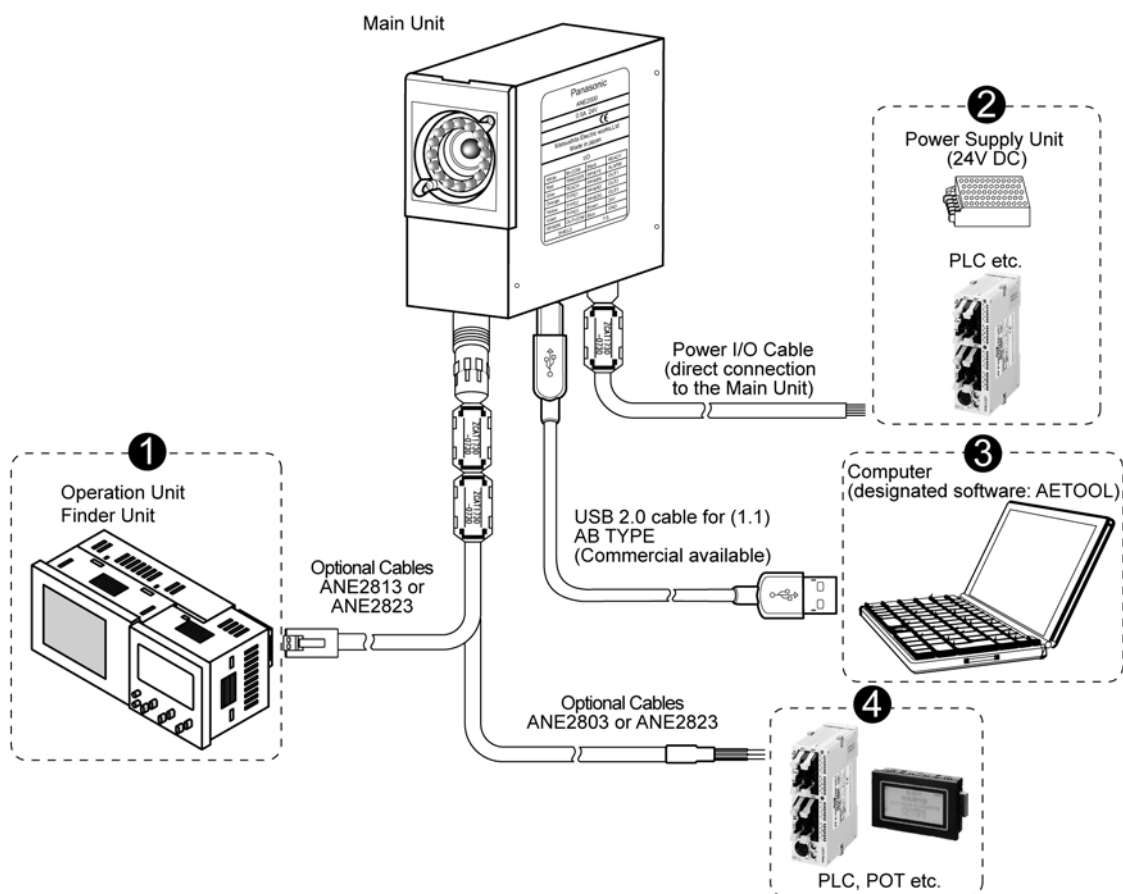
◆ NOTE

Expected service life of the backlight is approx. 40,000 hours (at operating ambient temperature 25°C). The LightPixAE20 comes with a built-in Backlight OFF-TIMER function. This function would be helpful if you want to turn the device off in 10, 30 or 60 minutes. Refer to Section 4.8, “Detailed Functions in CONFIGURATION Mode”.

Chapter 3

Installation and Wiring

3.1 List of Connectable Units and Devices



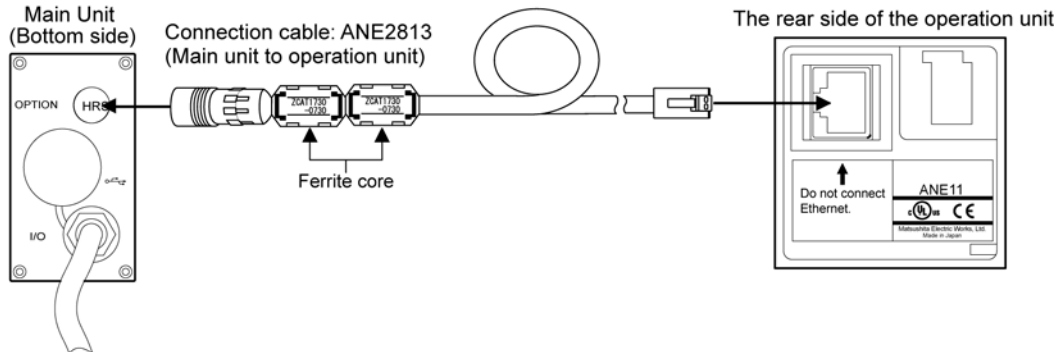
No.	Connectable unit/device	Purpose	Ref. Page
1	Operation unit and finder unit	To set inspection conditions and display images	13
2	I/O – power supply unit and PLC	To control the LightPixAE20 with external devices such as power supply unit and PLC and import measurement results.	15
3	AETOOL installed PC	To perform all operations without using the operation unit and finder unit.	153
4	Serial (RS232C) – PLC, POT, etc.	To receive inspection results, control the LightPixAE20 by sending commands from external devices and import measurement results.	26

3.2 Connection between the Units

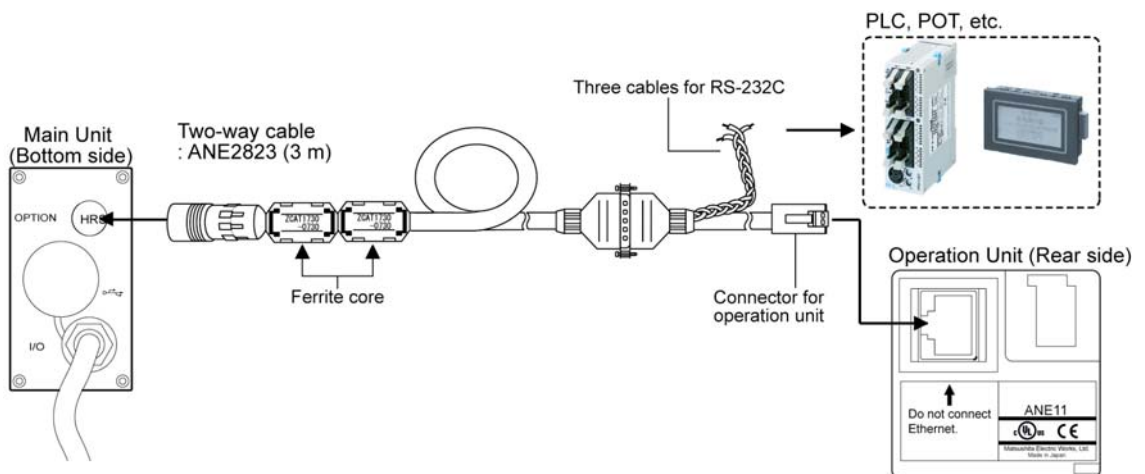
3.2.1 Connection the Main Unit to the Operation Unit

Use only the specified cable ANE2813 (cable length: 3m) or ANE2823 (cable length: 3m) to connect the main unit to the operation unit.

When connecting to only the operation unit (with the finder unit)



When connecting the main unit to the operation unit (with the finder unit) and to the external devices such as PLC and POT via RS-232C

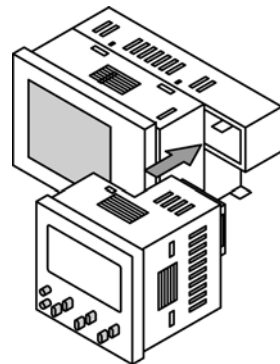


3.2.2 Connection of the Operation and Finder Units

You can mount the finder unit on the operation unit without using any cables. Use the connector for connecting the operation unit or finder unit on each unit.

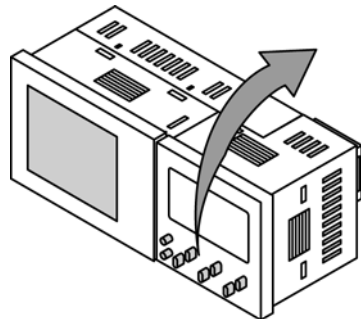
To mount the operation unit on the finder unit:

1. Insert the operation unit into the finder unit until it clicks.



To remove the operation unit from the finder unit:

1. Hold the finder unit with one hand.
2. Hold the operation unit with the other hand and lift the operation unit in the arrow direction.



◆ NOTE

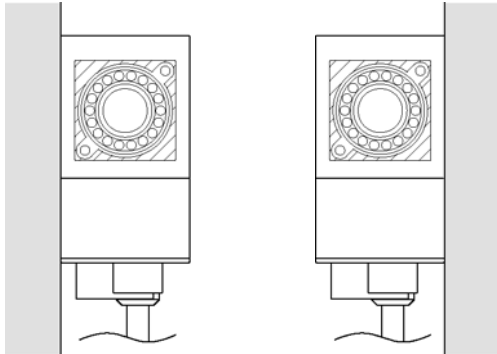
- When using the finder unit, mount the operation unit on the finder unit first and connect the devices with the optional cable for connecting to the main unit
- Do not mount the operation unit on the finder unit while the operation unit is running. Failure to do so may result in the product damage.

3.3 Fixing and Removing the Main Unit

3.3.1 Main Unit

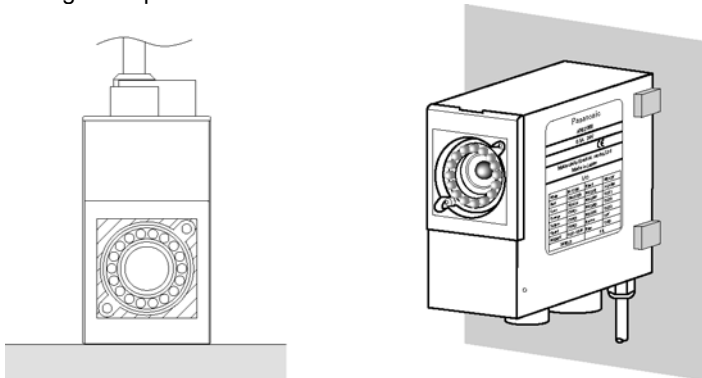
Mounting the main unit on a wall

Use the three holes on a side of the main unit to fix it on a wall.



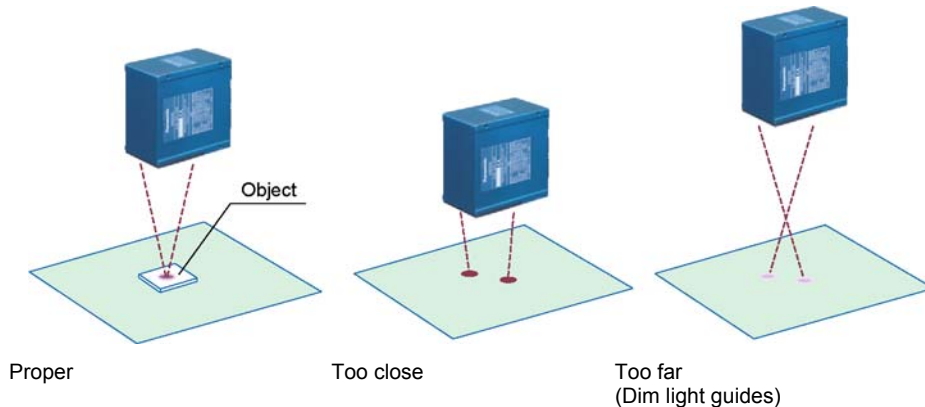
Avoid installing the main unit as the following figures shown below.

Wrong Examples



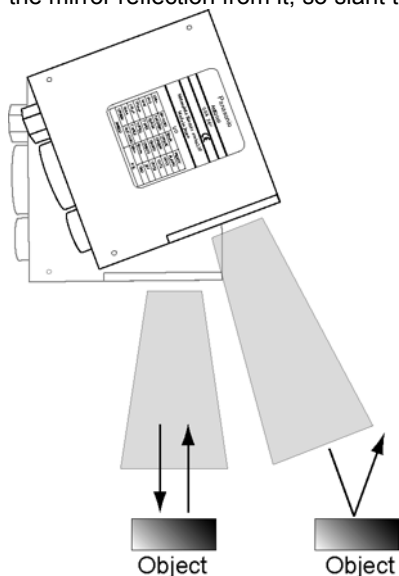
Installation distance between the main unit and the inspection object

Keep 15 to 220 mm space between the object and the main unit, but the space varies depending on the product number of the main unit. Since light guides (two red LED lights) are emitted from the LightPixAE20 to the area around the object, adjust the position of the main unit so that the two lights are close (or overlap) each other.



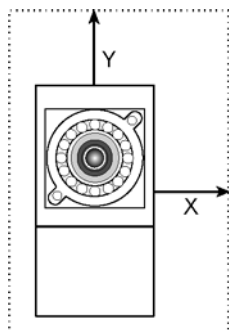
Installation angle

If you want to capture a shiny object, the light emitted from white LED may interfere with the object due to the mirror reflection from it, so slant the main unit.



Installation space between the multiple units

Keep the enough space between the units to prevent the lights emitted from each unit from interfering with each other (see the table below).



Product No.	View range (mm)	X, Y (mm)	Installation Distance (mm)
ANE2000	2 x 1.6	0	15
ANE2010	10 x 8	10	45
ANE2020	30 x 25	40	55
ANE2030	80 x 70 (70 x 56 ~ 100 x 80)	230	170 (150 ~ 220)



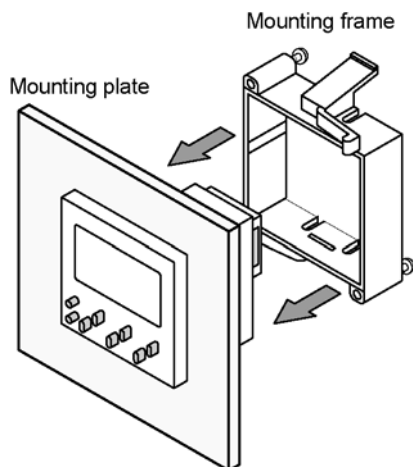
◆ NOTE

- Disturbance light, of which illumination intensity varies at the time of measurement, negatively affects the measurement results. Shield the device from any disturbance light.
- The larger the installation angle, the greater the warp generated in the captured mages. This will lead to mixed measurement results depending on the position of the object within the field of view. Determine the installation angle of the main unit after actually checking the image.

3.3.2 Operation Unit

Installing the operation unit only

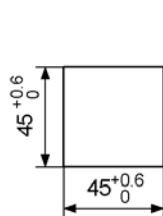
Mount the operation unit onto the front side of the mounting plate, insert the mounting frame into the rear side of the operation unit, then tighten the mounting frame with the screws.



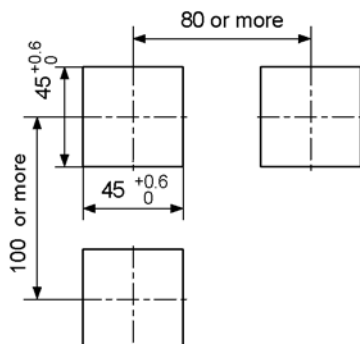
Sizes of the mounting plate

Use 1 to 5 mm-thick panel.

To install a single unit:

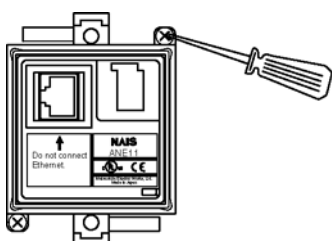


To install multiple units:

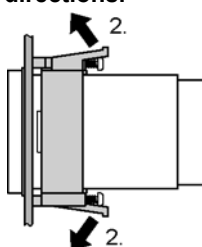


To remove the operation unit:

1. Loosen screws.



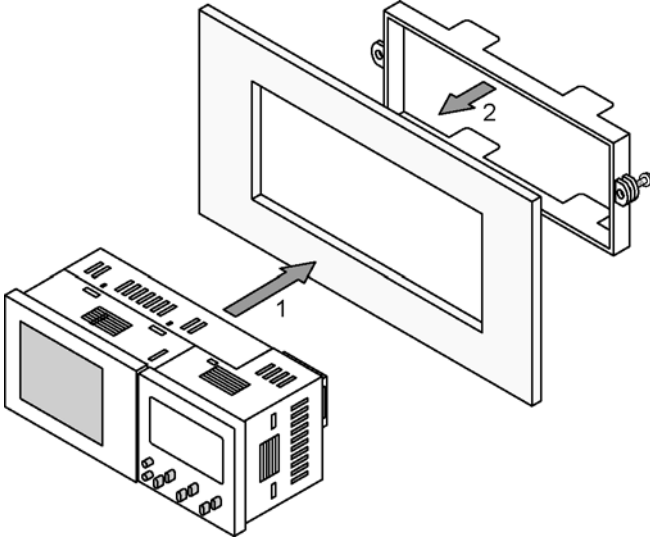
2. Remove the mounting frame while pulling the tabs in the arrow directions.



3.3.3 Finder Unit

To mount the finder unit:

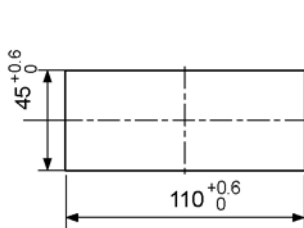
Assemble the operation unit first, mount the finder unit onto the front side of the mounting plate, and then insert the mounting frame into the rear side of the fixing plate.



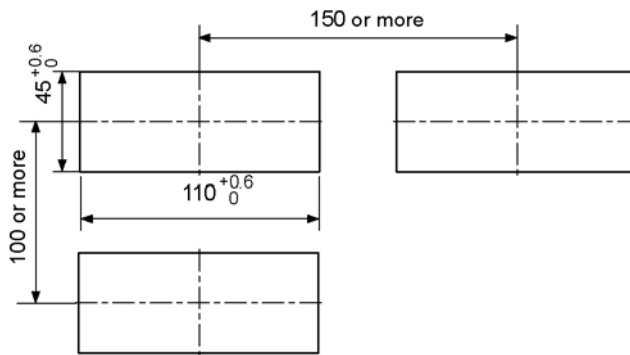
Sizes of the mounting plate

Use 1-5 mm-thick panel.

To install a single unit:



To install multiple units:



3.3.4 Installation Environment

Installation Environment

Avoid installing the LightPixAE20 in the following locations:

- Locations with direct sunlight or environmental temperatures exceeding a range of 0°C to +40°C.
- Locations with a relative humidity exceeding a range of 35%RH to 85%RH (without dew condensation at 25°C)
- Locations with a lot of fine particles, iron filings, salt, oily smoke or conductive dusts
- Locations with a lot of dusts, oily smoke, conductive dusts, or corrosive or flammable gases
- Locations where the product can contact oil or chemicals
- Locations near organic solvents (such as benzene, paint thinner, and alcohol) or strongly alkaline materials (such as ammonia and caustic soda)
- Locations within 100 mm of high-voltage wires (or devices), power-driven lines (or devices), radios, transmitters and devices generating large switching surge (be sure to keep more than 100 mm space between the LightPixAE20 and these devices)

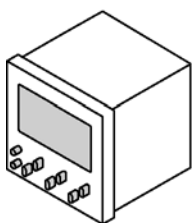
Noise Countermeasure

- Do not bundle the optional cable connecting between the main unit and the operation unit, and input/output signal cables connecting to the main unit together with motor or power cables. Ensure that they are at least 100m apart. Keep the signal cables as short as possible.
- If the external devices connected to the main unit are connected with directive conduction load (a motor or relay), equip noise-absorbing elements such as noise killers at the load side.
- Lighting equipment for image process generates signal of extremely high level due to high frequency lighting. If you use external lighting, arrange the wiring of power transmission and signal cables carefully.

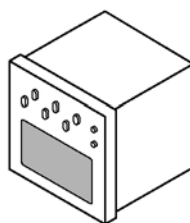
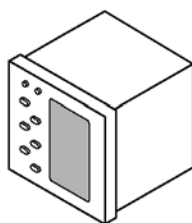
Countermeasure for Heat Radiation

- When installing the operation unit (or the operation unit with finder unit), set the device in the following direction for heat radiation.

Correct



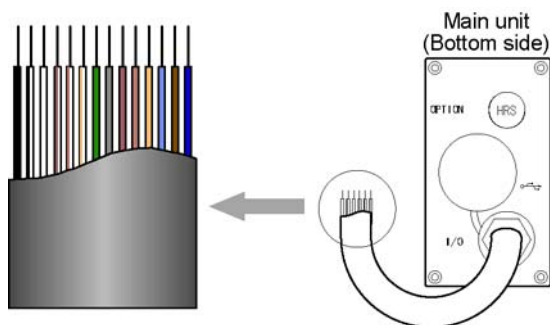
Wrong



3.4 Input/Output Cables for Connecting Power Supply Unit or External Devices

The cables for connecting to the power supply unit or external devices are attached on the LightPixAE20.

3.4.1 Sequence of Input/Output Signals

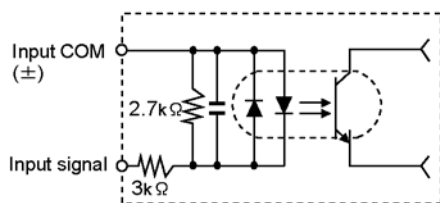


Color	Signal	Input/Output	Description
White	COM (IN)	Input	COM for input
Red	TRIGGER		Read start signal
Gray	TEACH		Switching from TEACHING mode to RUN mode
Orange	TYPE1		Specifies product type number for switching product types (Binary input: Specify the number subtracted one from the product number.)
Yellow	TYPE2		
Purple	TYPE3		
White/ Black	COM (OUT)	Output	COM for output
Black	READY		Ready completion signal
White/Yellow	ALARM		Alarm signal
White/Brown	OUT1		Judgement result output 1
White/Red	OUT2		Judgement result output 2
White/Orange	OUT3		Judgement result output 3
Brown	24 V	Power supply	24 V DC (+)
Blue	GND		24 V DC (–)
Frame	F.E.	-	Functional earth

3.4.2 Input Signal

Circuit

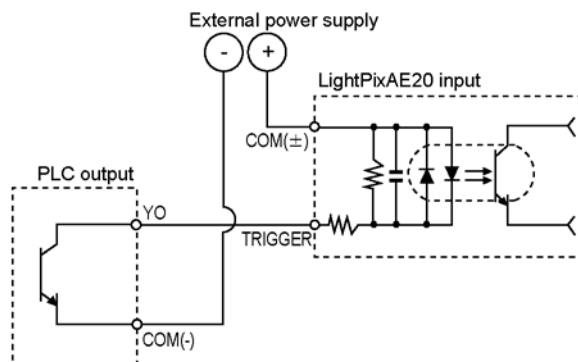
[Parallel input circuit]



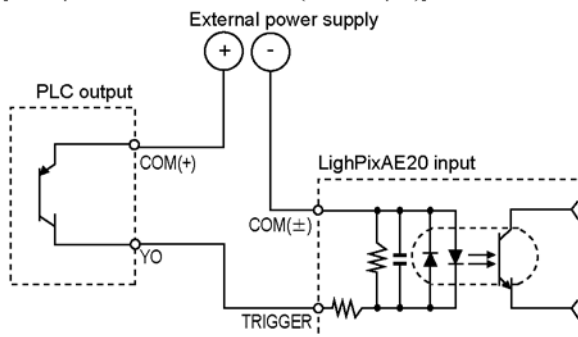
Rated operating voltage: 12 - 24 V DC

Max. applied voltage: 30 V DC

[Example connection with PLC (NPN output)]

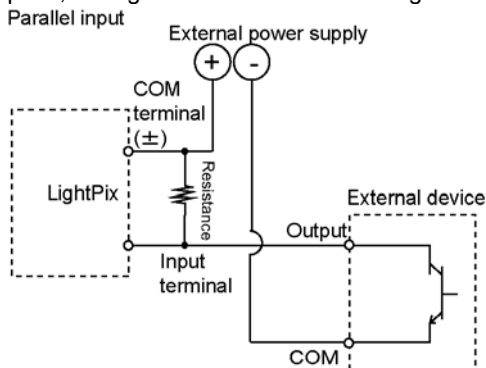


[Example connection with PLC (PNP output)]



Notes on Parallel Input

- To prevent input signal chattering, use a non-contact input (transistor etc.). If chattering occurs, inputs may be missed or input recognition may be delayed.
- Be careful when using only full-wave rectification (including ripples) power supply for DC input, as it may cause abnormal operation.
- Current leakage at the input side may not turn input off. In such as case, connect a resistor following the figure below.
- If Input to the LightPixAE20 is not turned off due to current leakage when 2-line photoelectric sensor (or proximity sensor) is used, connect a bleeder resistor.
- Even in cases where in-line LEDs such as LED reed switches are connected with an input contact point, Voltage more than the ON voltage must be applied to the LightPixAE20 input terminal.

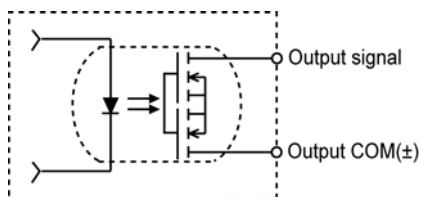


3.4.3 Output Signal

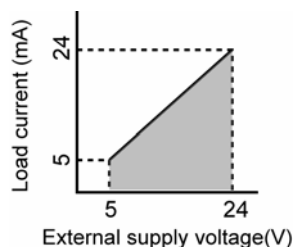
Circuit

Output part: Photo Mos relay

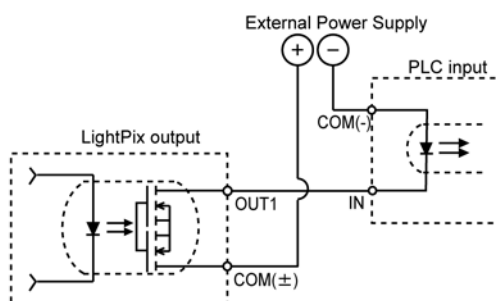
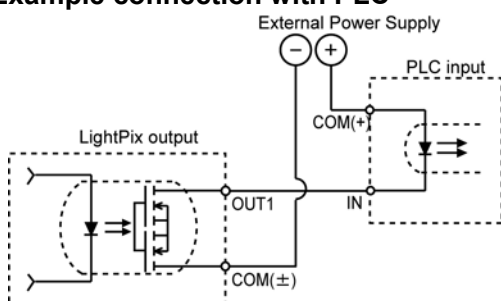
The output load should be within the specified range. See the figure shown below.



Rated operating voltage: 5 - 24 V DC



Example connection with PLC



Notes on Parallel Output

- Leakage current at the time of output signal OFF is less than 100 μ A.
- The LightPixAE20 has a low load capacity so that you can connect the LightPixAE20 to a PLC, etc. Do not connect directly with a device having a high load capacity such as a valve without passing it through our Power-Photo relay.
- The output circuit contains no built-in fuse. If it is necessary to prevent from burning out the output circuit in the event of output load short circuit, mount a fuse externally. However, it may not be able to protect internal elements in the event of short circuit.

3.4.4 Power Supply Unit and the Wiring

Use an Insulated Power Supply with a Built-in Protection Circuit

- Use an insulated power supply unit with a built-in protection circuit. The LightPixAE20 power supply unit is a non-insulated circuit. Therefore, 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.
- When supplying power to the LightPixAE20, do not commonly use the power source for powering the device and be sure to install a protection circuit such as a fuse.

Use a Power Supply Unit with Sufficient Capacity

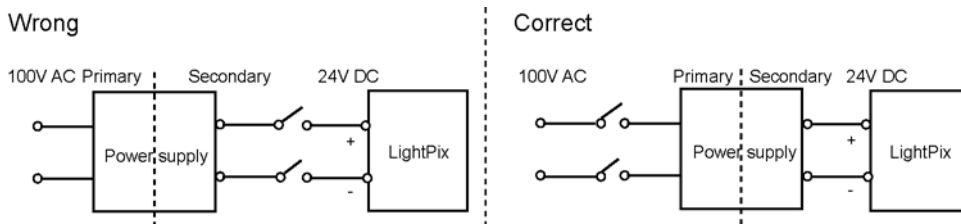
- When the power is turned on, the current far above the rated current temporarily flow. Use the power supply unit with enough capacity (more than 1A). Check the operation of the device when actually turning the power on.

Increase Resistance to Noise

- Separate the wiring systems for the LightPix AE20 main unit, input devices, and output devices with each other.
- When there is a particular concern about noise coming from input/output circuits, it is recommended that the power source for the LightPixAE20 and for input/output should be separately supplied.

Turn the LightPixAE20 ON/OFF at the Primary Side

- Turn the LightPixAE20 on/off at the primary side (100 V AC). If you turn the device on/off at the secondary side (24 V DC), the fuses of the device may melt down.



Consider the Electric Power Sequence

- Consider the power supply sequence so that the power supply unit for the LightPixAE20 can be turned off before the one for the input/output is turned off.
- If you turn the input/output power off before turning the LightPixAE20 off, the device will detect a change in the input signal level and may malfunction.
- When powering on the LightPixAE20 again, wait at least 10 seconds after powering off the device.

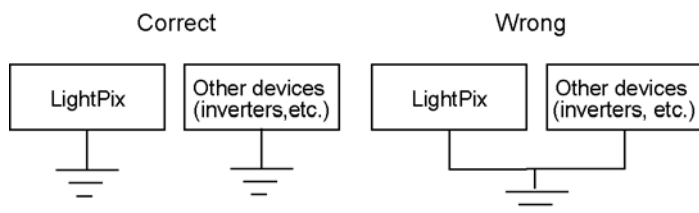
About Momentary Power Interruptions

- If momentary power interruption is less than 10 ms, the LightPix will perform continuous running.
- If momentary power interruption is between 10 and 70 ms, the device may perform continuous running depending on the condition but the device may reset itself.
- If momentary power interruption is more than 70 ms, the device will reset itself. When power is supplied again, the device will begin to operate from its initial state.

3.4.5 Grounding the Main Unit

Observe the followings to connect the grounding cable.

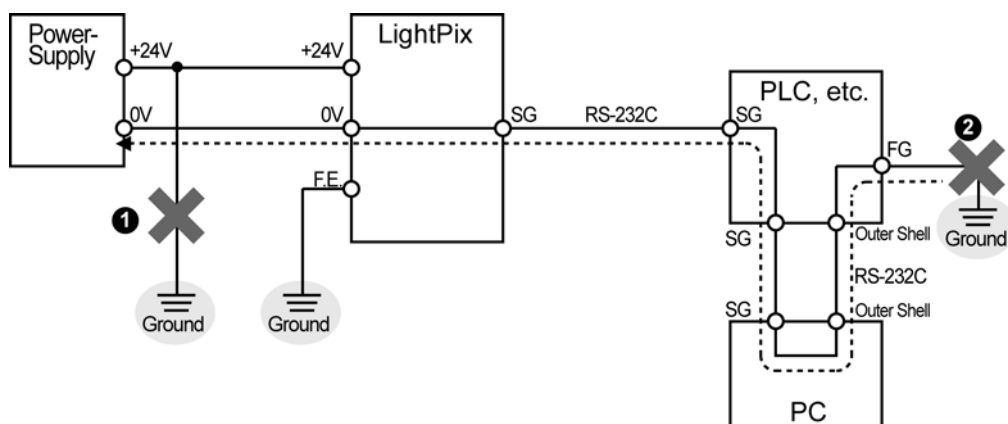
- Do not commonly use the ground with other devices.
- Grounding should be as close as the main unit as possible, and keep the distance short.
- Use a grounding cable of 0.5 to 1.25 mm² diameter.



Note on connecting the positive terminal of the power supply to ground

- Install another power supply for AE20 controller. Do not connect the positive terminal of the power supply to ground (see ❶ in the drawing below).
- Should the positive terminal of the power supply be connected to ground, do not connect the FG terminal of an external device such as PLC, etc. because the SG terminal of the AE20 may be connected to ground via the FG terminal (see ❷ in the drawing below).

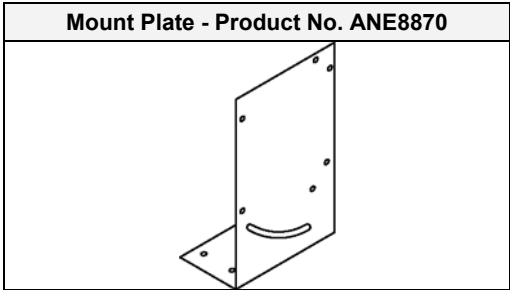
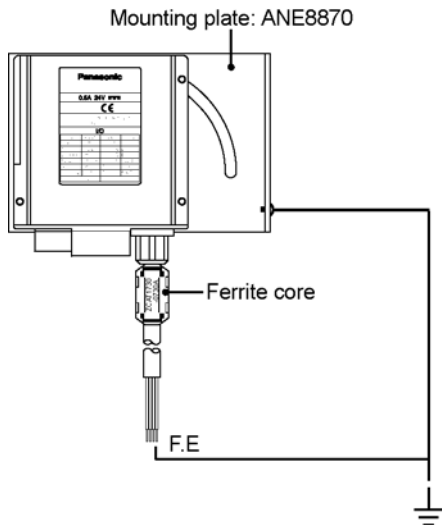
The SG terminal of the AE20 is internally connected to the GND (0V) terminal. For some computers, the SG terminal of RS232C port and the outer shell of the connector have already been connected. In this case, the SG terminal of the AE20 and the FG terminal of an external device such as PLC, etc. will be connected. If the positive terminal of the power supply to ground, a short-circuit condition occurs, resulting in damaging the internal circuit.



3.4.6 Conformity to the EMC standard

The LightPixAE20 will comply with the EMC standards (EN61000-6-4, EN61000-6-2) in EMC Directive (EMC Directive 89/336/EEC). The product must fulfill the following conditions:

- 1. No USB communication
- 2. Ferrite core must be used for the wirings as the figures shown below.
- 3. Mounting plate ANE8870 (separately sold) must be used for grounding.

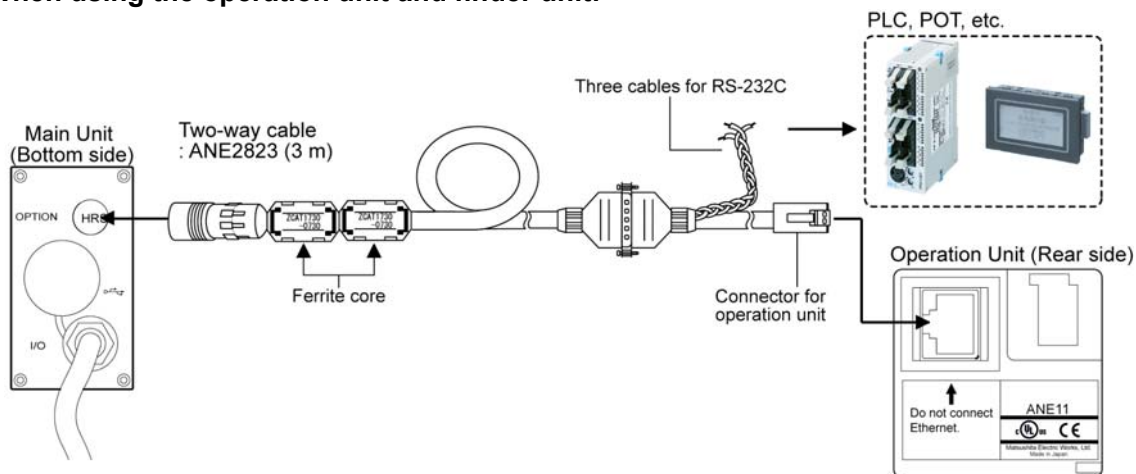


	Manufacturer	Product No.
Ferrite Core	TDK CO., LTD.	ZCAT1730-0730A

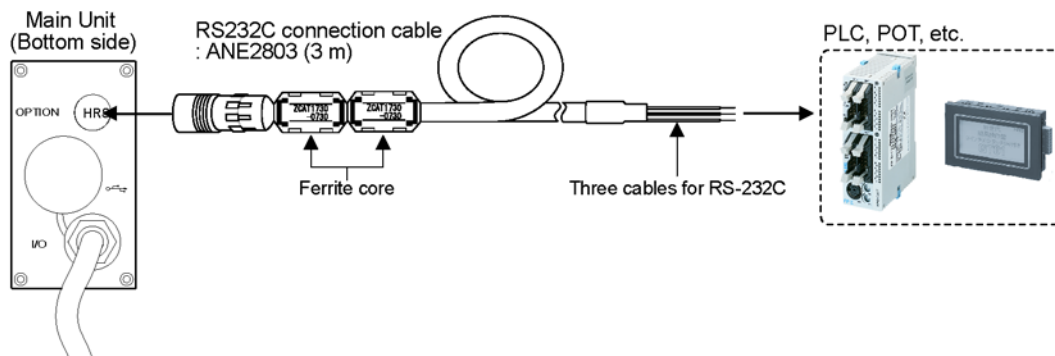
3.5 Serial (RS-232C) Port

3.5.1 Connecting to the External Devices

When using the operation unit and finder unit:



When NOT using the operation unit and finder unit:



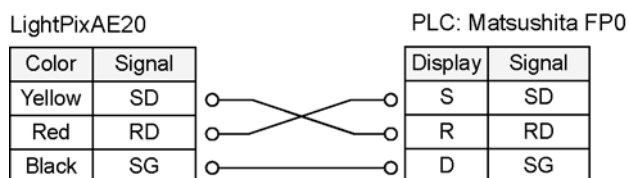
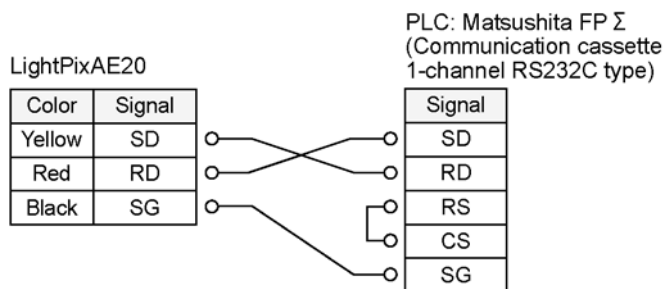
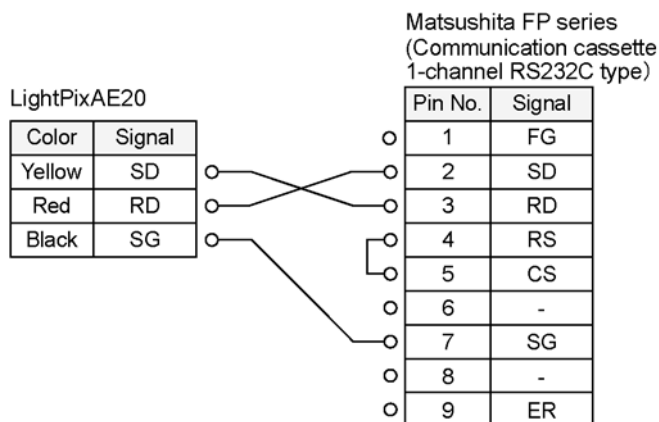
Three-cable system for RS-232C: Assignment

Cable color	Signal
Yellow	SD
Red	RD
Black	SG

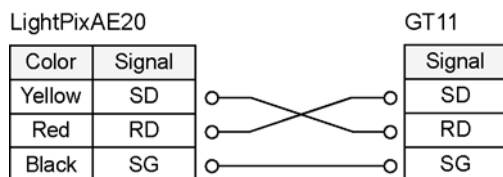
3.5.2 Wiring Method

Example of cable connections

Example of cable connection with PLC:



Example of cable connection with Matsushita programmable display GT11:



Notes on cable connections

Observe the followings to prevent the cables from melting down.

- Use the untwisted cables for connections.
- Avoid soldering cable cores; otherwise, vibration may cut off the cables.
- Do not apply load on the cables after making cable connections.

Making cable connections with multiple main units

If you control multiple main units with one host (including PLC and PC), use the RS-232C-to-RS485/RS485-to-RS232C (commercially available) conversion adapter. In this case, up to 31 main units can be connected to one host (max. transmission distance: 1200m). Assign device numbers (unit number) 0 and 1 – 31 to the host and main units respectively.



◆ REFERENCE

Assign the device number (unit number) when the LightPixAE20 is in CONFIGURATION mode. Refer to Section 4, "Inspection Applications"- "Setting up the LightPixAE20 in CONFIGURATION Mode".

Chapter 4

Inspection Applications

4.1 Overview

4.1.1 Inspection Applications

There are eight types of inspection applications available in the LightPixAE20. You can download one of the following inspection applications to the main unit using the program for system transfer that is installed at the same time as when the AETOOL is installed into PC.

Inspection Applications

	Type	Overview	Usage
1	Color Area	Measures the registered color area Checks whether or not the color area exceeds the set limit	Length measurement Presence detection Identification of right item
2	Color Judgement	Selects the color of the object from the maximum seven registered colors	Type recognition
3	Color Pattern Matching	In a color extraction image, detects the same image as the saved base image The images of which specific colors were extracted are saved, and they are used for inspection.	Identification of right item
4	Gray Pattern Matching	In a gray image, detects the same image as the saved base image Gray images are used to save a base image and inspect a subject.	Position detection Identification of right item
5	Edge Detection	Finds out whether or not the detected edges of the object moves from the registered base position This application is available for inspection for binary (black and white) images.	Position adjustment
6	Peak Detection	Finds out whether or not the detected vertices of the object moves from the registered base position This application is available for inspection for binary (black and white) images.	Position adjustment
7	Length Measurement	Finds out whether or not the measured max./min. values in the horizontal and vertical directions are equal to the resisted base size This application is available for binary (black and white) images.	Length measurement Identification of right item
8	Feature Extraction	Counts the objects within the search area, and judges whether the result is within the range set in advance. For counting, the conditions of size (area) and inclination (principal axis angle) can be specified. This application is available for binary (black and white) images.	Counting



◆ NOTE

Only one inspection application can be transferred to the main unit to use. You cannot transfer multiple applications and use them at the same time.

4.1.2 Inspection Time

Inspection time refers to the total time required for the following four inspections.

Inspection Time	1 Exposure time	0.03 - 50.00 ms, set the exposure time in TEACHING mode
	2 Transfer time	4 ms: Fixed
	3 Computation time	Differs depending on the application and "inspection speed" setting (Set the inspection speed in CONFIGURATION mode.)
	4 Display time	300 ms Available only if the image is displayed on the finder unit in RUN VIEW mode

Standard computation time (internal trigger: OFF)

Application \ Inspection speed settings	High	Middle	Low
Color Area	10 (No SPEED setting function)		
Color Judgement	20	50	150
Color Pattern Matching *	100	200	500
Gray Pattern Matching	100	200	500
Edge Detection	10	15	20
Peak Detection*	10 (No SPEED setting function)		
Length Measurement	15	20	30
Feature Extraction	15 (No SPEED setting function)		

Unit: ms

Internal trigger: ON

At least 30 ms is required for inspection.

(If the inspection time exceeds 30 ms, it will become equal to the one required for internal trigger OFF.)

For example, if exposure time for Color Judgement = 5 ms,

Internal trigger	Inspection time	Explanation
OFF	19 ms	= Computation time (10) + exposure time (5) + transmission time (4)
ON	30 ms	If the total time is less than 30 ms when internal trigger is ON, the device is forced to wait until 30 ms.



◆ NOTE

- Computation time for Color Pattern Matching, Gray Pattern Matching, and Feature Extraction slightly differs depending on the measurement condition and inspection position. The conditions of computation time in the table above is as follows:
 - Color Pattern Matching, Gray Pattern Matching: Template size 64 x 48 pixels
 - Feature Extraction: Area size 352 x 288 pixels, Ratio of black pixels 50 %
- After changing product types, it takes approximately 50 ms longer than normal inspection time for the first inspection.
- If you execute inspection monitoring images and measurement results with AETOOL, it takes 0.6 to 1.2 second longer than the inspection time shown in the table above.

4.2 Color Area and Color Judgement

4.2.1 Overview of Color Area

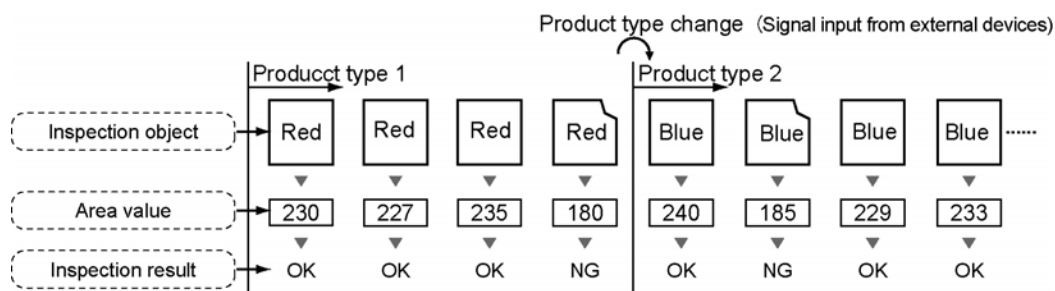
The Color Area application is used for measuring the registered color area. It judges whether or not the measured color area values are within the set area range, and if the color area values are within the range (OK judgement), the OUT1 signal is turned on, if they are out of the range (NG judgement), the OUT1 signal is turned off. You can register one product type for each color and totally seven colors for seven product types, but inspection is performed for each product type. If you want to inspect the object in the color different from the color that is saved as the current product type, change to the desired product type at the LightPix side first and continue the inspection.

Example:

Registered data

Product type No.	Registered color	Area range	
		Min.	Max.
1	Red	200	300
2	Blue	200	300

Operations of AE20



4.2.2 Overview of Color Judgement

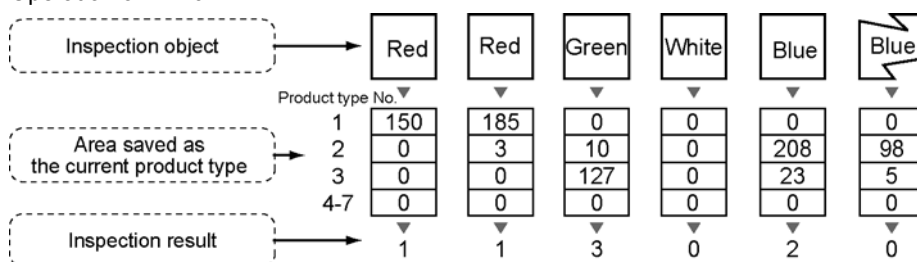
The Color Judgement application performs inspection to select the color of the object from maximum seven registered colors. With this application, you can set the area range that the object within the inspection area is judged as OK for each product type 1 - 7. In the captured object, the color areas saved as each product type are sequentially measured, then the number of the product type which was judged as OK is output.

Example

Registered data

Product type No.	Registered color	Area range	
		Min.	Max.
1	Red	100	200
2	Blue	150	300
3	Green	100	200
4 to 7	Black	500	500

Operation of AE20



As the figure above, if the object having an unregistered color or a registered color less than the area value you have set, inspection result "0" is output. This is because the unit judges that the object does not fulfill the area value saved as each product type no. 1 - 7.



◆ NOTE

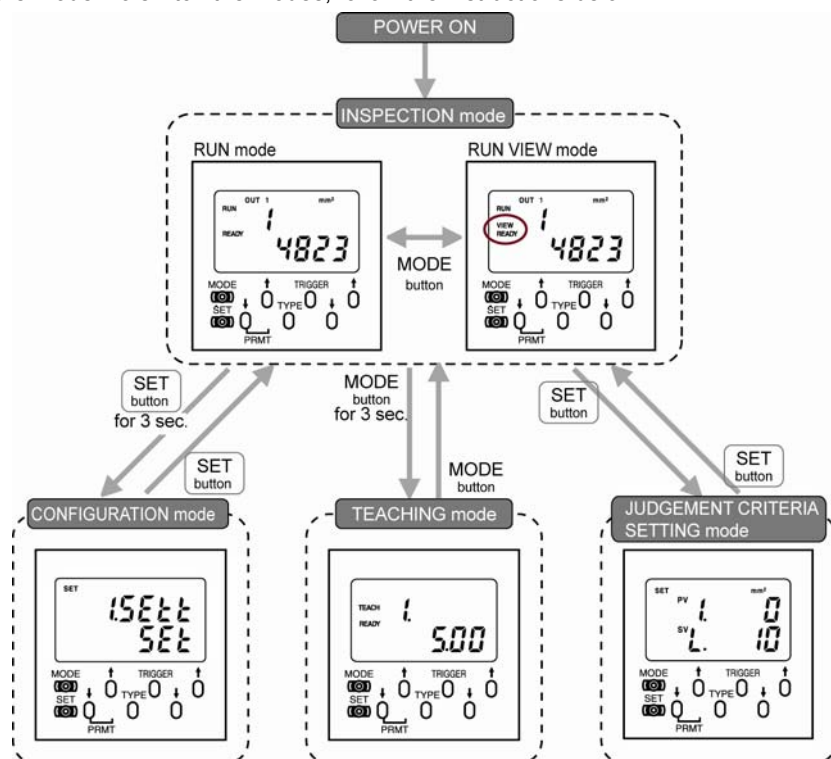
- If the object having the color saved as multiple product types is judged as OK, the lowest product type number is output as an inspection result.
- For Color Judgement, seven product types are executed every time inspection is performed, but if the number of colors (product types) actually used is less than six, you must also save the colors (not used for inspection or not captured) and color area (seven colors have been initially saved as a product type for which inspection is not performed. Do not use the preset colors; otherwise, the product type of the colors may be judged as OK).

4.2.3 Setting Procedures and Modes

The LightPixAE20 can be configured following the steps below:

1	Set up devices.	Install the main unit and connect to a power supply unit, each unit and external devices.	Section 3
2	Turn the LightPixAE20 on.	Apply 24 V DC	-
3	Configure the LightPixAE20. (in CONFIGURATION mode)	Set up the LightPixAE20 system in CONFIGURATION mode. Inspection/communication conditions and hardware settings of the unit	Page 35
4	Run teaching. (in TEACHING mode)	In the TEACHING mode, register extraction color, at the same time, set the exposure time or range for measuring area (inspection area), and area for setting extraction color.	Page 37
5	Set judgement criteria (in JUDGEMENT CRITERIA SETTING mode).	In JUDGEMENT CRITERIA SETTING mode, set the limits of area values (min. to max.). If the area values are within the limit, the LightPixAE20 judges as OK.	Page 41
6	Execute an inspection (in RUN / RUNVIEW mode)	Press the TRIGGER button in RUN (RUN VIEW) mode.	Page 42

There are four modes available in the LightPixAE20. The settings that you can make vary depending on the mode. To switch the modes, follow the instructions below.

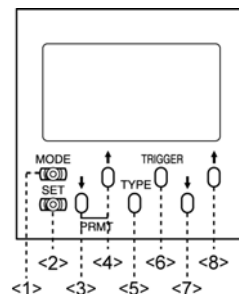


4.2.4 Setting up the LightPixAE20 in CONFIGURATION Mode

In CONFIGURATION mode, you can set up the main, operation and finder units and also set and save the inspection/communication conditions as shown below.

Refer to section 4.8 "Detailed Functions in CONFIGURATION Mode" for details of each function.

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



Function	Display on the operation unit (The left LCD display shows default settings.)
Upper: Function name and options to be displayed Middle: Name Lower: Description	
Display when starting	 for 3 sec.
I.SETT: (CANCEL / SET) Initial Setting (default): Initializes the settings	 If you want to initialize the settings, select "SET" and press the <6> button for approximately three seconds.
SAVE: (CANCEL / SAVE) SAVE function: Saves the current settings.	 If you want to save the settings, select "SAVE" and press the <6> button for approximately three seconds.
TEACH: (OK / OFF) Teaching: Kenly/OK&NG	 Allows you to select whether you want to execute a teaching for OK products only or both OK product and NG product.
B.L.PTN: (ON/OFF10/OFF30/OFF60) Backlight Pattern function: Sets the backlight of the finder unit OFF	
L.ON.OF: (ON / OFF) LED On/Off function: Allows you to select whether or not to use the built-in LED light	
V.IMG1 to 8 V.Image1 – 8: Displays up to eight saved images and the data detected when the image was saved	 ↑ When the image is saved, the detection data are displayed. When switching the image numbers, hold down the <7> and <8> button.
SV.IMG: (OFF / ALL / NG) Save Image function: Saves images during inspection	
A.SAVE: (ON / OFF) Auto Save function: Allows you to set to save the settings automatically	

ST.NO: (1 to 31) Station Number function: Sets a device number (unit) used for RS-232C communication	
BAUD.R: (9.6 to 57.6 kbps) Baud Rate function: Sets RS-232C communication speed	
OUT.D: (0 to 160 ms) in the 20 ms Output Delay function: Outputs inspection results after the original output timing	
CAP.D: (0 to 160 ms) in the 1 ms unit Capture Delay function: Sets the time delay from TRIGGER signal input to image capture	
I.TRR: (ON / OFF) Internal Trigger function:	<p>When the function is set to ON, the LightPixAE20 automatically performs continuous inspections When OFF, inspection is performed when TRIGGER signal is input.</p>
INI.T: (1 to 7) Initial Type: The selected product type number when the LightPixAE20 is turned on (available only for colored areas)	
SPEED: High / Middle / Low Speed: Allows you to select the processing time of measurement (available Color Judgement only)	
VER Version: Version, size of view range and system and operation unit versions. (Size of view range differs depending on the product number.)	<p>Color Area</p> <p>Color Judgement</p>
IOINI: (OFF / ON) I/O Initial Type function Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on	<ul style="list-style-type: none"> • OFF: Calls the product type No. that is set as an "Initial type" • ON: Calls the product type No. for the types of the signals that were input to the I/O port
T.TRG: (ON / OFF) Teaching Trigger function: Sets external trigger to ON (valid) or OFF (invalid)	
A.BACK: (ON / OFF) Answer back function: Displays the detection position in blue on the finder unit.	

4.2.5 Teaching in TEACHING Mode

In TEACHING mode, you can make and save the following settings for each product type:

- Exposure time: 0.03 - 50.00 ms
- Inspection area size/position: Sets the measurement area
- Color extraction area size/position: Sets the area for measuring the color to be saved
- Color: Registers the color existing most in the color extraction area

When you press the TRIGGER (<6>) button, the color within the color extraction area is registered.

Type of teaching

The following two types of teaching procedures are available:

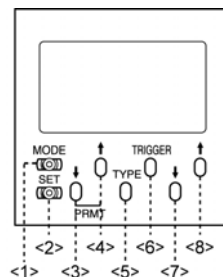
- Teaching for OK product only
- Teaching for OK and NG products

When performing a teaching, the minimum and maximum limits for the area set in JUDGEMENT CRITERIA SETTING mode is automatically set, but the area value varies depending on the type of teaching. See the table below.

Type	Allowable range to be set automatically
Teaching for OK product only	Sets to the area value when executing a teaching $\pm 5\%$
Teaching for OK and NG products	<p>Sets the max./min. area limit to the middle number between the area values for OK product and NG product.</p> <p>When the area for NG product is smaller than that for OK products:</p> <ul style="list-style-type: none"> • Max.: Area value when executing a teaching + 5% • Min.: Median between the area values each for OK product and NG product <p>The area for NG product is larger than that for OK product:</p> <ul style="list-style-type: none"> • Max.: Median between the area values for NG product and OK product • Min.: Area value when executing a teaching - 5%

Operation in TEACHING mode

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



TEACH: OK (teaching for OK product only)

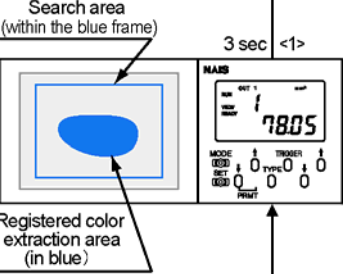
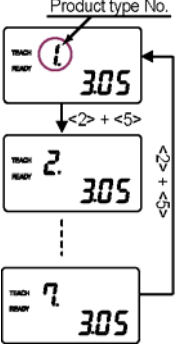
In INSPECTION (or RUN) mode	In TEACHING mode ("TEACH" is displayed)	
<p>Search area (within the blue frame)</p> <p>3 sec <1></p> <p>Registered color extraction area (in blue)</p>	<p>TEACH READY</p> <p>305</p> <p><5></p> <p>Exposure time: 0.03 to 50.00 ms (default: 3.05)</p> <ul style="list-style-type: none"> <7>: Decrease exposure time up to 0.03 ms <8>: Increase exposure time up to 50.00 ms 	<p>You can always change the product types by pressing <2> and <5> at the same time.</p> <p>Example:</p> <p>Product type No.</p> <p>TEACH READY</p> <p>305</p> <p><2> + <5></p> <p>TEACH READY</p> <p>2. 305</p> <p>...</p> <p>TEACH READY</p> <p>7. 305</p>
	<p>TEACH READY</p> <p>SIZE</p> <p><5></p> <p>SIZE: Resizes the inspection area</p> <p>If you want to perform a teaching at this point, press <6> and then <1>.</p>	
	<p>TEACH READY</p> <p>MOVE</p> <p><5></p> <p>MOVE: Moves the inspection area</p> <p>If you want to execute teaching, press <6> and then <1>.</p>	
	<p>TEACH READY</p> <p>T.SIZE</p> <p><5></p> <p>T.SIZE: Resizes the Color Extraction area</p> <p>If you want to execute a teaching at this point, press <6> first and then <1> after resizing.</p>	
	<p>TEACH READY</p> <p>T.MOVE</p> <p><6></p> <p>T.MOVE: Moves the Color Extraction area</p>	
	<p>TEACH READY</p> <p>DONE</p> <p><5></p> <p><6>: Executes a teaching</p> <p>Teaching is performed for the current product type.</p> <p>DONE: Indicates successful completion of teaching</p> <p>FAIL: Indicates unsuccessful completion of teaching (the ALARM signal is output).</p> <p><5>: Returns to the top.</p>	



◆ NOTE

Teaching with pressing the <6> TRIGGER button adjusts exposure time automatically. When you only change the value of exposure time, change the value and then press the <1> button but the <6> button. Changed value will be saved and you will return to RUN mode. Operation Unit cannot execute Teaching with specified exposure time. To execute Teaching without changing the set exposure time (or automatic adjusting), use the setting dedicated software, "AETOOL".

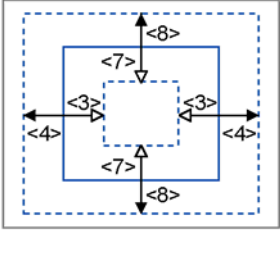
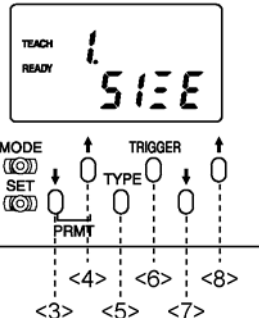
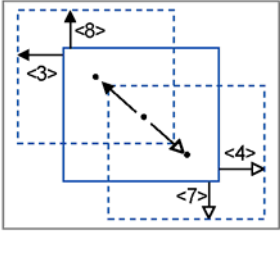
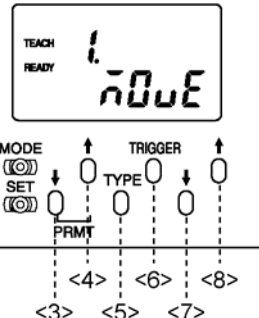
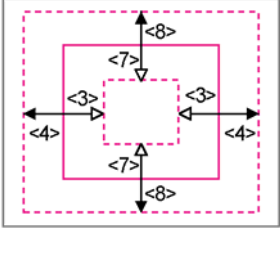
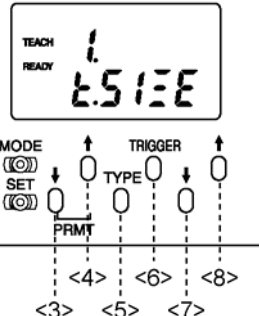
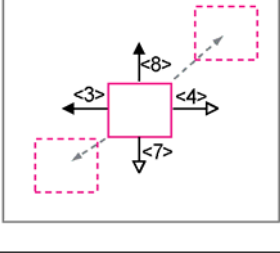
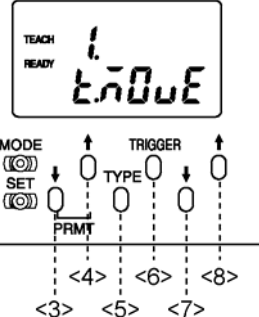
TEACH: OKNG (when perform a teaching for OK and NG products)

In INSPECTION (or RUN) mode	In TEACHING mode ("TEACH" is displayed.)	
	<p>TEACH READY 1. 3.05</p> <p>↓ <5></p> <p>Exposure time: 0.03 to 50.00 ms (default: 3.05)</p> <ul style="list-style-type: none"> <7>: Allows you to decrease exposure time up to 0.03 <8>: Allows you to increase exposure time up to 50.00 	<p>You can always change the product types by pressing the <2> and <5> buttons at the same time.</p> <p>Example.</p> <p>Product type No.</p> 
	<p>TEACH READY 1. SIZE</p> <p>↓ <5></p> <p>SIZE: Resizes inspection area</p> <p>If you want to perform a teaching at this point, press the <6> and then the <1>.</p>	
	<p>TEACH READY 1. MOVE</p> <p>↓ <5></p> <p>MOVE: Moves inspection area</p> <p>If you want to execute a teaching at this point, press the <6> and then the <1>.</p>	
	<p>TEACH READY 1. T.SIZE</p> <p>↓ <5></p> <p>T.SIZE: Resizes the Color Extraction area</p> <p>If you want to execute a teaching at this point, press the <6> first and then the <1> after resizing.</p>	
	<p>TEACH READY 1. T.MOVE</p> <p>↓ <6></p> <p>T.MOVE: Moves the Color Extraction area</p> <p><6>: Executes a teaching</p> <p>Executes a teaching for OK product of the current product type</p>	
	<p>TEACH READY 1. STNG</p> <p>↓ <6></p> <p>STNG: Indicates successful completion of teaching for OK products</p> <p><6>: Executes a teaching for NG products</p> <p>Executes a teaching for NG product of the current product type</p>	
	<p>TEACH READY 1. DONE</p> <p>↓ <5></p> <p>DONE: Indicates successful completion of NG product teaching</p> <p>FAIL: Indicates unsuccessful completion of teaching (the ALARM signal is output).</p> <p><5>: Returns to the top.</p>	

**◆ NOTE**

- If the ALARM signal is output after teaching is completed, the signal is held ON until teaching is successfully completed. As long as the unit keeps outputting the ALARM signal, it cannot properly execute an inspection. In this case, you have to execute a teaching again.
- Teaching with pressing the <6> TRIGGER button adjusts exposure time automatically. When you only change the value of exposure time, change the value and then press the <1> button but the <6> button. Changed value will be saved and you will return to RUN mode. Operation Unit cannot execute Teaching with specified exposure time. To execute Teaching without changing the set exposure time (or automatic adjusting), use the setting dedicated software, "AETOOL".

Resizing and positioning the reading area

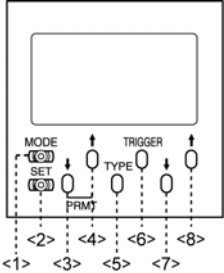
Setting item	Description
 	<p>Adjustment of inspection area size: SIZE</p> <p>X direction (wide)</p> <ul style="list-style-type: none"> • <3>: Reduces the inspection area • <4>: Enlarges the inspection area <p>Y direction (length)</p> <ul style="list-style-type: none"> • <7>: Reduces the inspection area • <8>: Enlarges the inspection area <p>The inspection area is displayed in "blue".</p>
 	<p>Movement of inspection area: MOVE</p> <ul style="list-style-type: none"> • <3>: Moves the inspection area to the left. • <4>: Moves the inspection area to the right. • <8>: Moves the inspection area up. • <7>: Moves the inspection area down
 	<p>Adjustment of Color Extraction area size: T.SIZE</p> <p>X direction (wide)</p> <ul style="list-style-type: none"> • <3>: Reduces the color extraction area • <4>: Enlarges the color extraction area <p>Y direction (length)</p> <ul style="list-style-type: none"> • <7>: Reduces the color extraction area • <8>: Enlarges the color extraction area
 	<p>Movement of Color Extraction area: T.MOVE</p> <ul style="list-style-type: none"> • <3>: Moves the color extraction area to the left. • <4>: Moves the color extraction area to the right. • <8>: Moves the color extraction area up. • <7>: Moves the color extraction area down

4.2.6 Setting Judgement Criteria in JUDGEMENT CRITERIA SETTING mode

In JUDGEMENT CRITERIA SETTING mode, you can set the minimum and maximum area limits that the unit judges as OK in mm² unit. Upon the completion of teaching, the area limits have been set for the type of teaching and detected area. Change the limits as necessary in JUDGEMENT CRITERIA SETTING mode.

Operation in JUDGEMENT CRITERIA SETTING mode

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



In INSPECTION (or RUN) mode	In JUDGEMENT CRITERIA SETTING mode ("SET" is displayed on the operation unit.)
	<p>Top line: Product type number and current min. area limit*</p> <p>Bottom line: L (min. value), minimum value to be set</p> <ul style="list-style-type: none"> <7>: Increases the min. value <8>: Decreases the min. value
	<p>Top line: Product type number and current max. area limit*</p> <p>Bottom line: H (max. value), maximum value to be set</p> <ul style="list-style-type: none"> <7>: Increases the max. value <8>: Decreases the max. value



NOTE

The currently registered minimum and maximum area limits indicate reference values to change the value or return to the original value in the bottom line. When you enter JUDGEMENT CRITERIA SETTING mode again after setting the min. and max. area limits and switching to RUN mode, the current setting value in the bottom line is displayed as a "current value" in the top line.

4.2.7 Inspection Execution

The ways of inspection execution

Internal trigger: ON	Inspection is automatically executed by switching to RUN mode
Internal trigger: OFF	After switching to RUN mode, input the TRIGGER signal to external devices or press the TRIGGER button.

Inspection judgement results

Inspection judgement results are output to the parallel ports of OUT1 to OUT3. See the table shown below.

Color Area

Judgement results		OUT3	OUT2	OUT1
OK	Within the range	OFF	OFF	ON
NG	Out of the range	OFF	OFF	OFF

Color Judgement

Color (Product type) No.	OUT3	OUT2	OUT1
No applicable = All NG	OFF	OFF	OFF
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	ON	ON
4	ON	OFF	OFF
5	ON	OFF	ON
6	ON	ON	OFF
7	ON	ON	ON



◆ NOTE

Internal Trigger: Switches ON/OFF in CONFIGURATION mode

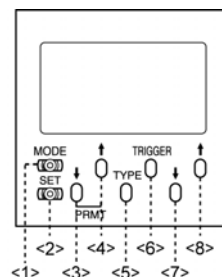


◆ REFERENCE

Parallel input/output timing chart: Page 118

Checking inspection data

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



Color Area

When inspecting in RUN mode, you can check the area value.

Data display and product type switch	
	<p>Top line: Product type number The <3>, <4> and <5> buttons: Changes the product types. Once you change them, the signals of OUT1 to 3 are reset.</p> <p>Bottom line: Area value Area value: Up to four digits* including the numbers under the decimal point * (The digits under the decimal point differs depending on the type of unit.)</p>

Color Judgement

When inspecting in RUN mode, you can check the selected product type No. and measured area value.

Data Display	
	<p>Top line: Product type numbers (1 to 7) Bottom line: Area value Area value: Up to four digits* including the numbers under the decimal point (The digits under the decimal point differs depending on the type of unit.)</p>

*The range of area values

Unit Data	ANE2000	ANE2010	ANE2020	ANE2030
Area value	0 to 3.20	0 to 80.00	0 to 750.0	0 to 5600

4.3 Color Pattern Matching and Gray Pattern Matching

4.3.1 Overview of Color Pattern Matching and Gray Pattern Matching

Pattern Matching is a function that detects the registered base image (template) in the inspection area (, which is called "Searching"). When the image is detected, the function judges whether the position of the image is within the set allowable range from the base position.

The LightPixAE20 saves the information of every pixel within the template as feature of the template and finds out the same (or similar) image as the template based on the information. How much similar between them is called "degree of similarity", which is indicated in numeric values, 0 to 100. The procedures for searching are called "steps" (of the first to third). You can alter the inspection conditions for each step.

Although one template can be saved for each of seven product types, the device inspects every type separately. To detect the different object, switch the product types of LightPix to execute inspections.

Color Pattern Matching and Gray Pattern Matching scan different type of images.

Gray Pattern Matching

The function registers and inspects a gray image. A gray image is formed by converting signal sent from a camera into 256 tones. When it is needless to focus on a particular color, use Gray Pattern Matching.

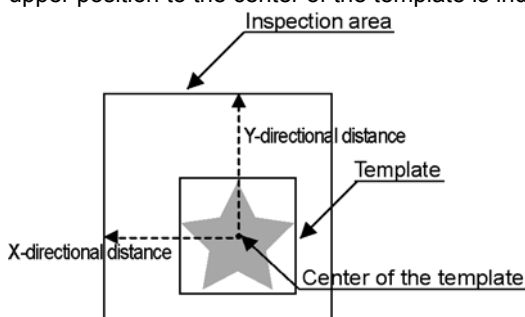
Color Pattern Matching

The function registers and inspects an image that is formed by extracting a particular color. After extracting, it becomes a binary image consisting of the extracted parts and the other. (One product type registers one color and one template.)

To inspect on an area with a particular color, use Color Pattern Matching. However, change in color of objective area (such as brightness or color tone) from registration fails to extract. In that case, use Gray Pattern Matching alternatively.

Showing the template position

A template is positioned within the inspection area, and its X-and Y-directional distance from the left upper position to the center of the template is indicated in mm.



Outputting the template to the ports of OUT1 to 3

The way of outputting template to the ports of OUT1 to 3 varies depending on the following inspection item:

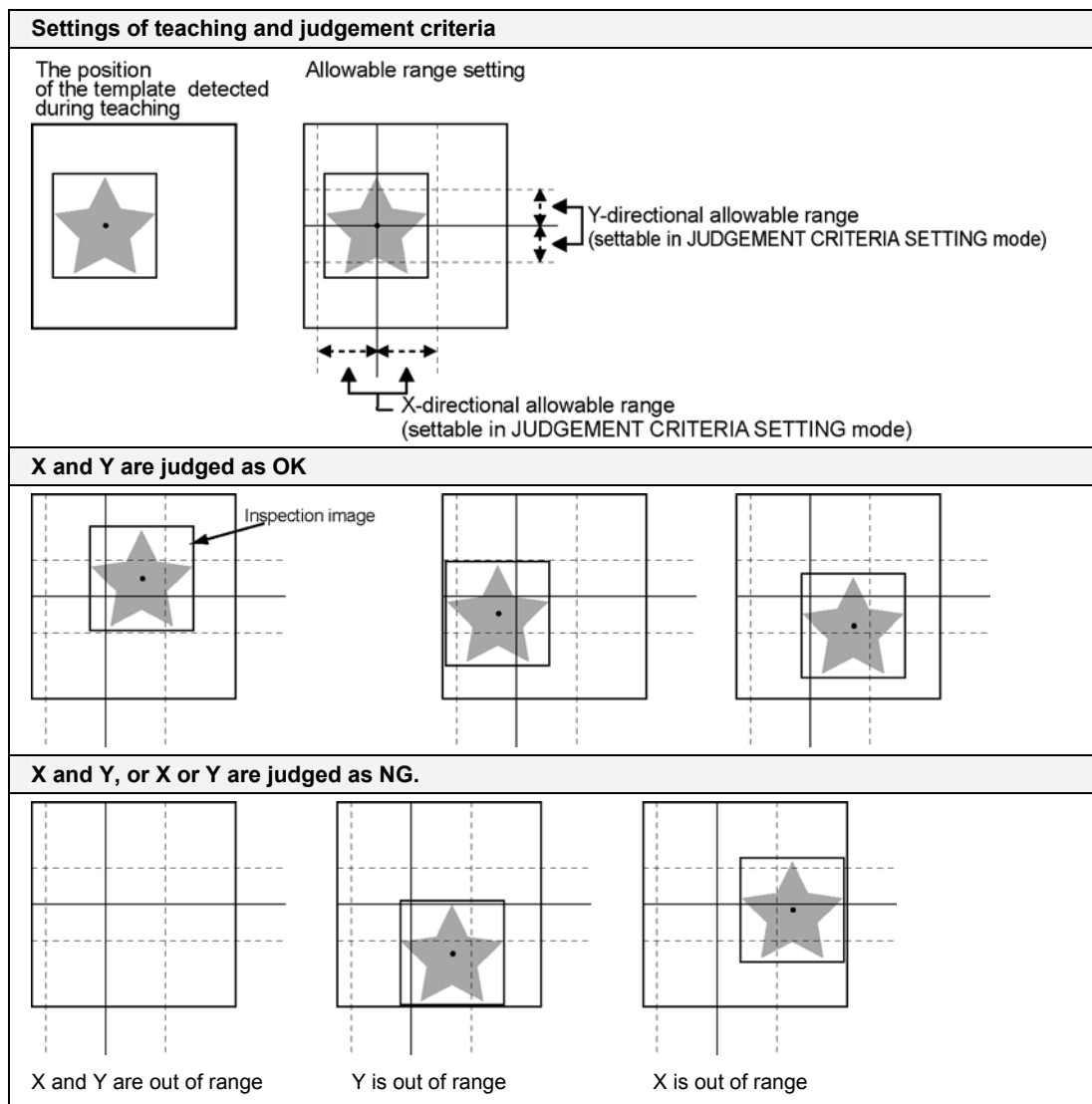
- Was the template detected?
- Is the X-directional position of the detected template within the allowable range?
- Is the Y-directional position of the detected template within the allowable range?

Signals output to the ports of OUT1 to 3 differ depending on the result of the inspection item above (see the table shown below).

Inspection Results			OUT3	OUT2	OUT1
Template Detection	X position	Y position			
YES	YES	YES	ON	ON	ON
YES	YES	NO	OFF	ON	ON
YES	NO	YES	ON	OFF	ON
YES	NO	NO	OFF	OFF	ON
NO	---	---	OFF	OFF	OFF

Conditions under which inspection image position is judged as OK

If the detected image is positioned within the position of the saved template +/- allowable range (settable in JUDGEMENT CRITERIA SETTING mode), the LightPixAE20 judges as OK.



About inspection steps

The LightPixAE20 searches an image similar to the template within the inspection area at second and third steps separately. The number of steps varies depending on the inspection speed (settable in CONFIGURATION mode) When the inspection speed is set to “High” or “Middle”, inspection is performed in three steps, and when it is set to “Low”, it is performed in two steps.

When inspection is set to high/middle and low, the unit roughly estimates the position of the object at the first and second steps and the first step respectively, then it finds out the exact position. At the first and second steps, the unit searches by converting the saved image into the rough image (the rough images can be searched more rapidly following these steps). At the final step, it detects the exact position of the object (the image at the first step is rougher than the one at the second step). Following these steps enables the LightPixAE20 to search the target image faster.

For reference

Inspection speed	Roughness of image (The greater the value, the rougher the image)		
	The 1st. step	The second step	The final step
High	8	4	2
Middle	8	4	1
Low	4	—	1

Detailed conditions

Detailed conditions mean the settable search conditions for each step. These conditions can be set in CONFIGURATION mode. There are the following two detailed conditions:

- Similarity Adjustment: Similarity Adjustments 1 and 2
- The of Detected Candidates: Detected Candidates 1 and 2

Detailed conditions: Similarity adjustment value

What is similarity adjustment?

The degree that the image matches the template is called a “degree of similarity”. The greater the degree of similarity is, the more similar the detected image. The lower the degree of similarity is, the less similar the detected image. If you wish to execute a strict inspection in order to detect the target image, increase the value, and if you wish to execute a rough inspection, decrease the value. Similarity adjustment means a searching by adjusting (or lowering) the similarity adjustment value.

Once you set the similarity adjustment value, the unit searches based on the value that similarity adjustment value was subtracted from the similarity value set in TEACHING and JUDGEMENT CRITERIA SETTING modes.

Example:

Setting value			Adjusted degree of similarity	Description
Similarity	80			
Adjustment value (for the 1st. step)	20		The 1 st . step 60	=80-20=Degree of similarity-Adjustment1
Adjustment value (for the 2nd. step)	10		The 2 nd . step 70	=80-10=Degree of similarity-Adjustment2
			The final step 80	= Similarity

It is recommended that you use the Adjustment Similarity function in the following cases:

As described above, at the first and second steps, the unit searches the target image in a rough image. Even if the degree of similarity is high for the original image, it becomes lower than the set Adjustment Similarity for the rough image. This may results in detection failure. If you perform a strict (80 or more) searching at the final step, it is recommended that you use this Adjustment Similarity function.

Detailed conditions: Number of detection candidates

Number of detection candidates


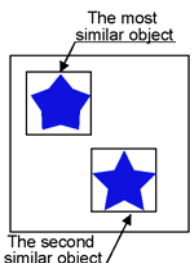
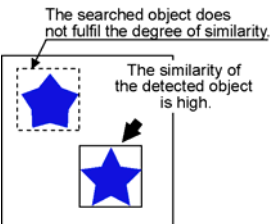
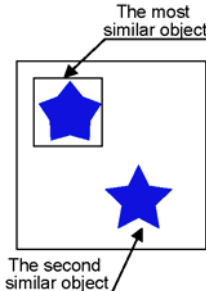
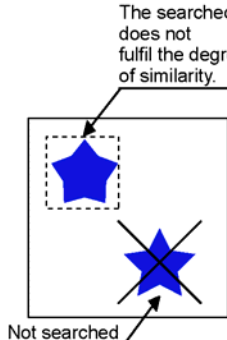
At the first and second steps, if you set the number of detection candidates when there are multiple images having more than the specified degree of similarity, you can detect the images of the specified number. The detected multiple images are called the “number of detection candidates”. If you do not set the number of detection candidates, only one candidate is detected at the first step. If multiple images are detected at the first step, the unit searches for each image at the second step and it continues the same operation until the final step.

It is recommended that you set the number of detection candidates in the following cases:

This feature would be helpful if there is an object in the same color as the object you want to detect, or the same pattern exist in the background as the part you want to detect.

For a searching for a rough image, the degree of similarity for these objects or background may become reversely higher than or equal to the target object or part. The unit detects only the image having the highest degree of similarity among the images having the degree of similarity more than the specified. Therefore, if the number of detection candidates is not set just like the following NG judgment, the unit detects an unwanted object or pattern at the first step, the degree of similarity gets lower after the unit keeps searching only the area up to the final step, which may result in the failure of the target image detection.

Example:

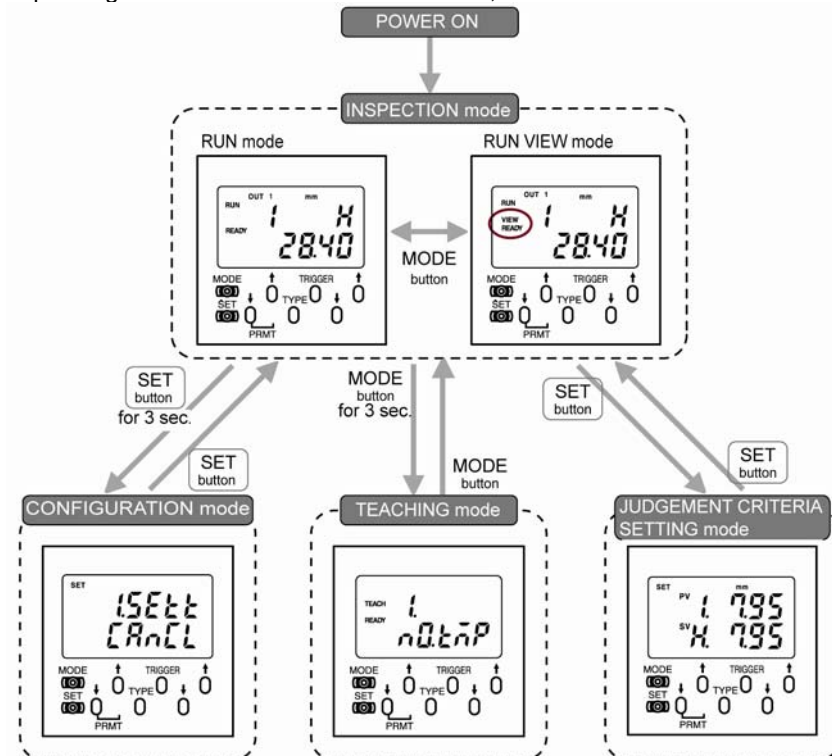
Setting of detection candidates	Template	The first and steps (The figure shown below is the original image. The unit actually searches in the rough image.)	The final step	Image detection judgement
When used				OK
When NOT used				NG

4.3.2 Setting Procedure and Modes

Make the inspection settings following the steps below:

1	Set up devices.	Install the main unit, and connect to a power supply unit, each unit and external devices.	Section 3
2	Turn the LightPixAE20 on.	Apply 24 V DC.	-
3	Configure the LightPixAE20 (in CONFIGURATION mode)	Set up the LightPixAE20 system in CONFIGURATION mode. Hardware settings of the unit, output method of reading data, saving method of captured images and other inspection conditions.	Page 50
4	Run a teaching (in TEACHING mode)	In TEACHING mode, register a template (base) image (and extraction color in Color Matching). At the same time, set exposure time and an area searching the template (inspection area).	Page 53
5	Set judgement criteria (in JUDGEMENT CRITERIA SETTING mode)	In JUDGEMENT CRITERIA SETTING mode, set the limits of area values (min. to max.) and the threshold value of degree of similarity for detected image.	Page 58
6	Execute an inspection (in RUN / RUNVIEW mode)	Press the TRIGGER button in RUN (RUN VIEW) mode.	Page 59

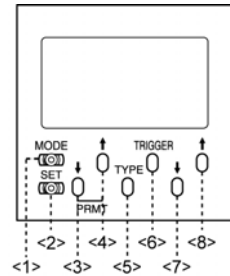
There are mainly four modes available for the LightPixAE20. The settings that you can make vary depending on the mode. To switch the modes, follow the instructions below.


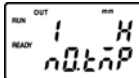

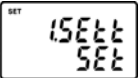
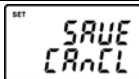

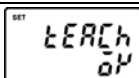
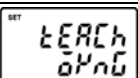
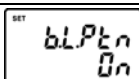
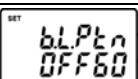
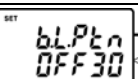
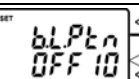
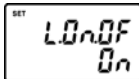
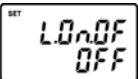
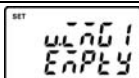
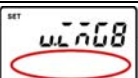
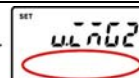
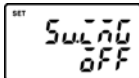
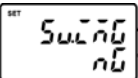
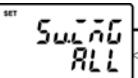



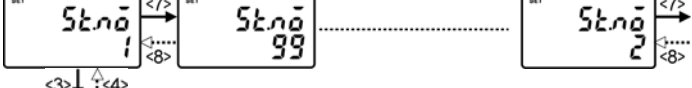
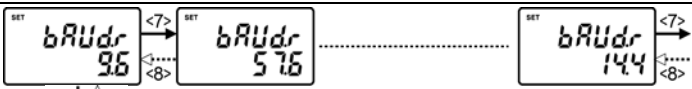
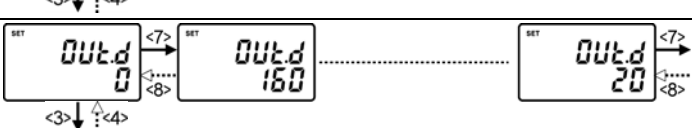
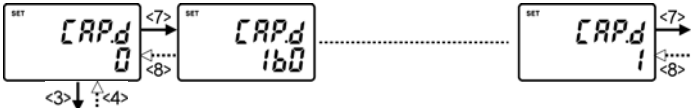
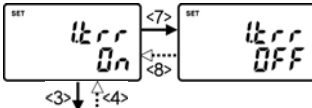
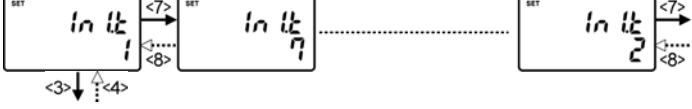

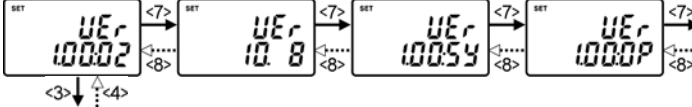
4.3.3 CONFIGURATION mode

In CONFIGURATION mode, you can set up the main, operation, and finder units, and save the settings. The setting items available in this mode are as follows:

The number in < > in the table below represents the button number of the operation unit (see section 4.8 Detailed Functions in CONFIGURATION Mode)



Function	Display on the operation unit (The left LCD display shows default settings.)
Upper: Function name and options to be displayed Middle: Name Lower: Description	
 Display when starting	 for 3 sec.
I.SETT: (CANCEL / SET) Initial Setting (default): Initializes the settings	  If you want to initialize the settings, select "SET" and press the <6> button for approximately three seconds.
SAVE: (CANCEL / SAVE) SAVE function: Saves the current settings	  If you want to save the settings, select "SAVE" and press the <6> button for approximately three seconds
TEACH: (OK / OKNG) Teaching: OK only/OK&NG:	  Allows you to select whether you want to execute a teaching for OK products only or both OK product and NG product
B.L.PTN: (ON/OFF10/OFF30/OFF60) Backlight Pattern function: Sets the backlight of the finder unit OFF	   
L.ON.OF: (ON / OFF) LED On/Off function: Allows you to select whether or not to use the built-in LED light	 
V.IMG1 to 8: V. Image 1 to 8: Displays up to eight saved images and the data detected when the image was saved	   ↑ When the image is saved, the detection data are displayed. When switching the image numbers, hold down the <7> and <8> button.
SV.IMG: (OFF / ALL / NG) Save Image function: Saves images during inspection	  

Function Upper: Function name and options to be displayed Middle: Name Lower: Description	Display on the operation unit (The left LCD display shows default settings.)
A.SAVE: (ON / OFF) Auto Save function: Allows you to set to save the settings automatically	
ST.NO: (1 to 31) Station Number function: Sets a device number (unit) used for RS-232C communication	
BAUD.R: (9.6 to 57.6 kbps) Baud Rate function: Sets RS-232C communication speed	
OUT.D: (0 to 160 ms) in the 20 ms Output Delay function: Outputs inspection results after the original output timing	
CAP.D: (0 to 160 ms) in the 1 ms unit Capture Delay function: Sets the time delay from TRIGGER signal input to image capture	
I.TRR: (ON / OFF) Internal Trigger function: When the function is set to ON, the LightPixAE20 automatically performs continuous inspections. When OFF, it performs an inspection every time trigger signal input.	
INI.T: (1 to 7) Initial Type: The selected product type number when the LightPixAE20 is turned on (available only for colored areas)	
SPEED: (High / Mid / Low) Speed High: High speed, low resolution Low: Low speed, high resolution	
VER Version: Version, size of view range and system and operation unit versions. (Size of view range differs depending on the product number.)	

Function Upper: Function name and options to be displayed Middle: Name Lower: Description	Display on the operation unit (The left LCD display shows default settings.)
The following four functions are available only if the DETAL function is turned ON.	
REVI2: (0 to 50) Revise2 function: Adjusts the threshold for the degree of similarity at the second step by decreasing by the set value	
REVIS: (0 to 50) Revise function Adjusts the threshold for the degree of similarity at the first step by decreasing the set value	
CAND2: (1 to 50) Candidate2: Indicates the number of detection candidates at the second step	
CAND1: (1 to 50) Candidate1: Indicates the number of detection candidates at the first step	
DETAL: (ON / OFF) Detail function: Allows you to select whether or not to make the settings of computation conditions	<ul style="list-style-type: none"> • OFF: Make the detailed settings • ON: Not make the detailed settings. (Default values are used for searching.)
IOINI: (OFF / ON) I/O Initial Type function Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on	<ul style="list-style-type: none"> • OFF: Calls the product type No. that is set as an "Initial type" • ON: Calls the product type No. for the types of the signals that were input to the I/O port
T.TRG: (ON / OFF) Teaching Trigger function: Sets external trigger to ON (valid) or OFF (invalid)	
A.BACK: (ON / OFF) Answer Back function: Displays a detected color in blue on the finder unit	

4.3.4 Teaching in TEACHING Mode

In TEACHING mode, you can make and save the following settings for each product type:

- Exposure time: 0.03 to 50.00 ms
- Color extracting area size/position: Sets the area for searching the registered color (Only for Color Matching)
- Color: Registers the color existing most in the color extraction area (Only for Color Matching)
- Template area size/position: Sets the area for specifying the image to be registered
- Base image (template): In an extraction image, saves the information about the image within the template area
- The distance between the start point of a search area and base image (template) (in the X and Y directions)

Type of teaching

There are following two ways of performing a teaching:

- Teaching for OK products only
- Teaching for OK and NG products

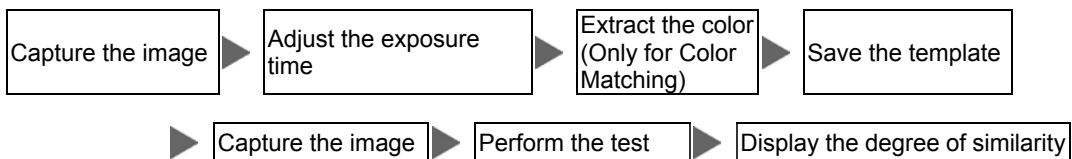
When performing a teaching, the allowable range of the distance between the start point of a search area and the middle point of the base image (template) (in the X and Y direction) is automatically set. The allowable range to be set automatically depends upon the type of teaching (see the table shown below).

Type	Allowable range to be automatically set
Teaching for OK products only	Sets to the template position detected during teaching (+/- 5%)
Teaching for OK and NG products	<p>When the limit for NG product is lower than that for OK product (short distance):</p> <ul style="list-style-type: none"> • Plus: Distance value when executing a teaching + 5% • Minus: Median between the distance values for OK product and NG product <p>When the limit for NG product is higher than that for OK product (long distance):</p> <ul style="list-style-type: none"> • Plus: Median between the distance values for OK product and NG product • Minus: Distance value when executing a teaching – 5%

Change the allowable range that has been automatically set while in Judgement Criteria Setting mode.

Notice on teaching

After changing to TEACHING mode, set each item and press the TRIGGER button to execute a teaching. The processing flow of the unit is as follows:



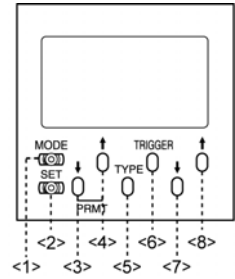
As the processing flow shown above, after saving the template, the LightPixAE20 captures a new image and perform the test. If any image within the allowable limit does not detected, teaching is not properly completed. The unit recognizes that teaching is unsuccessfully completed and outputs the ALARM signal. In this case, you have to perform a teaching from the beginning again.

If the first captured image is different from the one captured during the test, there is a high possibility of teaching failure. After starting a teaching, do not move the object until the completion of teaching.

Operation in TEACHING mode

Operation in TEACHING mode differ the type of teaching. (The type of teaching is settable in CONFIGURATION mode.)

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



TEACH: OK (teaching for OK product only)

In INSPECTION (or RUN) mode	In TEACHING mode ("TEACH" is displayed)		
<div><div>Search area (within the blue frame)</div><div>Template area (within the pink frame)</div><div>Registered color extraction area (in blue) (only for Color Pattern Matching)</div><div><div>NAIS</div><div>MODE</div><div>TEST</div><div>REP</div><div>0</div><div>0</div><div>0</div><div>0</div><div>30.38</div><div>3 sec.</div></div></div>	<div><div>TEACH READY</div><div>TEMP</div><div>1</div></div> <div><5></div>	TEMP: Saved template The saved template image is displayed at the left upper area on the finder unit.	NO TEMP: When no template is saved
	<div><div>TEACH READY</div><div>193</div></div> <div><5></div>	Exposure time: 0.03 to 50.00 ms (default: 1.93) <7> : Shortens the exposure time <8> Extends the exposure time If you want to perform a teaching at this point, press <6> and then <1>	<div>Product switch</div> <div>Press <2> and <5> at the same time to change the product types.</div> <div>Product type No.</div> <div><div>TEACH READY</div><div>1</div><div>193</div></div> <div><2> + <5></div> <div><div>TEACH READY</div><div>2</div><div>193</div></div> <div>⋮</div> <div><div>TEACH READY</div><div>7</div><div>193</div></div>
	<div><div>TEACH READY</div><div>SIZE</div></div> <div><5></div>	SIZE: Resizes inspection area If you want to perform a teaching at this point, press <6> and then <1>.	
	<div><div>TEACH READY</div><div>MOVE</div></div> <div><6></div>	MOVE: Moves the inspection area If you want to execute a teaching, press <6> and then <1>.	
	<div><div>TEACH READY</div><div>T.SIZE</div></div> <div><5></div>	T.SIZE: Resizes the Color Extraction area (Only for Color Matching) If you want to execute teaching, press <6> and then <1>.	
	<div><div>TEACH READY</div><div>T.MOVE</div></div> <div><5></div>	T.MOVE: Moves the Color Extraction area (Only for Color Matching) If you want to execute a teaching at this point, press <6> first and then <1> after resizing.	
	<div><div>TEACH READY</div><div>M.SIZE</div></div> <div><5></div>	M.SIZE: Resizes the template area If you want to perform a teaching at this point, press <6> and then <1>.	
	<div><div>TEACH READY</div><div>M.MOVE</div></div> <div><5></div>	M.MOVE: Moves template area If you want to perform a teaching at this point, press <6> and then <1>.	
	<div><div>TEACH READY</div><div>085</div></div> <div><6></div>	The <6> button: Executes a teaching Teaching is performed for OK products of the current product type.	
	<div><div>TEACH READY</div><div>Adj</div><div>85</div></div> <div><5></div>	ADJ: Teaching is being performed Values (two digits): The degree of similarity detected during the test run When the unit completed a teaching, the degree of similarity appears in the ADJ display area.	
	<div><div>TEACH READY</div><div>93</div><div>85</div></div> <div><5></div>	<5>: Returns to the top.	
		<div><div>TEACH READY</div><div>DONE</div><div>MOVE</div></div>	



◆ NOTE

Teaching with pressing the <6> TRIGGER button adjusts exposure time automatically.

When you only change the value of exposure time, change the value and then press the <1> button but the <6> button. Changed value will be saved and you will return to RUN mode.

Operation Unit cannot execute Teaching with specified exposure time.

To execute Teaching without changing the set exposure time (or automatic adjusting), use the setting dedicated software, "AETOOL".

TEACH: OKNG (Teaching for OK product and NG product

In INSPECTION (or RUN) mode	In TEACHING mode ("TEACH" is displayed)		
<p>Search area (within the blue frame)</p> <p>Template area (within the pink frame)</p> <p>Registered color extraction area (in blue) (only for Color Pattern Matching)</p> <p><1> 3 sec.</p>	<div>TEMP: Saved template</div> <div>The saved template image is displayed at the left upper area on the finder unit.</div> <div>TEACH READY L TEMP</div> <div><5></div>	NO TEMP: If no template is saved	<div>TEACH READY L nO TEMP</div>
	<div>Exposure time: 0.03 to 50.00 ms (default: 1.93)</div> <ul style="list-style-type: none"> <7>: Shortens time <8>: Extends time <div>TEACH READY L 1.93</div> <div><5></div>	If you want to perform a teaching at any point, press <6> and then <1>.	Product type switch Press the <2> button and the <5> button at the time to change the product types. Product type No. <div>TEACH READY 1 1.93</div> <div><2> + <5></div> <div>TEACH READY 2 1.93</div> <div>⋮</div> <div>TEACH READY ? 1.93</div>
	<div>SIZE: Resizes inspection area</div> <div>TEACH READY L SIZE</div> <div><5></div>		
	<div>MOVE: Moves inspection area</div> <div>TEACH READY L MOVE</div> <div><6></div>		
	<div>T.SIZE: Resize the color extraction area (Only for Color Matching)</div> <div>TEACH READY L T.SIZE</div> <div><5></div>		
	<div>T.MOVE: Moves the color extraction area (Only for Color Matching)</div> <div>TEACH READY L T.MOVE</div> <div><5></div>		
	<div>M.SIZE: Resizes the template area size</div> <div>TEACH READY L M.SIZE</div> <div><5></div>		
	<div>M.MOVE: Moves template area</div> <div>TEACH READY L M.MOVE</div> <div><5></div>		
	<div>Upper line: The degree of similarity for the previous teaching "0" is displayed when executing a teaching for the first time.</div> <div>Lower line: M85 - the threshold value for degree of similarity</div> <div>TEACH READY L 0 M85</div> <div><6></div>		But, after executing a teaching for OK product, product type switch is unavailable before teaching for NG product.
	<div>ADJ: Teaching is being executed</div> <div>STNG: Teaching for OK product – Successful teaching</div> <div>FAIL: Teaching failure (ALARM signal is output).</div> <div>TEACH READY L Adj M85</div> <div><1></div>		Display of teaching completion Execute a teaching If teaching is successfully completed by the time of inspection area move, "DONE" is displayed a the upper line Example: <div>TEACH READY L DONE M85</div>
	<div><6> Teaching Execution</div> <div>Executes a teaching for NG product of the current product type</div> <div>Values (two digits): The degree of similarity detected during a test run</div> <div>When the unit completes a teaching, the degree of similarity appears in the ADJ display area.</div> <div>TEACH READY L 93 M85</div> <div><5></div>		
	<div><5>: Returns to the top.</div>		

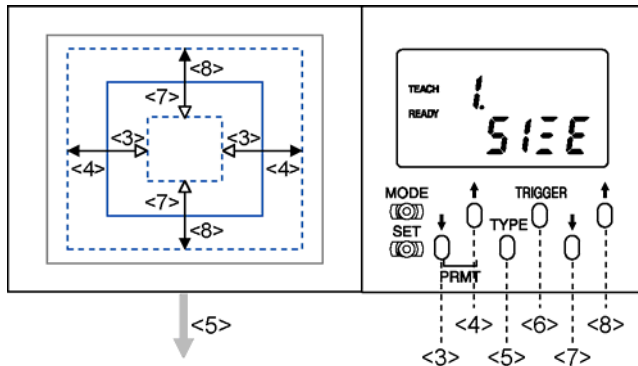


◆ NOTE

- If the ALARM signal is output after teaching is completed, the signal is held ON until teaching is successfully completed. As long as the unit keeps outputting the ALARM signal, it cannot properly execute an inspection. In this case, you have to execute a teaching again.
- Teaching with pressing the <6> TRIGGER button adjusts exposure time automatically. When you only change the value of exposure time, change the value and then press the <1> button but the <6> button. Changed value will be saved and you will return to RUN mode. Operation Unit cannot execute Teaching with specified exposure time. To execute Teaching without changing the set exposure time (or automatic adjusting), use the setting dedicated software, "AETOOL".

Resizing and positioning the inspection, template, and color extraction areas (only for Color Matching)

Resizing the inspection and color extraction areas



You can resize these three types of area following the common way. The figure on the left is an example inspection area.

Area	Display	Area color
Inspection	SIZE	Blue
Color extraction	T.SIZE	Black
Template	M.SIZE	Pink

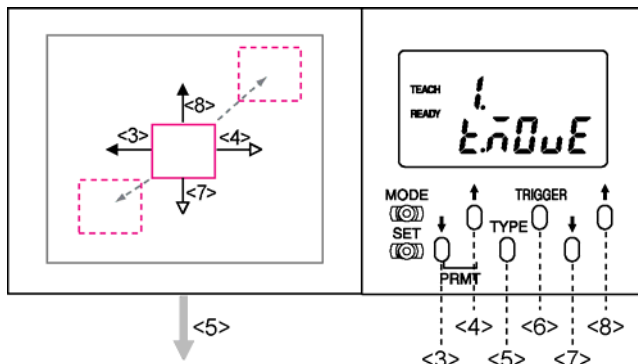
X direction (wide)

- The <3> button : Reduces the width
- The <4> button: Enlarges the width

Y direction (length)

- The <7> button: Reduces the length
- The <8> button: Enlarges the length

Moving the inspection and color extraction areas



You can move these three types of area following the common way. The figure on the left is an example template area.

Area	Display	Area color
Inspection	MOVE	Blue
Color extraction	T.MOVE	Black
Template	M.MOVE	Pink

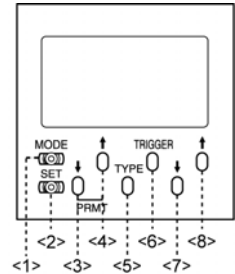
- The <3> button: Moves the area to the left
- The <4> button: Moves the area to the right
- The <8> button: Moves the area up
- The <7> button: Moves the area down

4.3.5 Setting Judgement Criteria in JUDGEMENT CRITERIA SETTING Mode

Based on the X-and Y-directional distance between the left upper corner of the inspection area that saved by teaching and the center of the template, set the allowable limit for OK judgement in mm. If the image is located within the range from the left upper corner of the inspection area to the median between the detection positions of the OK product and NG product when an OK/NG teaching was executed, change the limit in this mode as necessary. Set the degree of similarity of the detected image in this mode, too.

Operation in JUDGEMENT CRITERIA SETTING mode

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



In INSPECTION (or RUN) mode	In JUDGEMENT CRITERIA SETTING mode ("SET" is displayed)	
<p>Search area (within the blue frame)</p> <p>Template area (within the pink frame)</p> <p>Registered color extraction area (in blue) (only for Color Pattern Matching)</p>	<p>Top line: Product type number and current allowable limit*</p> <p>Bottom line: X, allowable limit to be set Sets the X-directional allowable limit</p>	
	<p>Top line: Product type number and current allowable limit*</p> <p>Bottom line: Y, allowable limit to be set Sets the Y-directional allowable limit</p>	
	<p>Top line: Product type number, the degree of similarity during a test run in TEACHING mode</p> <p>Bottom line: M, the degree of similarity to be set</p>	

4.3.6 Inspection Execution

The Ways of inspection execution

Internal trigger: ON	Inspection is automatically performed by switching to RUN mode.
Internal trigger: OFF	After switching to RUN mode, input the TRIGGER signal via the external device or press the TRIGGER button.

Inspection judgement results

Output judgement results to the parallel ports of OUT1 to OUT3 as the table shown below.

Judgement results		OUT3	OUT2	OUT1
All OK	An image having more than the specified degree of similarity is detected. X- and Y- positions (distance) is within the allowable range.	ON	ON	ON
Image Detection X = OK	An image having more than the specified degree of similarity is detected X-position (distance): Within the limit Y-position (distance): Out of the limit	OFF	ON	ON
Image Detection Y = OK	An image having more than the specified degree of similarity is detected. X-position (distance): Out of the limit Y-position (distance): Out of the limit	ON	OFF	ON
Image Detection	An image having more than the specified degree of similarity is detected, but X- and Y-position (distance) is out of range	OFF	OFF	ON
Any images having more than the specified degree of similarity are not detected.		OFF	OFF	OFF



◆ NOTE

Switch the internal trigger signal (I.TRR) ON/OFF in CONFIGURATION mode.



◆ REFERENCE

Parallel input/output timing chart: Page 118

Checking the measured data

When inspecting in RUN mode, you can confirm X- and Y- directional positions, degree of similarity and inspection time.

Display data switch		<p>Upper line: Product type number and data type Data type: X / Y / Time / M</p> <ul style="list-style-type: none"> • X: X-directional position • Y: Y-directional position • Time: Computation time • M: The degree of similarity <p>Lower line: Data value</p> <ul style="list-style-type: none"> • Position: Up to four digits* (including the numbers under the decimal point) • Computation time; Up to two digits (including the numbers under decimal point) • Degree of similarity: 0 - 100 <p>When the unit failed to detect an image having more than the degree of similarity, the screen display is as the figure shown right.</p>
Product type switch		<p>The <3>, <4> and <5> buttons: Changes the product types</p> <p>Once the product types are switched, OUT1 to 3 are reset</p>

*Range of position data

Type Data	ANE2000	ANE2010	ANE2020	ANE2030*
X	0 to 2.00	0 to 10.00	0 to 30.00	0 to 80.00
Y	0 to 1.60	0 to 8.00	0 to 25.00	0 to 70.00

*The view range changes within the range of 70 x 56 to 100 x 80 depending on the installation position of ANE2030, but the position data are converted into mm based on the range of view 80 x 70. Therefore, if you use the unit out of the view range 80 x 70, the position data differs from the actual size.

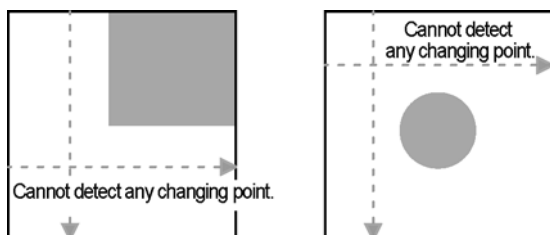
4.4 Edge Detection

4.4.1 Overview of Edge Detection

In a binarized image, the unit detects an edge in the inspection area. When the edge in the same direction as the base edge saved in TEACHING mode and the edges within the base distance +/- allowable limit are detected, it is judged as OK and OUT1 is turned ON.

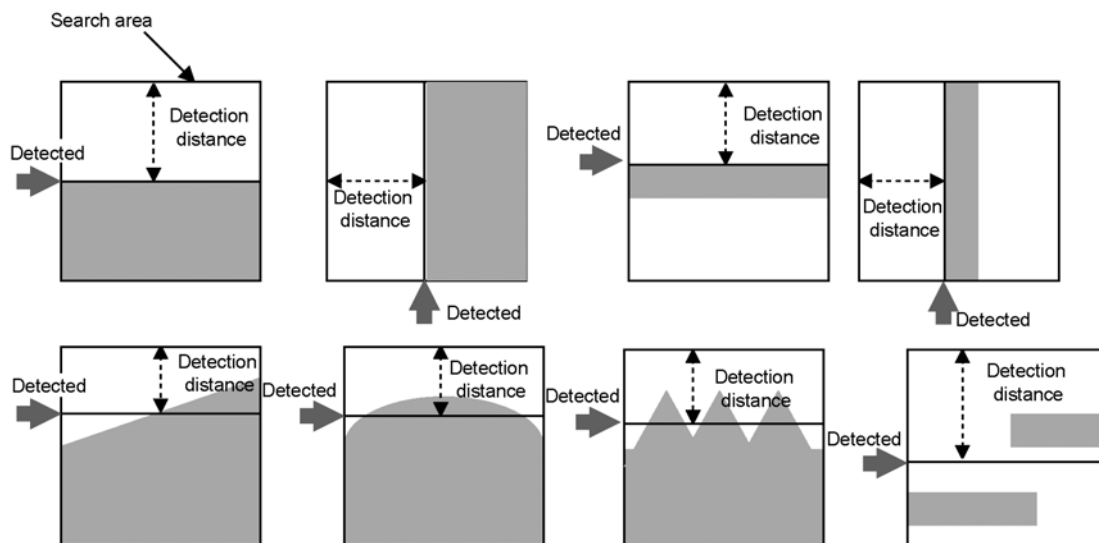
Conditions under which edges are detected

The unit scans within the inspection area from up to down (in the Y direction) and from left to right (in the X direction) and detects a point changing “from white to black” or “from black to white”. If you could detect an edge, changing points in whole scanning lines either in Y or X direction. Therefore, the unit cannot detect any edge in some scanning lines in the following images and judges as NG.



The example images where edges can be detected and the detection edge distance

The examples of detectable edges are shown as follows. The “detection distance of edges” is the data that the averaged position of the changing point detected in whole scanning lines was converted into distance.

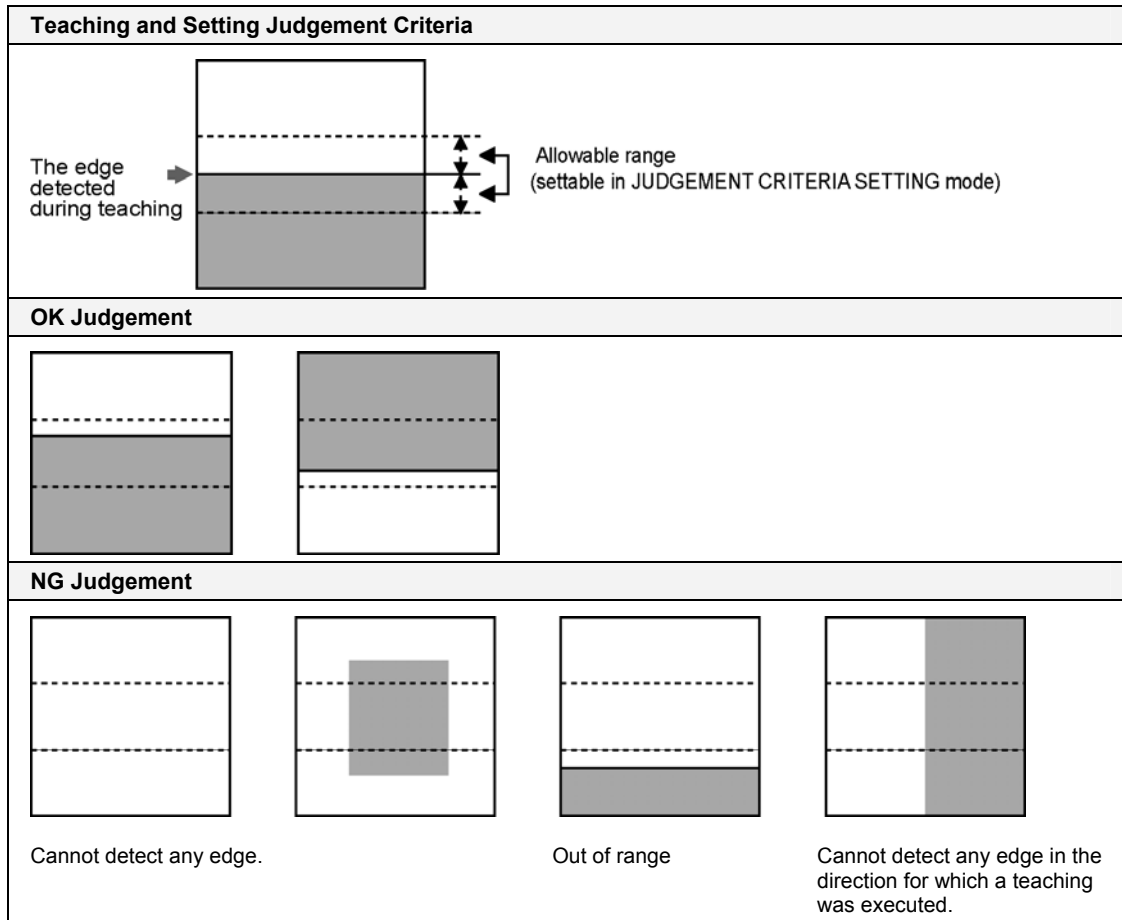


Conditions under which measuring results are judged as OK

If the detected edge meets the inspection results and following two conditions, it is judged as OK.

- The edge in the edge direction (X or Y) for which a teaching was executed must be detected.
- Detection edge distance does not exceed the edge distance for which a teaching was executed +/- allowable range set in JUDGEMENT CRITERIA SETTING mode.

Example:

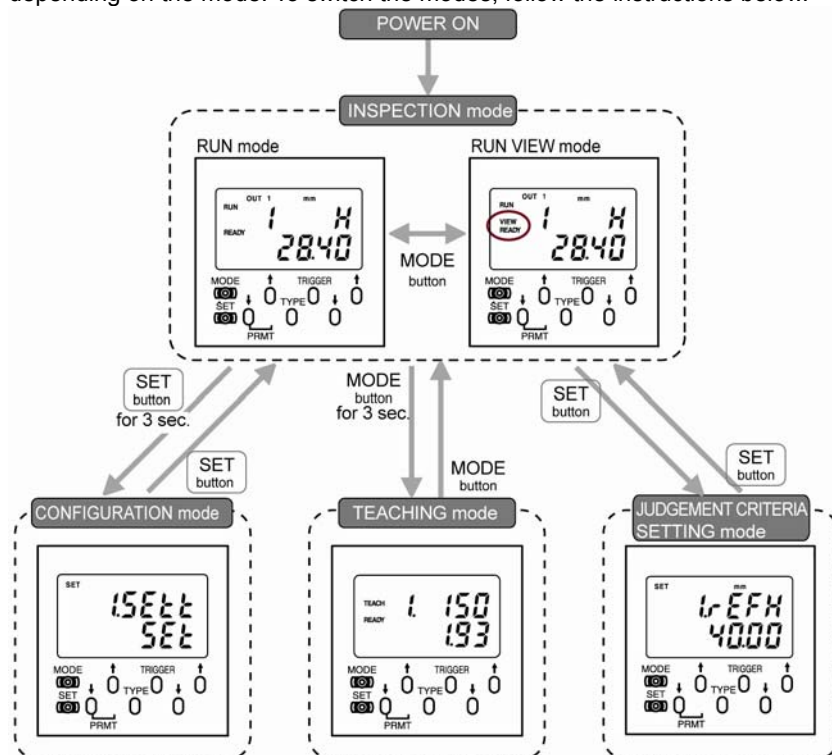


4.4.2 Setting Procedure and Modes

Inspection is performed following the steps below:

1	Set up devices.	Install the main unit, and connect to a power supply unit, each unit and external devices.	Section 3
2	Turn the LightPixAE20 on.	Apply 24 V DC.	---
3	Configure the LightPixAE20 (in CONFIGURATION mode)	Set up the LightPixAE20 system in CONFIGURATION mode. Hardware settings of the unit, output method of reading data, saving method of captured images and other inspection conditions.	Page 64
4	Run a teaching (In TEACHING mode)	In the TEACHING mode, register edge direction and distance, at the same time, set the exposure time or range for measuring area (inspection area), and area for setting extraction color.	Page 66
5	Set judgement criteria (In JUDGEMENT CRITERIA SETTING mode)	In JUDGEMENT CRITERIA SETTING mode, set the allowable limits of edge distance for teaching execution.	Page 70
6	Execute an inspection (In RUN / RUNVIEW mode)	Press the TRIGGER button in RUN (RUN VIEW) mode.	Page 71

There are mainly four modes available for the LightPixAE20. The settings that you can make vary depending on the mode. To switch the modes, follow the instructions below.

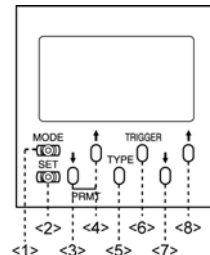



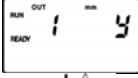
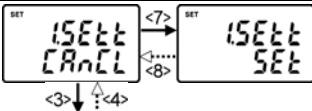
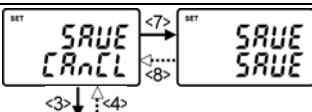
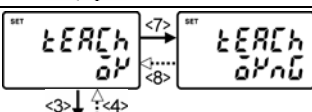
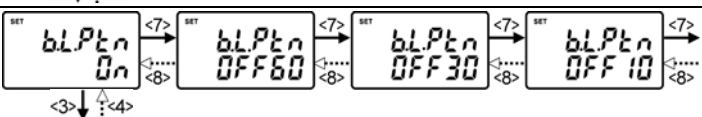
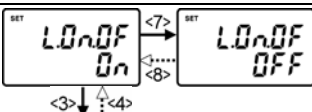
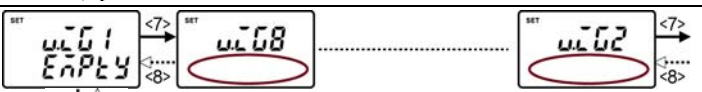
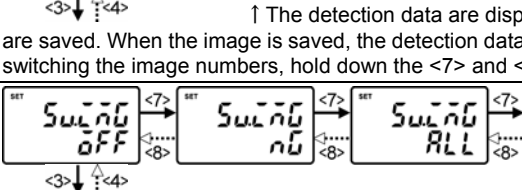
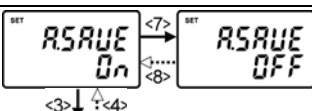
4.4.3 Setting Up the LightPixAE20 in CONFIGURATION Mode

In CONFIGURATION mode, you can set up the main, operation and finder units and also set and save the inspection/communication conditions as shown below.

Refer to section 4.8 "Detailed Functions in CONFIGURATION Mode" for details of each function.

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



Function	Display on the operation unit (The left LCD display shows default settings.)
Upper: Function name and options to be displayed Middle: Name Lower: Description	
 Display when starting	 For 3 sec.
I.SETT: (CANCEL / SET) Initial Setting (default): Initializes the settings	 If you want to initialize the settings, select "SET" and press the <6> button for approximately three seconds.
SAVE: (CANCEL / SAVE) SAVE function: Saves the current settings	 If you want to save the settings, select "SAVE" and press the <6> button for approximately three seconds.
TEACH: (OK / OKNG) Teaching: OK only/OK&NG:	 Allows you to select whether you want to execute a teaching for OK products only or both OK product and NG product
B.L.PTN: (ON/OFF10/OFF30/OFF60) Backlight Pattern function: Sets the backlight of the finder unit OFF	
L.ON.OF: (ON / OFF) LED On/Off function: Allows you to select whether or not to use the built-in LED light	
V.IMG1 to 8: V.Image1 to 8: Displays up to eight saved images and the data detected when the image was saved	 ↑ The detection data are displayed if any images are saved. When the image is saved, the detection data are displayed. When switching the image numbers, hold down the <7> and <8> button.
SV.IMG: (OFF / ALL / NG) Auto Save function: Allows you to set to save the settings automatically	
A.SAVE: (ON / OFF) Auto Save function: Allows you to set to save the settings automatically	

Function	Display on the operation unit
Upper: Function name and options to be displayed Middle: Name Lower: Description	(The left LCD display shows default settings.)
ST.NO: (1 to 31) Station Number Sets a device number (unit) used for RS-232C communication	
BAUD.R: (9.6 to 57.6 kbps) Baud Rate function: Sets RS-232C communication speed	
OUT.D: (0 to 160 ms) 20 ms Output Delay function: Outputs inspection results after the original output timing	
CAP.D: (0 to 160 ms) 1 ms Capture Delay function: Sets the time delay from TRIGGER signal input to image capture	
I.TRR: (ON / OFF) Internal Trigger function: When the function is set to ON, the LightPixAE20 automatically performs continuous inspections When OFF, inspection is performed when TRIGGER signal is input.	
INI.T: (1 to 7) Initial Type: Selected product type number when the LightPixAE20 is turned on (available only for colored areas)	
SPEED: High / Middle / Low Speed: Allows you to select the processing time of measurement	
VER Version: Version, size of view range and system and operation unit versions. (Size of view range differs depending on the product number.)	
IOINI: (OFF / ON) IO Initial Type function Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on	<ul style="list-style-type: none"> • OFF: Calls the product type No. that is set as an "Initial type" • ON: Calls the product type No. for the types of the signals that were input to the I/O port
T.TRG: (ON / OFF) Teaching Trigger function: Sets external trigger to ON (valid) or OFF (invalid)	
A.BACK: (ON / OFF) Answer Back function: Displays a detected color in pink on the finder unit	

4.4.4 Executing a Teaching in TEACHING Mode

In TEACHING mode, you can make and save the following settings for each product type:

- Exposure time: 0.03 to 50.00 ms
- Binary level: To set a threshold value in order to obtain a binary
- Inspection area size/position: To set a area where edges are detected
- Base edge distance: To register edge direction and distance as judgement

When you pressed the TRIGGER button (<6>), an edge is detected in the inspection area and the position is saved.

Types of Teaching

The following two types of teaching procedures are available:

- Teaching for OK products only
- Teaching for OK and NG products

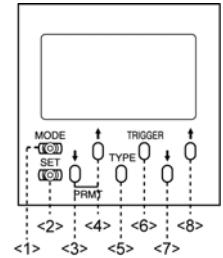
When executing a teaching, the allowable limit specified in JUDGEMENT CRITERIA SETTING mode is automatically set, but the max. and min. values differ depending on the type of teaching.

Type	Allowable range to be set automatically
Teaching only for OK	Sets to the area value when executing a teaching +/- 5%
Teaching for OK and NG products	<p>When the limit for NG product is lower than that for OK product (short distance):</p> <ul style="list-style-type: none"> • Plus: Distance value when executing a teaching + 5% • Minus: Median between the distance values for OK product and NG product <p>When the limit for NG product is higher than that for OK product (long distance):</p> <ul style="list-style-type: none"> • Plus: Median between the distance values for OK product and NG product • Minus: Distance value when executing a teaching – 5%

Operation in TEACHING mode

The teaching procedure differs between for OK product only and for OK/NG products. (Type of teaching is selectable in CONFIGURATION mode.)

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



TEACH: OK (teaching for OK products only)

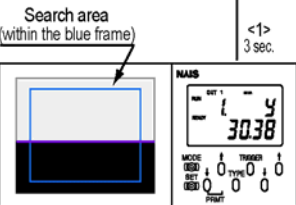
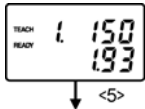
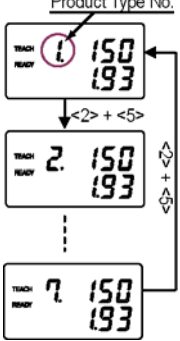


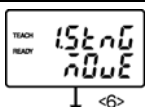

In INSPECTION (or RUN) mode	In TEACHING mode ("TEACH" is displayed.)
<p>Search area (within the blue frame)</p> <p>MODE: 0, SET: 0, TYPE: 0, TRIGGER: 0</p> <p>PRMT: 0</p> <p>3 sec.</p>	<p>TEACH READY: 1. 150 193</p> <p><5></p> <p>Upper line- Binary level: 0 – 255 (default: 150) <3>: Decreases the value <4>: Increases the value</p> <p>Lower line-Exposure time: 0.03 to 50.00 ms (default: 1.93) • <7>: Shortens the exposure time • <8>: Extends the exposure time If you want to perform a teaching at this point, press <6> first and then <1>.</p> <p>TEACH READY: 1. 150 193</p> <p><5></p> <p>SIZE: Resizes the inspection area</p> <p>If you want to execute a teaching at this point, press <6> first and then <1> after resizing.</p> <p>TEACH READY: 1. 150 193</p> <p><5></p> <p>MOVE: Moves inspection area</p> <p><6> : Executes a teaching for the current product type Teaching for the current product type is executed.</p> <p>TEACH READY: 1. 150 193</p> <p><5></p> <p>DONE: Indicates successful completion of teaching FAIL: Abnormal termination of teaching (the ALARM signal is output.) <5>: Returns to the top.</p>
	<p>You can always switch the product types by pressing <2> and <5> buttons at the same time.</p> <p>Product Type No.</p> <p>TEACH READY: 1. 150 193</p> <p><2> + <5></p> <p>TEACH READY: 2. 150 193</p> <p>...</p> <p>TEACH READY: 7. 150 193</p>



◆ NOTE

Teaching with pressing the <6> TRIGGER button adjusts exposure time automatically.
 When you only change the value of exposure time, change the value and then press the <1> button but the <6> button. Changed value will be saved and you will return to RUN mode.
 Operation Unit cannot execute Teaching with specified exposure time.
 To execute Teaching without changing the set exposure time (or automatic adjusting), use the setting dedicated software, "AETOOL"

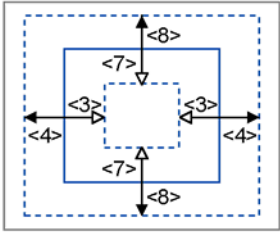
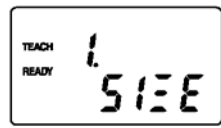
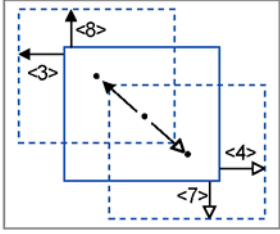
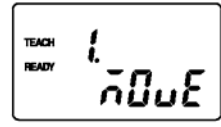
TEACH: OKNG (Teaching for OK and NG products)

In INSPECTION (or RUN) mode	TEACHING mode ("TEACH" is displayed.)	
 <p>Search area (within the blue frame)</p> <p><1> 3 sec.</p> <p><5></p> <p><6></p> <p><1></p> <p><5></p>	 <p>Upper line- Binary level: 0 – 255 (default: 150) <3>: Decreases the value <4>: Increases the value Lower line-Exposure time: 0.03 to 50.00 ms (default: 1.93)</p> <ul style="list-style-type: none"> <7>: Shortens the exposure time <8>: Extends the exposure time <p>If you want to perform a teaching at this point, press <6> first and then <1>.</p>	<p>You can always switch the product types by pressing <2> and <5> buttons at the same time.</p> <p>Product Type No.</p>  <p><2> + <5></p>
	 <p>SIZE: Resizes the inspection area</p> <p>If you want to execute a teaching at this point, press <6> first and then <1> after resizing.</p>	
	 <p>MOVE: Moves inspection area</p> <p><6>: Executes a teaching for the current product type Teaching for the current product type is executed.</p>	
	 <p>STNG: Teaching for OK products-Normal completion FAIL: Abnormal termination of teaching →The ALARM signal is output.</p> <p><6>: Executes a teaching Executes a teaching for NG product of the current product type</p>	
	 <p>DONE: Teaching for NG product-Normal completion FAIL: Abnormal teaching (the ALARM signal is output.)</p> <p><5>: Returns to the top.</p>	

**◆ NOTE**

- If the ALARM signal is output after teaching is completed, the signal is held ON until teaching is successfully completed. As long as the unit keeps outputting the ALARM signal, it cannot properly execute an inspection. In this case, you have to execute a teaching again.
- Teaching with pressing the <6> TRIGGER button adjusts exposure time automatically. When you only change the value of exposure time, change the value and then press the <1> button but the <6> button. Changed value will be saved and you will return to RUN mode. Operation Unit cannot execute Teaching with specified exposure time. To execute Teaching without changing the set exposure time (or automatic adjusting), use the setting dedicated software, "AETOOL".

Resizing and moving the inspection area

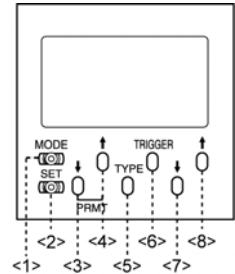
Setting items	Description
 	<p>Resize the inspection area size: SIZE</p> <p>X direction (width)</p> <ul style="list-style-type: none"> The <3> button: Reduces the width The <4> button: Enlarges the width <p>Y direction (length)</p> <ul style="list-style-type: none"> The <7> button: Reduces the length The <8> button: Enlarges the length <p>The inspection area is displayed in blue.</p>
 	<p>MOVE: Movement of inspection area position</p> <ul style="list-style-type: none"> The <3> button: Moves the inspection area to the left. The <4> button: Moves the inspection area to the right. The <8> button: Moves the inspection area up. The <7> button: Moves the inspection area down

4.4.5 Setting Up the Judgement Criteria in JUDGEMENT CRITERIA SETTING mode

Based on the base edge distance saved by teaching, specify the limit for OK judgement in mm. When executing a teaching, the proper values for teaching type and detected edge distance are set. Change the allowable limit in this mode as necessary.

Operation in JUDGEMENT CRITERIA SETTING mode

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



In INSPECTION mode	In JUDGEMENT CRITERIA SETTING mode ("SET" is displayed.)
<p>Search area (within the blue frame)</p> <p>Detection edge (in pink)</p> <p>MODE: 0, SET: 0, TYPE: 0, TRIGGER: 0</p> <p>3038 y</p>	<p>Ref X: Base edge distance – X direction Edge distance saved by teaching is displayed *Even if Y-directional edge is saved, default or X-directional edge is displayed.</p>
	<p>Ref Y: Base edge distance – Y direction The edge distance saved by teaching is displayed. *Even if X-directional edge is saved, default or Y-directional edge is displayed.</p>
	<p>Per X: Allowable range – X direction Settings of X-directional allowable limit</p> <ul style="list-style-type: none"> <8>: Increases the value (= extends the allowable range) <7>: Decreases the value (= reduces the allowable range)
	<p>Per Y: Allowable range – Y direction</p> <ul style="list-style-type: none"> <8>: Increases the value (= extends the allowable range) <7>: Decreases the value (=reduces the allowable range) <p>To product type 2</p>



◆ NOTE

For base edge in the X directions, the base edge distance (Ref Y) and allowable range (Per Y) in the Y direction does not affect the inspection judgement. Similarly, for base edge in the Y direction, base edge distance (Ref X) and allowable range (Per X) in the X direction does not affect the judgement.

4.4.6 Inspection Execution

The Ways of Inspection Execution

Internal trigger: ON	Inspection is automatically performed by switching to RUN mode.
Internal trigger: OFF	After switching to RUN mode, input the TRIGGER signal to external devices or press the TRIGGER button.


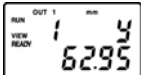

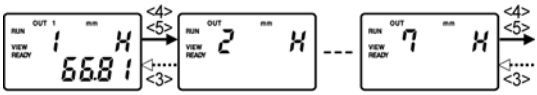
Inspection Judgement Results

Judgement results are output to the parallel ports of OUT1 to OUT3 as the table shown below

Judgement Results	OUT3	OUT2	OUT1
OK : Edge was detected and the detected edge distance is within the "base distance +/- allowable range."	OFF	OFF	ON
NG : Except those above	OFF	OFF	OFF

Checking the measured data

When executing an inspection in RUN mode, you can check the X- and Y- directional distance of the detected edge.

Display data switch		<p>Upper line: Product type number and type of data Type of data: X/Y</p> <ul style="list-style-type: none"> X: X-directional distance of the detected edge Y: Y-directional distance of the detected edge
	<p>or</p> 	
		<p>Lower line: Data value</p> <ul style="list-style-type: none"> Detection edge distance: Four digits including the numbers under the decimal point. (The number of digits under the decimal point differs depending on the type of unit.) When the unit failed to detect an edge, the screen display is as the figure on the right. 
	Data type in the edge direction saved by teaching and the data are displayed.	
Product type switch		<p>The <3>, <4> and <5> buttons: Changes the product types Once you change the product types, OUT1 to 3 are reset.</p>

*Range of data

Type Data	ANE2000	ANE2010	ANE2020	ANE2030*
X	0 to 2.00	0 to 10.00	0 to 30.00	0 to 80.00
Y	0 to 1.60	0 to 8.00	0 to 25.00	0 to 70.00

*The view range changes within the range of 70 x 56 to 100 x 80 depending on the installation position of ANE2030, but the position data are converted into mm based on the range of view 80 x 70. Therefore, if you use the unit out of the view range 80 x 70, the position data differs from the actual size.



4.5 Peak Detection

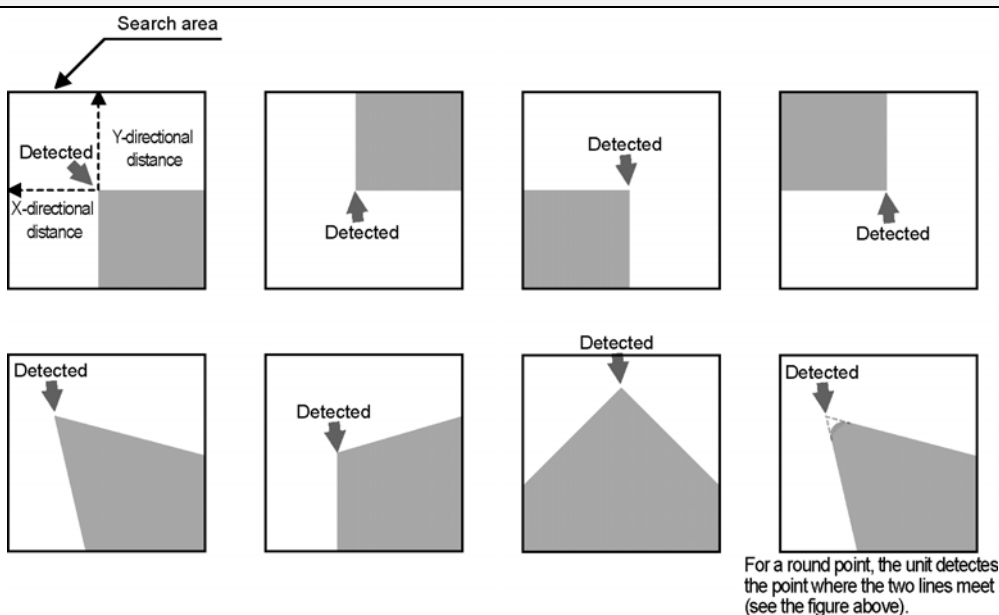
4.5.1 Overview of Peak Detection

In a binarized image, the unit detects a point in the inspection area. If the base point saved in TEACHING mode is detected, and the distance between the left upper of the point in the inspection area where the point is detected and the detected point is within the base position \pm allowable range, the image is judged as OK, and OUT1 is turned ON.

Detectable and undetectable peaks

The unit detects two points in the X and Y directions by computing the intersected point. The X- and Y-directional distance between the left upper part of the point in the inspection area and the detected point is displayed as a position of the detected point in mm.

Example detectable images



These are examples of black objects against a white background, but the unit can also detect a white object against a black background.

Undetectable image

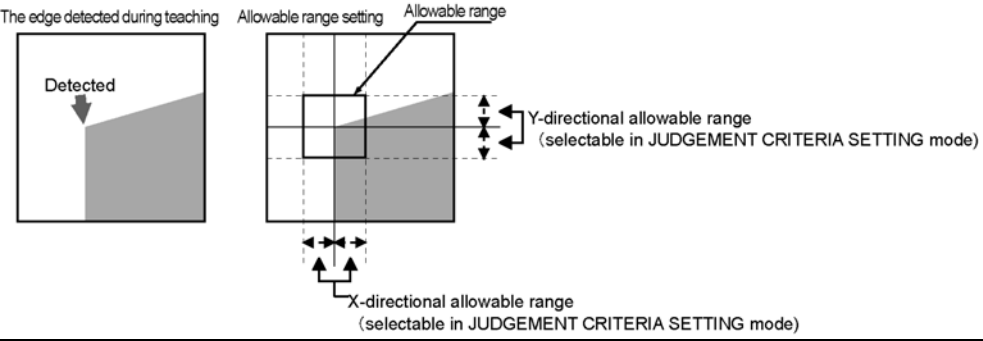
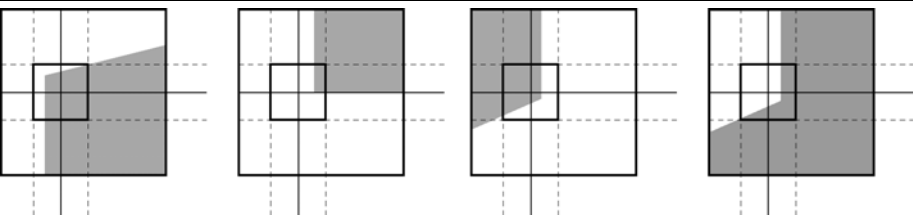
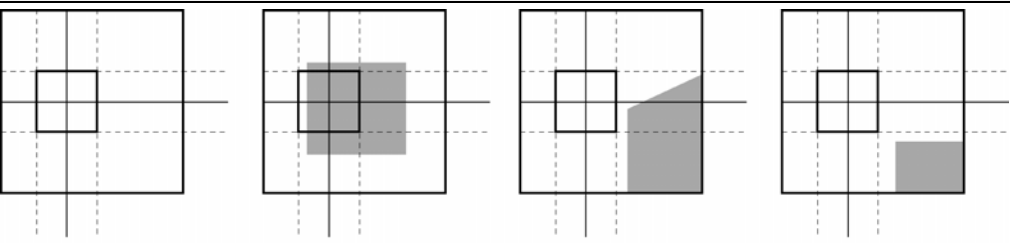


Conditions under the measuring results are judged as OK

As a result of inspection, if the image that meets the following two conditions, it is judged as OK.

- The points of the images must be detected.
- The detected X- and Y-directional distances must be within the distance between the left upper of the point in the inspection area and the detected point for which a teaching was executed +/- allowable range set in the JUDGE MENT CRITERIA SETTING mode. (If either of the directional distances is out of range, the unit judges it as NG.

Example

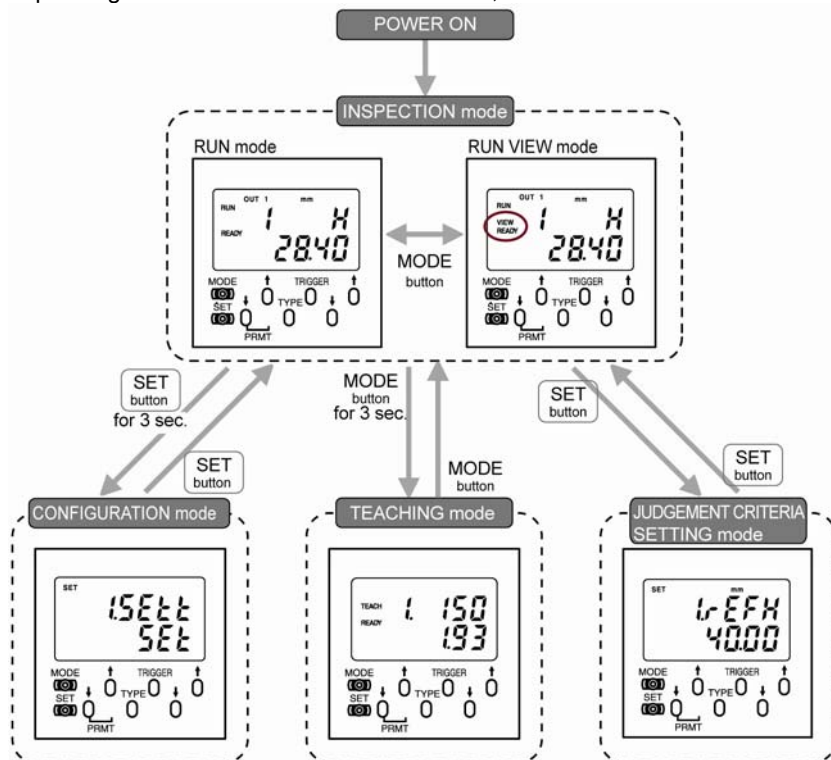
Settings of teaching and judgement criteria			
<p>The edge detected during teaching Allowable range setting Allowable range</p> 			
OK judgement			
 <p>The shape of the object is different, but the peak distance is within the allowable range.</p> <p>The brightness between the object and the background is reversed, but the peak distance is within the allowable range.</p>			
NG judgement			
 <p>Cannot detect any peak.</p> <p>X- or Y-directional detection distance is out of the allowable range.</p> <p>X- and Y-directional detection distances are out of the allowable range.</p>			

4.5.2 Setting Procedure and Modes

Inspection is performed following the steps below:

1	Set up devices.	Install the main unit, and connect to a power supply unit, each unit and external devices.	Section 3
2	Turn the LightPixAE20 on.	Apply 24 V DC.	-
3	Configure the LightPixAE20 (In CONFIGURATION mode)	Set up the LightPixAE20 system in CONFIGURATION mode. Hardware settings of the unit, output method of reading data, saving method of captured images and other inspection conditions.	Page 75
4	Run a teaching (In TEACHING mode)	In the TEACHING mode, register a distance between the left upper of the point in the inspection area and the detected point, set the exposure time or range for measuring area (inspection area), and area for setting extraction color.	Page 77
5	Set judgement criteria (In JUDGEMENT CRITERIA SETTING mode)	In JUDGEMENT CRITERIA SETTING mode, set the allowable distance limit between the left upper inspection area of the point and the point.	Page 81
6	Execute an inspection (In RUN / RUNVIEW mode)	Press the TRIGGER button in RUN (RUN VIEW) mode.	Page 82

There are mainly four modes available for the LightPixAE20. The settings that you can make vary depending on the mode. To switch the modes, follow the instructions below.

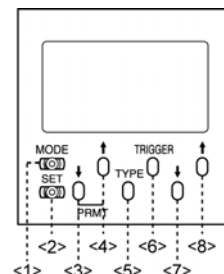



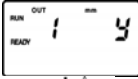
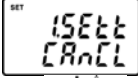
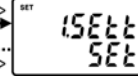


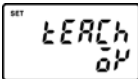
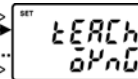
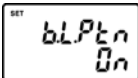
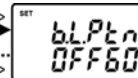
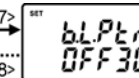

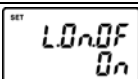

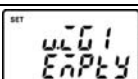

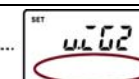
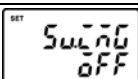
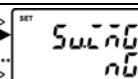
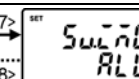
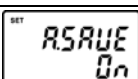
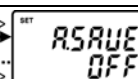
4.5.3 Setting Up the LightPixAE20 in CONFIGURATION

In CONFIGURATION mode, you can set up the main, operation and finder units and also set and save the inspection/communication conditions as shown below.

Refer to section 4.8 "Detailed Functions in CONFIGURATION Mode" for details of each function.

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



Function	Display on the operation unit
Upper: Function name and options to be displayed Middle: Name Lower: Description	(The left LCD display shows default settings.)
 Display when starting	 For 3 sec.
I.SETT: (CANCEL / SET) Initial Setting (default): Initializes the settings	  If you want to initialize the settings, select "SET" and press the <6> button for approximately three seconds.
SAVE: (CANCEL / SAVE) SAVE function: Saves the current settings	  If you want to save the settings, select "SAVE" and press the <6> button for approximately three seconds
TEACH: (OK / OKNG) Teaching: OK only/OK&NG:	  Allows you to select whether you want to execute a teaching for OK products only or both OK product and NG product
B.L.PTN: (ON/OFF10/OFF30/OFF60) Backlight settings function: Sets the backlight of the finder unit	   
L.ON.OF: (ON / OFF) LED On/Off function: Allows you to select whether or not to use the built-in LED light	 
V.IMG1 to 8: V.Image1 to 8: Displays up to eight saved images and the data detected when the image was saved	   ↑ When the image is saved, the detection data are displayed. When switching the image numbers, hold down the <7> and <8> button.
SV.IMG: (OFF / ALL / NG) Save Image function: Saves images during inspection	  
A.SAVE: (ON / OFF) Auto Save function: Allows you to set to save the settings automatically	 

Function	Display on the operation unit
Upper: Function name and options to be displayed Middle: Name Lower: Description	(The left LCD display shows default settings.)
ST.NO: (1 to 99) Station Number Station Number function: Sets a device number (unit) used for RS-232C communication	
BAUD.R: (9.6 to 57.6 kbps) Baud Rate function: Sets RS-232C communication speed	
OUT.D: (0 to 160 ms) 20 ms Output Delay function: Outputs inspection results after the original output timing	
CAP.D: (0 to 160 ms) 1 ms Capture Delay function: Sets the time delay from TRIGGER signal input to image capture	
I.TRR: (ON / OFF) Internal Trigger function: When the function is set to ON, the LightPixAE20 automatically performs continuous inspections. When OFF, it performs an inspection every time trigger signal input.	
INI.T: (1 to 7) Initial Type: The selected product type number when the LightPixAE20 is turned on (available only for colored areas)	
VER Version: Version, size of view range and system and operation unit versions (size of view range differs depending on the product number.)	
IOINI: (OFF / ON) I/O Initial Type function Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on	<ul style="list-style-type: none"> • OFF: Calls the product type No. that is set as "Initial Type" • ON: Calls the product type No. for the types of the signals that were input to the I/O port
T.TRG: (ON / OFF) Teaching Trigger function: Sets external trigger to ON (valid) or OFF (invalid)	
A.BACK: (ON / OFF) Answer Back function: Displays a detected color in blue on the finder unit	

4.5.4 Teaching in TEACHING Mode

In TEACHING mode, you can make and save the following settings for each product type:

- Exposure time: 0.03 - 50.00 ms
- Binary level: Binary level: To set a threshold value in order to obtain a binary
- Inspection area size/position: Set an area where a point is detected.
- Base peak distance: Save the X- and Y-directional distances between the left upper part inspection area of the point and the point

Pressing the TRIGGER button (<6>) detects a point within the inspection area and save the items listed above.

Type of teaching

The following two types of teaching procedures are available:

- Teaching for OK products only
- Teaching for OK and NG products

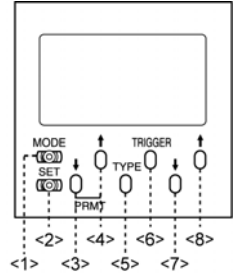
When performing a teaching, the allowable distance limit specified in JUDGEMENT CRITERIA SETTING mode is automatically set, but the distance varies depending on the type of teaching. See the table below.

Type	Allowable range to be set automatically
Teaching for OK products only	Sets to the distance between the left upper part of the point in the inspection area and the detected point +/-5%
Teaching for OK and NG products	<p>When the limit for NG product is lower than that for OK product (short distance):</p> <ul style="list-style-type: none"> • Plus: Distance value when executing a teaching + 5% • Minus: Median between the distance values for OK product and NG product <p>When the limit for NG product is higher than that for OK product (long distance):</p> <ul style="list-style-type: none"> • Plus: Median between the distance values for OK product and NG product • Minus: Distance value when executing a teaching – 5%

Operation in TEACHING mode

Operation in TEACHING mode differ the type of teaching (the type of teaching is settable in CONFIGURATION mode).

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



TEACH: OK (teaching for OK product only)

In INSPECTION (or RUN) mode	TEACHING mode ("TEACH" is displayed.)
<p>Search area (within the blue frame)</p> <p>Detection position (in pink)</p> <p>3 sec.</p> <p><1></p>	<p>TEACH READY 1 150 193</p> <p>↓ <5></p> <p>Upper line Binary level: 0 – 255 (default: 150) <3>: Decreases the value <4>: Increases the value</p> <p>Lower line Exposure time: 0.03 - 50.00 ms (default: 1.93)</p> <ul style="list-style-type: none"> • <7>: Shorten the exposure time • <8>: Longer the exposure time <p>If you want to perform a teaching at this point, press <6> first and then <1></p>
	<p>TEACH READY 1 512</p> <p>↓ <5></p> <p>SIZE: Resizes the inspection area</p> <p>If you want to perform a teaching at this point, press <6> first and <1>.</p>
	<p>TEACH READY 1 1.93</p> <p>↓ <6></p> <p>MOVE: Moves the inspection area</p> <p>-----</p> <p><6>: Executes a teaching Executes a teaching for OK product of the current product type</p>
	<p>TEACH READY 1 DONE</p> <p>↓ <5></p> <p>DONE: Indicates successful completion of teaching FAIL: Abnormal termination of teaching (the ALARM signal is output.)</p> <p>-----</p> <p><5>: Returns to the top.</p>
	<p>You can always switch the product types by pressing <2> and <5> buttons at the same time.</p> <p>Product Type No.</p> <p>TEACH READY 1 150 193</p> <p>↓ <2> + <5></p> <p>TEACH READY 2 150 193</p> <p>↓</p> <p>TEACH READY 7 150 193</p>



NOTE

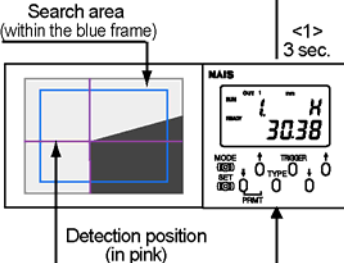
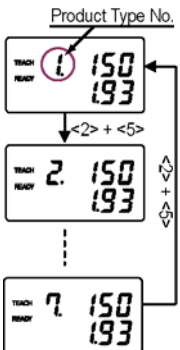
Teaching with pressing the <6> TRIGGER button adjusts exposure time automatically.

When you only change the value of exposure time, change the value and then press the <1> button but the <6> button. Changed value will be saved and you will return to RUN mode.

Operation Unit cannot execute Teaching with specified exposure time.

To execute Teaching without changing the set exposure time (or automatic adjusting), use the setting dedicated software, "AETOOL".

TEACH: OKNG (teaching for OK and NG products)

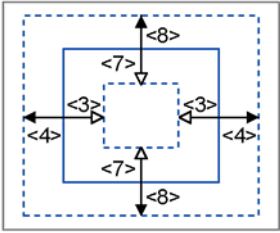
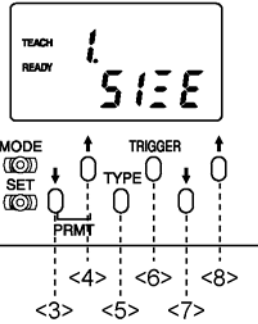
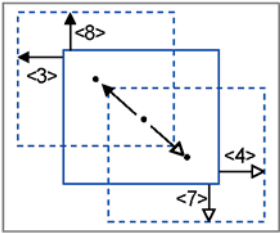
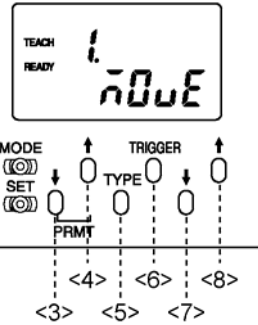
In INSPECTION (or RUN) mode	In TEACHING mode ("TEACH" is displayed.)	
 <p>Search area (within the blue frame)</p> <p>Detection position (in pink)</p> <p>MAIS 30.38</p> <p>MODE 0 0 0 0</p> <p>TRIGGER</p>	<p>TEACH READY 1 150 193</p> <p>↓ <5></p> <p>Upper line Binary level: 0 – 255 (default: 150) <3>: Decreases the value <4>: Increases the value Lower line Exposure time: 0.03 - 50.00 ms (default: 1.93)</p> <ul style="list-style-type: none"> <7>: Shorten the exposure time <8>: Longer the exposure time <p>If you want to perform a teaching at this point, press <6> first and then <1></p>	<p>You can always switch the product types by pressing <2> and <5> buttons at the same time.</p> <p>Product Type No.</p> 
	<p>TEACH READY 1 SIZE</p> <p>↓ <5></p> <p>SIZE: Resizes the inspection area</p> <p>If you want to perform a teaching at this point, press <6> first and <1>.</p>	
	<p>TEACH READY 1 MOVE</p> <p>↓ <6></p> <p>MOVE: Moves the inspection area</p> <p><6>: Executes a teaching Executes a teaching for OK product of the current product type</p>	
	<p>TEACH READY 15606 MOVE</p> <p>↓ <6></p> <p>STNG: Teaching for OK products-Normal completion</p> <p>FAIL: Abnormal termination of teaching →The ALARM signal is output.</p> <p><6>: Executes a teaching Executes a teaching for NG product of the current product type</p>	
	<p>TEACH READY 15606 MOVE</p> <p>↓ <5></p> <p>DONE: Teaching for NG product-Normal completion</p> <p>FAIL: Abnormal teaching (the ALARM signal is output.)</p> <p><5>: Returns to the top.</p>	



◆ NOTE

- If the ALARM signal is output after teaching is completed, the signal is held ON until teaching is successfully completed. As long as the unit keeps outputting the ALARM signal, it cannot properly execute an inspection. In this case, you have to execute a teaching again.
- Teaching with pressing the <6> TRIGGER button adjusts exposure time automatically. When you only change the value of exposure time, change the value and then press the <1> button but the <6> button. Changed value will be saved and you will return to RUN mode. Operation Unit cannot execute Teaching with specified exposure time. To execute Teaching without changing the set exposure time (or automatic adjusting), use the setting dedicated software, "AETOOL".

Resizing and moving the inspection area

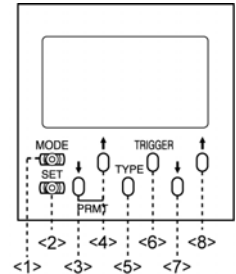
Setting items	Description
 	<p>SIZE: Resize the inspection area size</p> <p>X direction (width)</p> <ul style="list-style-type: none"> The <3> button: Reduces the width The <4> button: Enlarges the width <p>Y direction (length)</p> <ul style="list-style-type: none"> The <7> button: Reduces the length The <8> button: Enlarges the length <p>The inspection area is displayed in blue</p>
 	<p>MOVE: Movement of inspection area</p> <ul style="list-style-type: none"> The <3> button: Moves the inspection area to the left. The <4> button: Moves the inspection area to the right. The <8> button: Moves the inspection area up. The <7> button: Moves the inspection area down

4.5.5 Setting Up the Judgement Criteria in JUDGEMENT CRITERIA SETTING Mode

Based on the base distance in the X and Y directions between the left upper of the point in the inspection area and the detected point saved by teaching, specify the limit for OK judgement in mm. When executing a teaching, the proper values for teaching type and for detected distance between the left upper of the point in the inspection area and the detected point are set. Change the allowable limit in JUDGEMENT CRITERIA SETTING mode as necessary.

Operation in JUDGEMENT CRITERIA SETTING

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



In INSPECTION (or RUN) mode	In JUDGEMENT CRITERIA SETTING mode ("SET" is displayed.)
<p>Search area (within the blue frame)</p> <p>Detection position (in pink)</p>	<p>Ref X: Base peak distance – X direction Peak distance saved by teaching: The value of X-directional distance</p> <p>SET REFX 3568 <4> ↓ ↑ <3></p>
	<p>Ref Y: : Base peak distance- Y direction Peak distance saved by teaching: The value of Y-directional distance</p> <p>SET REFY 1565 <4> ↓ ↑ <3></p>
	<p>Per X: Allowable range-in the X direction <8>: Increases the value (= extends the allowable range) <7>: Decreases the value (= reduces the allowable range)</p> <p>SV PERX 386 <4> ↓ ↑ <3></p>
	<p>Per Y: Allowable range – Y direction Setting of allowable range in the Y direction <8>: Increases the value (= extends the allowable range) <7>: Decreases the value (= reduces the allowable range)</p> <p>SV PERY 340 <4> ↓ ↑ <3></p> <p>To product type No.2</p>

4.5.6 Inspection Execution

The ways of inspection execution

Internal trigger: ON	Inspection is automatically performed by switching to RUN mode.
Internal trigger: OFF	After switching to RUN mode, input the TRIGGER signal to external devices or press the TRIGGER button.


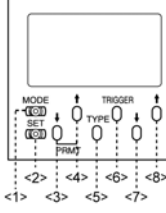
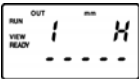
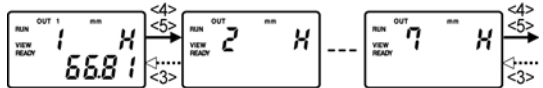
Inspection judgement results

Judgement results are output to the parallel ports of OUT1 to OUT3 as the table shown below.

Judgement results		OUT3	OUT2	OUT1
OK	Point was detected, and the detected peak distance is within the "base distance +/- allowable range."	OFF	OFF	ON
NG	Except those above	OFF	OFF	OFF

Checking the measured data

When executing an inspection in RUN mode, you can check the X- and Y- directional distance of the detected edge. But you cannot display all the measurement data at the same time.

Display data switch 	<p>Upper line: Product type number and type of data Data type: X / Y / TIME</p> <ul style="list-style-type: none"> X: X-directional distance of the detected point Y: Y-directional distance of the detected point TIME: Calculation time <p>Lower line: Data value</p> <ul style="list-style-type: none"> X-/Y-directional distance: Up to four digits* including the numbers under the decimal point. (The digits under the decimal point differ depending on the type of device.) When any point is not detected, the screen display is as the figure shown right. Calculation time: Less than two digits , slightly differs depending on the position of the detected point 	
	<p>To the Top</p>	
Product type switch		<p>The <3>, <4> and <5> buttons: Changes the product types Once the product types are switched, OUT1 to 3 are reset.</p>

Data range*

Type Data	ANE2000	ANE2010	ANE2020	ANE2030*
X	0 to 2.00	0 to 10.00	0 to 30.00	0 to 80.00
Y	0 to 1.60	0 to 8.00	0 to 25.00	0 to 70.00

*The view range changes within the range of 70 x 56 to 100 x 80 depending on the installation position of ANE2030, but the position data are converted into mm based on the range of view 80 x 70. Therefore, if you use the unit out of the view range 80 x 70, the position data differs from the actual size.



Parallel input/output timing chart: Page 118

4.6 Length Measurement

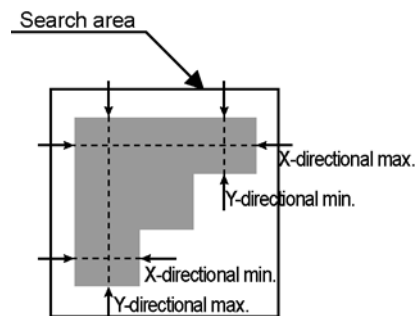
4.6.1 Overview of Length Measurement

In a binary image, the LightPixAE20 measures the X- and/or Y-directional lengths of the object in the selected color (black or white) within the inspection area. The unit checks whether or not the minimum and maximum values for the detected length does not exceed the base length +/- allowable range, and it outputs the judgement result for the maximum and minimum values to OUT1 and OUT2 respectively.

Judgement result		OUT2	OUT1
All OK	Both minimum and maximum values does not exceed the base length +/- allowable range	ON	ON
MAX:OK	Only maximum value is within the allowable range	OFF	ON
MIN: OK	Only minimum value is within the allowable range	ON	OFF
All NG	Both maximum and minimum values are out of range Measurement of length failed	OFF	OFF

What does the length mean in the LightPixAE20?

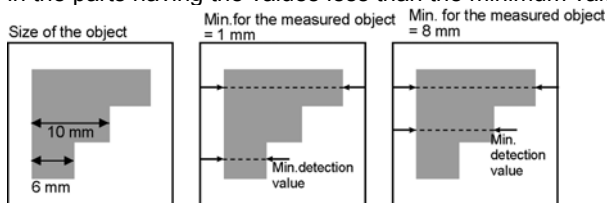
The LightPixAE20 finds out the pixels of the object color from left to right and from right to left within an inspection area. The distance between the two points detected first is a (X-directional) length. A minimum and maximum values for the length detected in whole scanning lines following the same procedure are set.



If you do not want to allow the unit to search a length in some parts,

You can set the part fulfilling the following conditions as a masked part.

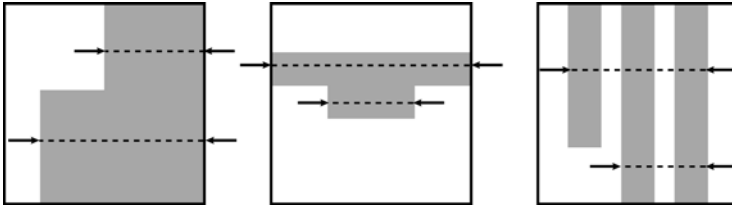
- Being consisted of less than five pixels:
To not allow the unit to detect fine dusts or noise. Note that you cannot change or delete the setting conditions.
- Being consisted of less than the minimum value for inspection object:
"Minimum value for inspection object" is a value that is specified in the JUDGEMENT CRITERIA SETTING /INSPECTION MINIMUM VALUE SETTING mode, and the unit is not allowed to search in the parts having the values less than the minimum value for inspection object.



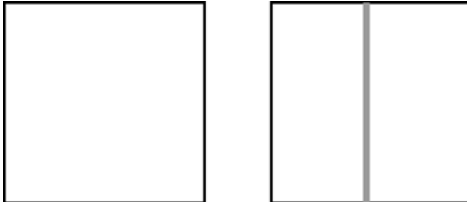
Example of the images having detectable and undetectable

If detection direction= X (Direct.T = X), inspection object color=Black (OUT.T=BLACK)

Detectable images



Undetectable images



Reasons:


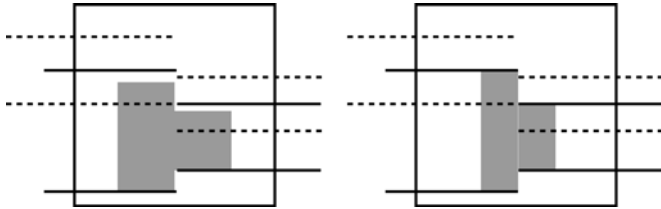

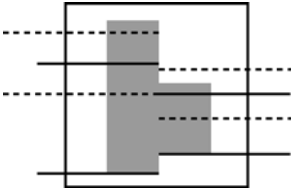
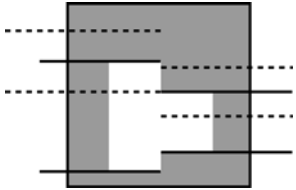
Only the part having no inspection color, less than 5 pixels and the value less than the minimum value for inspection object is captured.

Conditions under which measuring result are judged as OK

If the inspection results fulfill the following conditions, the LightPixAE20 judges them as OK.

- Can find out the length in the direction of the object in the color specified in CONFIGURATION mode
- The measured length does not exceed the limit (the length value for which teaching was executed +/- allowable limit)

Example

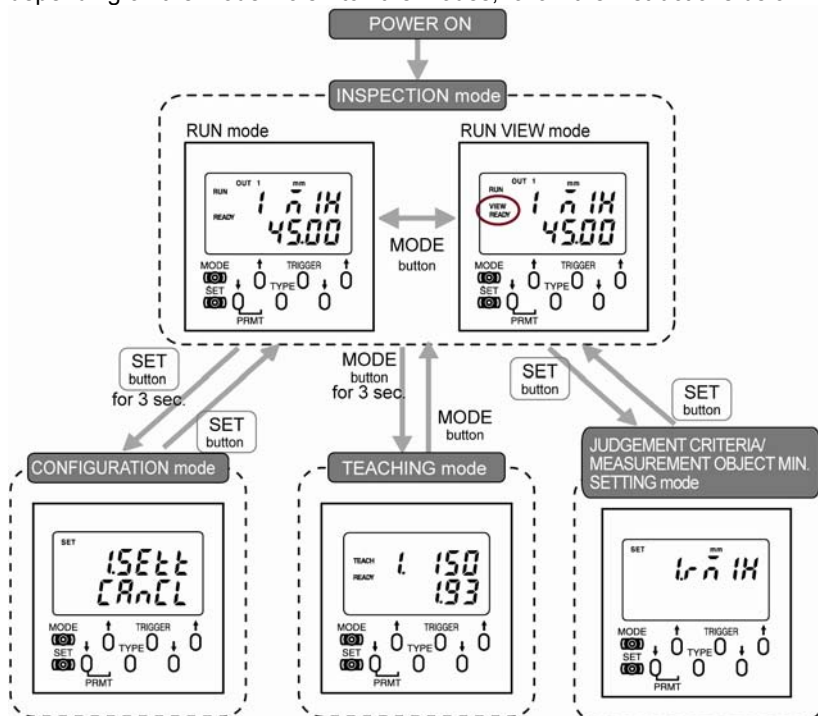
Settings of teaching and judgement criteria		
		If the color of the inspection object=black and detection direction=X.
OK judgement		
		
NG judgement		
		
Cannot detect the color of the inspection object	The inspection length is beyond a base length value +/- allowable range.	Since the color of the inspection object is black, the maximum/minimum values for the inspection length are set to fill the entire screen, resulting in exceeding base length +/- allowable range.

4.6.2 Setting Procedure and Modes

Make the inspection settings following the steps below:

1	Set up devices	Install the main unit, and connect to a power supply unit, each unit and external devices	Section 3
2	Turn the LightPixAE20 on.	Apply 24V DC.	-
3	Configure the LightPixAE20. (in CONFIGURATION mode)	Set up the LightPixAE20 system in CONFIGURATION mode. Hardware settings of the unit, output method of reading data, saving method of captured images and other inspection conditions.	Page 87
4	The minimum value for inspection object (In JUDGEMENT CRITERIA SETTING)	In JUDGEMENT & INSPECTION MINIMUM VALUE SETTING modes, set the minimum value for the inspection object of which a length is measured. The unit detects only the parts more than the minimum value for inspection object.	Page 89
5	Run a teaching (In TEACHING mode)	In the TEACHING mode, register edge direction and distance, at the same time, set the exposure time or range for measuring area (inspection area), and area for setting extraction color.	Page 90
6	Set judgement criteria (In JUDGEMENT CRITERIA SETTING mode)	In JUDGEMENT CRITERIA SETTING and INSPECTION MINIMUM VALUE SETTING mode, set the limits of area values (min. and max.) and the threshold value of degree of similarity for detected image.	Page 94
7	Execute an inspection (in RUN / RUNVIEW mode)	Press the TRIGGER button in RUN (RUN VIEW) mode.	Page 95

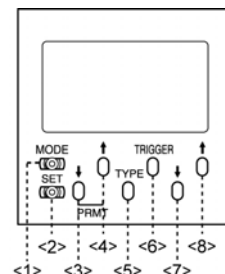
There are mainly four modes available for the LightPixAE20. The settings that you can make vary depending on the mode. To switch the modes, follow the instructions below.


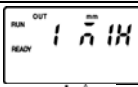
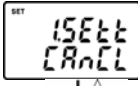
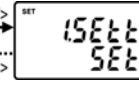
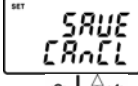

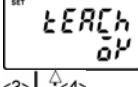
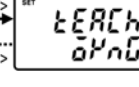
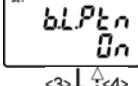
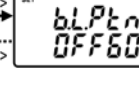
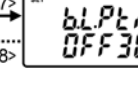
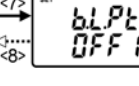
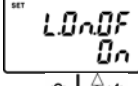
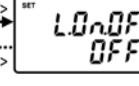
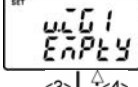
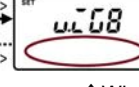
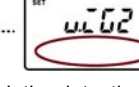
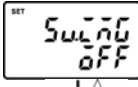
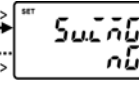
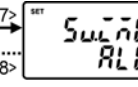
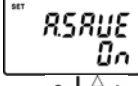



4.6.3 Setting Up the LightPixAE20 in CONFIGURATION Mode

In CONFIGURATION mode, you can set up the main, operation and finder units and also set and save the inspection/communication conditions as shown below. Refer to section 4.8 “Detailed Functions in CONFIGURATION Mode” for details of each function.

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



Function Upper: Function name and options to be displayed Middle: Name Lower: Description	Display on the operation unit (The left LCD display shows default settings.)
 Display when starting	 For 3 sec.
I.SETT: (CANCEL / SET) Initial Setting (default): Initializes the settings	  If you want to initialize the settings, select “SET” and press the <6> button for approximately three seconds.
SAVE: (CANCEL / SAVE) SAVE function: Saves the current settings	  If you want to save the settings, select “SAVE” and press the <6> button for approximately three seconds.
TEACH: (OK / OKNG) Teaching: OK only/OK&NG:	  Allows you to select whether you want to execute a teaching for OK products only or both OK product and NG product
B.L.PTN: (ON/OFF10/OFF30/OFF60) Backlight Pattern function: Sets the backlight of the finder unit OFF	    (Navigation arrows between displays)
L.ON.OF: (ON / OFF) LED On/Off function: Allows you to select whether or not to use the built-in LED light	  (Navigation arrows between displays)
V.IMG1 to 8: V.Image1 to 8: Displays up to eight saved images and the data detected when the image was saved	   ↑ When the image is saved, the detection data are displayed. When switching the image numbers, hold down the <7> and <8> button.
SV.IMG: (OFF / ALL / NG) Auto Save function: Saves images during inspection	   (Navigation arrows between displays)
A.SAVE: (ON / OFF) Auto Save Allows you to set to save the settings automatically	  (Navigation arrows between displays)

Length Measurement

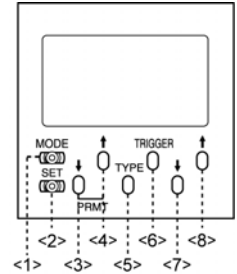
ST.NO: (1 to 99) Station Number function: Sets a device number (unit) used for RS-232C communication	
BAUD.R: (9.6 to 57.6 kbps) Baud Rate function: Sets RS-232C communication speed	
OUT.D: (0 to 160 ms) 20 ms Output Delay function: Outputs inspection results after the original output timing	
CAP.D: (0 to 160 ms) in the 1 ms Capture Delay function: Sets the time delay from TRIGGER signal input to image capture	
I.TRR: (ON / OFF) Internal Trigger function:	<p>When the function is set to ON, the AE20 automatically performs continuous inspections. When OFF, it performs an inspection every time trigger signal input.</p>
INI.T: (1 to 7) Initial Type: The selected product type number when the LightPixAE20 is turned on (available only for colored areas)	
SPEED: High / Middle / Low Speed: Allows you to select the processing time of measurement	
DIRC.T: Both / DX / DY Direction Type: Allows you to select a direction in which lengths are measured	
OUT.T: Black / White Measurement Object Color: Allows you to select an object color to be measured	
VER Version: Version, Size of view range and system and operation unit versions.	<p>(Size of view range differs depending on the product number.)</p>
IOINI: (OFF / ON) I/O Initial Type function Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on	<ul style="list-style-type: none"> • OFF: Calls the product type No. that is set as an "Initial type" • ON: Calls the product type No. for the types of the signals that were input to the I/O port
T.TRG: (ON / OFF) Teaching Trigger function: Sets external trigger to ON (valid) or OFF (invalid)	
A.BACK: (ON / OFF) Answer back function: Displays a detected color in blue on the finder unit.	

4.6.4 Setting a Minimum Value for a Measurement Object

In JUDGEMENT CRITERIA SETTING and MEASUREMENT OBJECT MIN. SETTING mode, set the length of an inspection object.

You can set up to four digits including the numbers under the decimal point, but the number of digits you can set varies depending on the type of unit.

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



In INSPECTION (or RUN) mode	JUDGEMENT CRITERIA/MEASUREMENT OBJECT MIN. SETTING mode ("SET" is displayed.)
<p>Search area (within the blue frame)</p> <p>The position of the detected min./max (in pink)</p> <p>MAIS</p> <p>MODE (00) SET (00) PRMT (00) TYPE (00) TRIGGER (00)</p>	<p>Referring the value saved when executing a teaching</p> <ul style="list-style-type: none"> • RMinX: Min. in the X direction • RMaxX: Max. in the X direction • RMinY: Min. in the Y direction • RMaxY: Max. in the Y direction
	<p>Allowable range to be set</p> <p>PMinX: Min. in the X direction</p> <p>PMaxX: Max. in the X direction</p> <p>PMinY: Min. in the Y direction</p> <p>PMaxY: Max. in the Y direction</p>
	<ul style="list-style-type: none"> • The <8> button: Increases the value • The <7> button: Decreases the value
	<p>MinX: Min. for Measurement Object – in the X direction</p> <ul style="list-style-type: none"> • The <8> button: Increases the value • The <7> button: Decreases the value
	<p>MinY: Min. for Measurement Object-in the Y direction</p> <ul style="list-style-type: none"> • The <8> button: Increases the value • The <7> button: Decreases the value
	<p>Product type No.2</p>

4.6.5 Teaching in TEACHING mode

In TEACHING mode, you can make and save the following settings for each product type

- Exposure time: 0.03 to 50.00 ms
- Binary level: To set a threshold value in order to obtain a binary
- Inspection area size/position: Sets the area where a length is detected
- Base length: Min. and max. lengths are saved as judgement criteria

When you pressed the TRIGGER button (<6>), the value for the length detected within an inspection area is saved.

Type of teaching

There are following two ways of performing a teaching:

- Teaching for OK products only
- Teaching for OK and NG products

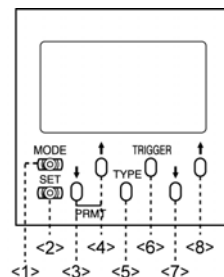
When performing a teaching, the allowable limit for the distance set in JUDGEMENT CRITERIA SETTING mode is automatically set, but the distance varies depending on the type of teaching. See the table below.

Type	Allowable range to be set automatically
Teaching for OK product only	Edge distance when executing a teaching +/- 5%
Teaching for OK and NG products	<p>When the limit for NG product is lower than that for OK product (short distance):</p> <ul style="list-style-type: none"> • Plus: Distance value when executing a teaching + 5% • Minus: Median between the distance values for OK product and NG product <p>When the limit for NG product is higher than that for OK product (long distance):</p> <ul style="list-style-type: none"> • Plus: Median between the distance values for OK product and NG product • Minus: Distance value when executing a teaching – 5%

Operation in TEACHING mode

The teaching procedure differs between for OK product only and for OK/NG products. (Type of teaching is selectable in CONFIGURATION mode.)

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



TEACH: OK (teaching for OK product only)

In INSPECTION (or RUN) mode	TEACHING mode ("TEACH" is displayed.)
<p>Search area (within the blue frame)</p> <p>The position of the detected min./max (in pink)</p>	<p>TEACH READY 1 150 193</p> <p>↓ <5></p> <p>Upper line- Binary level: 0 – 255 (default: 150) <3>: Decreases the value <4>: Increases the value</p> <p>Lower line-Exposure time: 0.03 to 50.00 ms (default: 1.93) • <7>: Shortens the exposure time • <8>: Extends the exposure time</p> <p>If you want to perform a teaching at this point, press <6> first and then <1>.</p>
	<p>TEACH READY 1 SIZE</p> <p>↓ <5></p> <p>SIZE: Resizes the inspection</p> <p>If you want to execute a teaching at this point, press <6> first and then <1> after resizing.</p>
	<p>TEACH READY 1 MOVE</p> <p>↓ <6></p> <p>MOVE: Moves inspection area</p> <p><6>: Executes a teaching for the current product type Teaching for the current product type is executed.</p>
	<p>TEACH READY 1 DONE</p> <p>↓ <5></p> <p>DONE: Indicates successful completion of teaching FAIL: Abnormal termination of teaching (The ALARM signal is output.)</p> <p><5>: Returns to the top.</p>
	<p>You can always switch the product types by pressing the <2> and <5> buttons at the same time.</p> <p>Product type No.</p> <p>TEACH READY 1 193</p> <p>↓ <2> + <5></p> <p>TEACH READY 2 193</p> <p>↓</p> <p>TEACH READY 7 193</p>



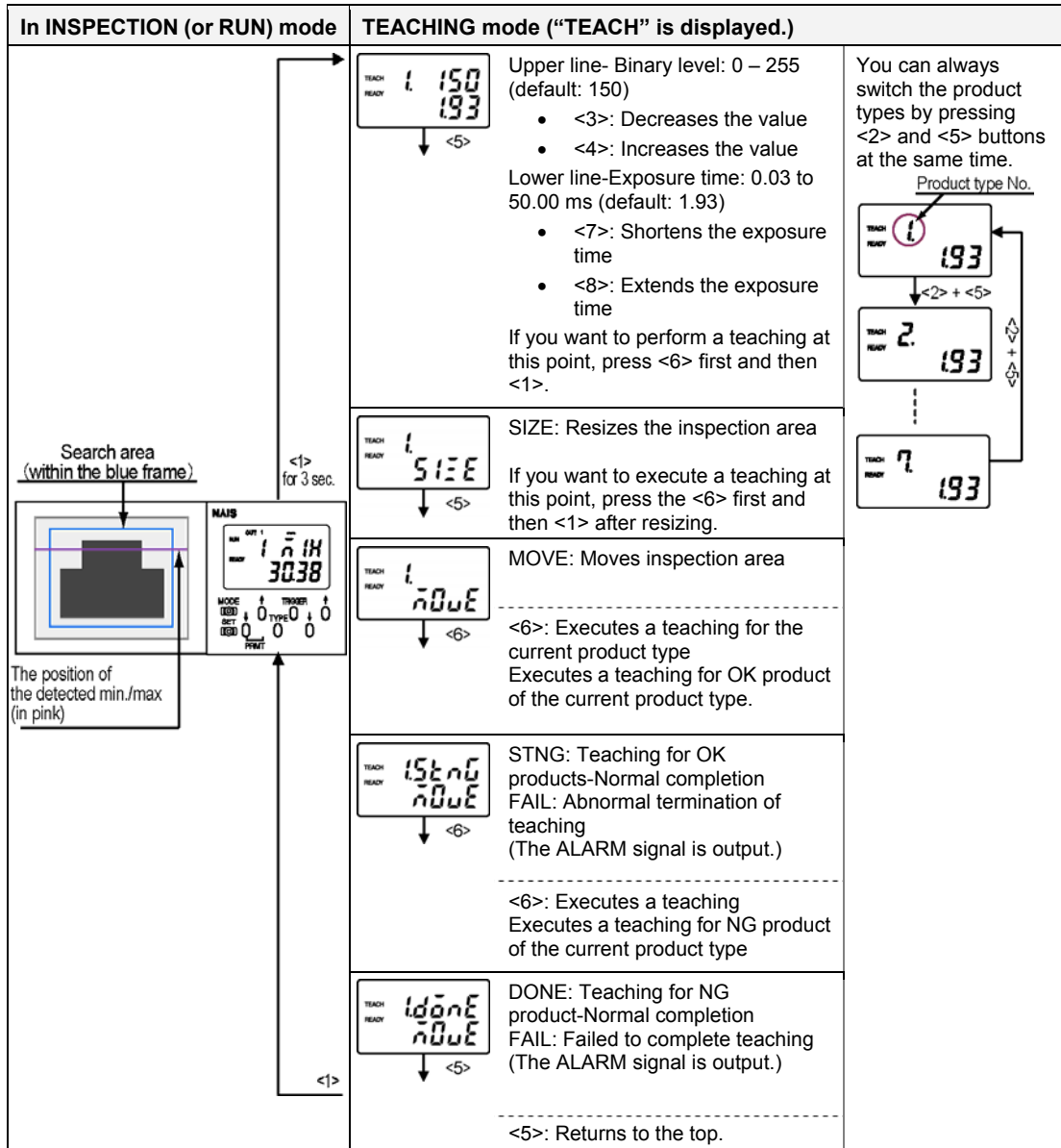
NOTE

- If the ALARM signal is output after teaching is completed, the signal is held ON until teaching is successfully completed. As long as the unit keeps outputting the ALARM signal, it cannot properly execute an inspection. In this case, you have to execute a teaching again.
- Teaching with pressing the <6> TRIGGER button adjusts binary level and exposure time automatically.

When you only change the value of binary level and exposure time, change the value and then press the <1> button but the <6> button. Changed value will be saved and you will return to RUN mode.

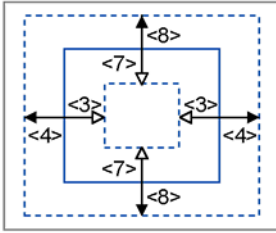
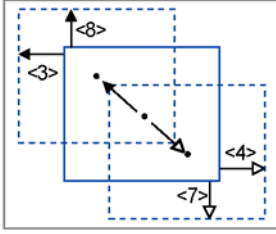
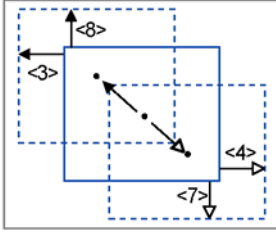
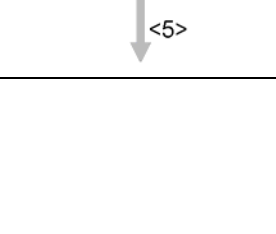
Operation Unit cannot execute Teaching with specified binary level and exposure time.

To execute Teaching without changing the set binary level and exposure time (or automatic adjusting), use the setting dedicated software, "AETOOL".

TEACH: OKNG (teaching for OK and NG products)◆ **NOTE**

- If you change to RUN mode before teaching for NG product, the ALARM signal is output. The ALARM signal is held ON until teaching for OK and NG products are successfully completed. As long as the unit keeps outputting the ALARM signal, it cannot execute an inspection properly.
- Teaching with pressing the <6> TRIGGER button adjusts binary level and exposure time automatically.
When you only change the value of binary level and exposure time, change the value and then press the <1> button but the <6> button. Changed value will be saved and you will return to RUN mode.
Operation Unit cannot execute Teaching with specified binary level and exposure time.
To execute Teaching without changing the set binary level and exposure time (or automatic adjusting), use the setting dedicated software, "AETOOL".

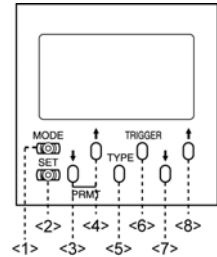
Resizing and moving the inspection area

Setting items	Description
 	<p>SIZE: Resize the inspection area size</p> <p>X direction (width)</p> <ul style="list-style-type: none"> The <3> button: Reduces the width The <4> button: Enlarges the width <p>Y direction (length)</p> <ul style="list-style-type: none"> The <7> button: Reduces the length The <8> button: Enlarges the length <p>The inspection area is displayed in blue.</p>
 	<p>MOVE : Movement of inspection area position</p> <ul style="list-style-type: none"> The <3> button: Moves the inspection area to the left. The <4> button: Moves the inspection area to the right. The <8> button: Moves the inspection area up. The <7> button: Moves the inspection area down

4.6.6 Setting Up Judgement Criteria in JUDGEMENT CRITERIA and MEASUREMENT OBJECT MIN. SETTING modes

Based on the base measurement saved by teaching, the allowable limits for OK judgement specified each in X and Y direction in mm.

Operation in JUDGEMENT CRITERIA SETTING mode



In INSPECTION (or RUN) mode	In JUDGEMENT CRITERIA SETTING mode ("SET" is displayed.)
<p>Search area (within the blue frame)</p> <p>The position of the detected min./max (in pink)</p>	<p>Referring the value saved during teaching</p> <ul style="list-style-type: none"> RMinX: Min. in the X direction RMaxX: Max. in the X direction RMinY: Min. in the Y direction RMaxY: Max. in the Y direction
	<p>Allowable range to be set</p> <ul style="list-style-type: none"> PMinX: Min. in the X direction PMaxX: Max. in the X direction PMinY: Min. in the Y direction PMaxY: Max. in the Y direction The <8> button: Increases the value The <7> button: Decreases the value
	<p>MinX: Min. for Measurement Object - in the X direction</p> <ul style="list-style-type: none"> The <8> button: Increases the value The <7> button: Decreases the value
	<p>MinY: Min. for Measurement Object - in the Y direction</p> <ul style="list-style-type: none"> The <8> button: Increases the value The <7> button: Decreases the value



◆ NOTE

Even if you selected X-directional measurement direction in CONFIGURATION mode, Y-directional base length and the allowable range do not affect the inspection results. Similarly, even if you selected Y-directional measurement direction in CONFIGURATION mode, X-directional base length and the allowable range do not affect the inspection results.

4.6.7 Measurement Execution

The ways of measurement execution

Internal trigger: ON	Measurement is automatically executed by switching to RUN mode.
Internal trigger: OFF	After switching to RUN mode, input the TRIGGER signal to external devices or press the TRIGGER button.

Judged measurement results

The LightPixAE20 outputs these judgement results to parallel ports of OUT1 to OUT3

Judgement results		OUT3	OUT2	OUT1
All OK	Both maximum and minimum are within the base length +/-value for judgement base criteria	OFF	ON	ON
MAX:OK	Only maximum value is within the range	OFF	ON	OFF
MIN: OK	Only minimum value is within the range	OFF	OFF	ON
All NG	Both maximum and minimum values are beyond the range, or the unit failed to measure a length.	OFF	OFF	OFF



◆ NOTE

Internal Trigger: Switches ON/OFF in CONFIGURATION mode



◆ REFERENCE

Parallel input/output timing chart: Page 118

Checking measurement data

When carrying out measurement in RUN mode, you can check the minimum and maximum of the detected length in the X and Y directions. When setting the direction of the inspection object in CONFITURATION mode to X, you can check the default or previous settings by selecting Y, but you should not refer to the settings.

Display data switch	<p>Return to the top.</p>	<p>Upper line: Product type number and data type Data type: MinX / MaxX / MinY / MaxY</p> <ul style="list-style-type: none"> • MinX: Minimum in the X direction • MaxX: Maximum in the X direction • MinY: Minimum in the Y direction • MaxY: Maximum in the Y direction • Time: Calculation time <p>Lower line: Data value</p> <ul style="list-style-type: none"> • Detection length: Up to four digits* including the numbers under the decimal point The unit failed to detect any length, the display on the display is as the figure shown right • Calculation time: Up to two digits* including the numbers under the decimal point <p>If the detection direction is set to either X or Y, the measurement data for unselected direction are not displayed.</p>	
Product type switch		<p>The <3>, <4> and <5> buttons: Change the product types Once you switch the product types, the outputs to the ports of OUT1 to OUT3 are reset.</p>	

Data range*

Unit type	ANE2000	ANE2010	ANE2020	ANE2030*
Data				
X	0 to 2.00	0 to 10.00	0 to 30.00	0 to 80.00
Y	0 to 1.60	0 to 8.00	0 to 25.00	0 to 70.00

*The view range changes within the range of 70 x 56 to 100 x 80 depending on the installation position of ANE2030, but the position data are converted into mm based on the range of view 80 x 70. Therefore, if you use the unit out of the view range 80 x 70, the position data differs from the actual size.

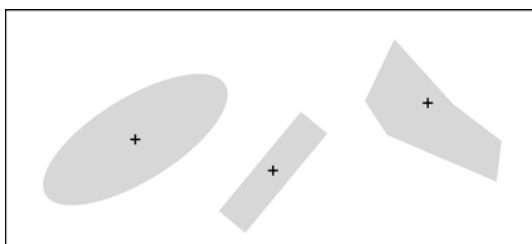
4.7 Feature Extraction

4.7.1 Overview of Feature Extraction

In a binary image consisting of white and black, the LightPix AE20 counts the objects and judges whether the number is within the range set in advance. For counting, the conditions of size (area) and inclination (principal axis angle*) can be specified. The counted number is “detected count”. When the detected count is between the maximum/minimum values which have been set, the judgment is “OK” and “OUT1” turns “ON”.

The data of area value, coordinates of gravity center(X, Y), and principal axis angle can be output through RS-232C communication.

Judgement result		OUT2	OUT1
OK	When the number of detected objects satisfies the judgment criteria. (The objects of specified number are detected, which have certain size and principle axis angle.)	OFF	ON
NG	When the number of detected objects fails to satisfy the judgment criteria, or more than 501 objects are detected.	OFF	OFF



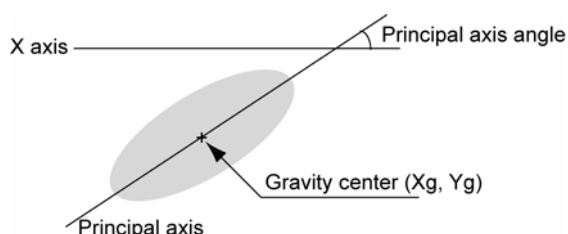
◆ NOTE

Principal Axis Angle

Principal axis angle is formed by the principal axis of the object and X axis and indicates in the range of -89.9 to +90.0.

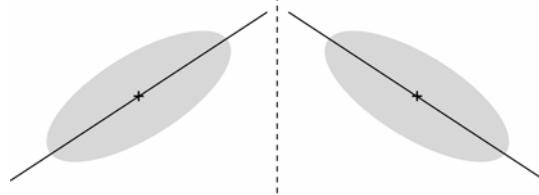
When the object is square, circle, or regular triangle, the angle can not be obtained. In that case, it is output as “0”.

If principal axis is diagonally right up, the angle is negative value, and it is diagonally right down, the angle is positive value.



Principal axis angle = negative (-)

Principal axis angle = positive (+)


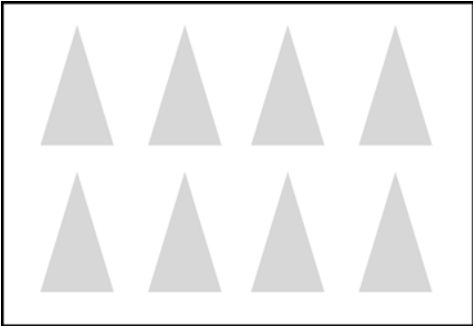
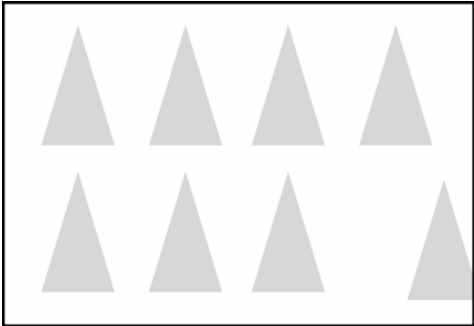
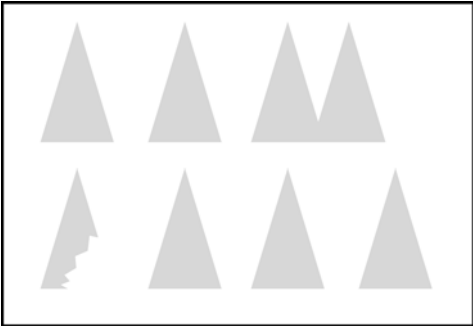
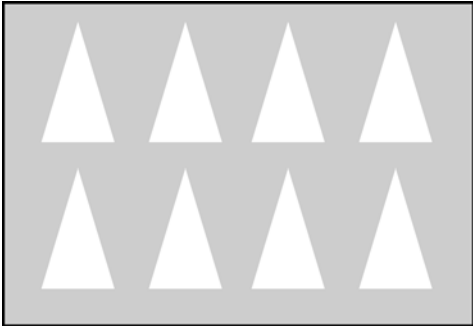


Conditions that the measuring results are judged as OK

As a result of inspection, if the image that meets the following two conditions, it is judged as OK.

- The “detected count” of the objects with the following conditions must be detected; the color (black or white) specified in CONFIGURATION mode, “area” and “principal axis angle” within the range specified in the JUDGEMENT CRITERIA SETTING mode.

Example

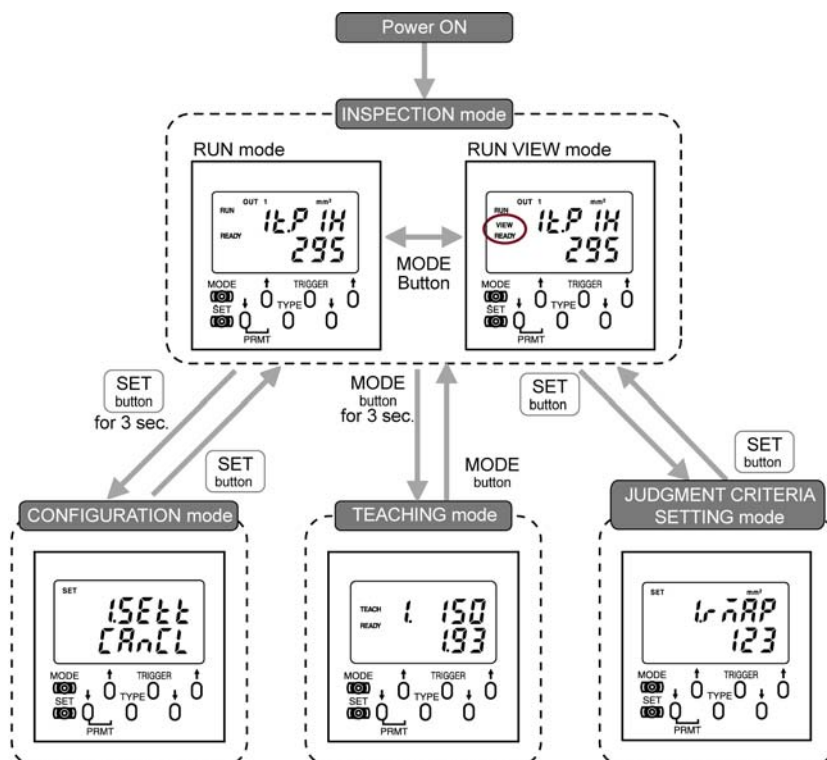
Detecting condition	
Object color : Black Area range: 200 to 300 Principle axis angle: -89.9 to +90.0: Detected count: 8	 <p>←Area is around 250.</p>
OK judgment	
 <p>Detected count = 8</p>	 <p>Detected count = 8 The object having a set area measurement can be detected, even if the object is out of the inspection area.</p>
NG judgment	
 <p>Detected count = 5 Out of setting range of detected count.</p> <p>The lower left object is excluded because the area is small due to chip. The upper right object is excluded because the area is double due to touching.</p>	 <p>Detected count = 0 Out of setting range of detected count.</p>

4.7.2 Setting Procedure and Modes

Make the inspection settings following the steps below:

1	Set up devices	Install the main unit, and connect to a power supply unit, each unit and external devices	Section 3
2	Turn the LightPixAE20 on.	Apply 24V DC.	-
3	Configure the LightPixAE20. (in CONFIGURATION mode)	Set up the LightPixAE20 system in CONFIGURATION mode. Hardware settings of the unit, output method of reading data, saving method of captured images and other inspection conditions.	Page 100
4	Run a teaching (In TEACHING mode)	In the TEACHING mode, set the exposure time, binary level, and range for measuring area (inspection area).	Page 103
5	Set judgement criteria (In JUDGEMENT CRITERIA SETTING mode)	In JUDGEMENT CRITERIA SETTING and INSPECTION MINUMUN VALUE SETTING mode, set the limits of area values (min. and max.) and the threshold value of degree of similarity for detected image.	Page 105
6	Execute an inspection (in RUN / RUNVIEW mode)	Press the TRIGGER button in RUN (RUN VIEW) mode.	Page 106

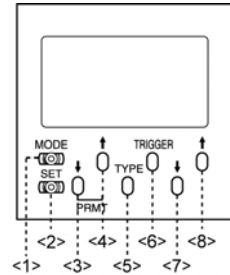
There are mainly four modes available for the LightPixAE20. The settings that you can make vary depending on the mode. To switch the modes, follow the instructions below.



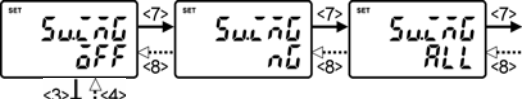

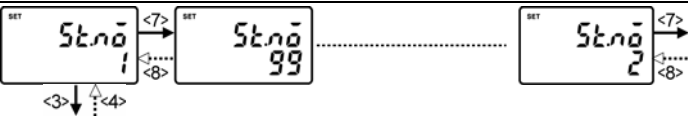
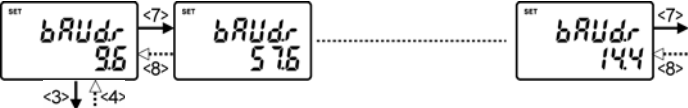
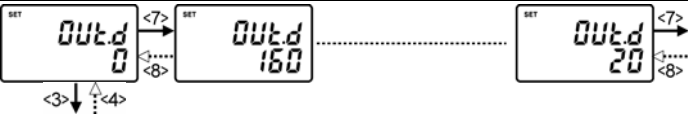
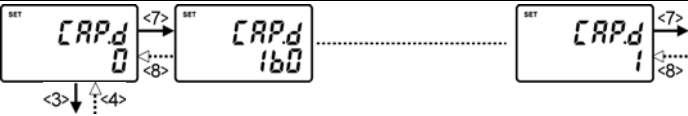
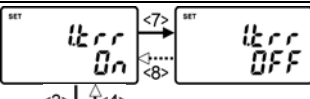
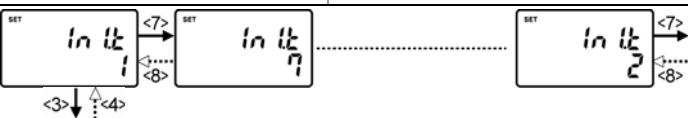

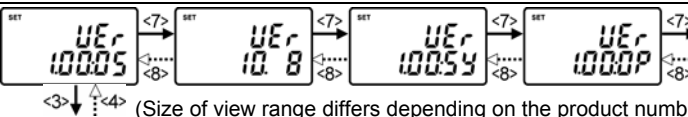
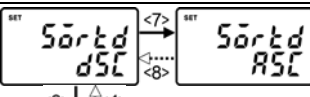
4.7.3 Setting Up the LightPixAE20 in CONFIGURATION Mode

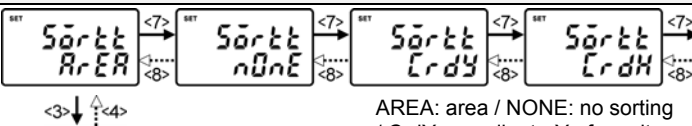
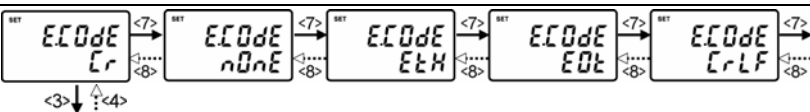



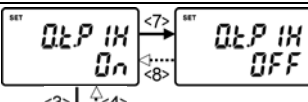
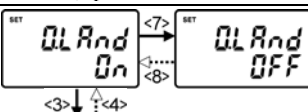
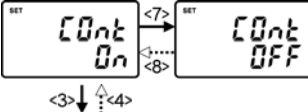
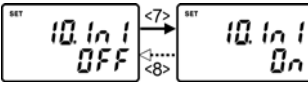
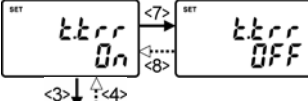

In CONFIGURATION mode, you can set up the main, operation and finder units and also set and save the inspection/communication conditions as shown below. Refer to section 4.8 "Detailed Functions in CONFIGURATION Mode" for details of each function.

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



Function	Display on the operation unit (The left LCD display shows default settings.)
Upper: Function name and options to be displayed Middle: Name Lower: Description	
 Display when starting	 For 3 sec.
I.SETT: (CANCEL / SET) Initial Setting (default): Initializes the settings	 If you want to initialize the settings, select "SET" and press the <6> button for approximately three seconds.
SAVE: (CANCEL / SAVE) SAVE: Saves the current settings	 If you want to save the settings, select "SAVE" and press the <6> button for approximately three seconds.
B.L.PTN: (ON/OFF10/OFF30/OFF60) Backlight Pattern: Sets the backlight of the finder unit OFF	
L.ON.OF: (ON / OFF) LED On/Off function: Allows you to select whether or not to use the built-in LED light	
V.IMG1 to 8: V.Image1 to 8: Displays up to eight saved images and the data detected when the image was saved	

Function Upper: Function name and options to be displayed Middle: Name Lower: Description	Display on the operation unit (The left LCD display shows default settings.)
SV.IMG: (OFF / ALL / NG) Save Image: Saves images during inspection	 OFF: No save ALL: Save all NG: Save only NG
A.SAVE: (ON / OFF) Auto Save Allows you to set to save the settings automatically	
ST.NO: (1 to 99) Station Number: Sets a device number (unit) used for RS-232C communication	
BAUD.R: (9.6 to 57.6 kbps) Baud Rate: Sets RS-232C communication speed	
OUT.D: (0 to 160 ms) 20 ms Output Delay: Outputs inspection results after the original output timing	
CAP.D: (0 to 160 ms) in the 1 ms Capture Delay: Sets the time delay from TRIGGER signal input to image capture	
I.TRR: (ON / OFF) Internal Trigger function:	 ON: automatically inspects continuously OFF: inspects at every trigger signal
INI.T: (1 to 7) Initial Type: The selected product type number when the LightPixAE20 is turned on (available only for colored areas)	
OUT.T: Black / White Target color: Selects detecting color.	 Black (default) / White
VER Version: Version, Size of view range and system and operation unit versions.	 (Size of view range differs depending on the product number.)
SORTD Sorting order: Set sorting order ascending or descending.	 DSC: Descending ASC: ascending

Function Upper: Function name and options to be displayed Middle: Name Lower: Description	Display on the operation unit (The left LCD display shows default settings.)
SORTT Sorting: Selects standard item for sorting.	 <p>AREA: area / NONE: no sorting / CrdY: coordinate-Y of gravity center / CorX: coordinate-X of gravity center</p>
E.CODE Terminal code: Selects type of terminal code when continuous output.	
O.ANGLE Out Angle: Outputs the principal axis angle.	 <p>Output principal axis angle of objects when the setting of Continuous output is ON.</p>
O.CORD Out Coordinate: Outputs coordinate of gravity center.	 <p>Outputs coordinate of gravity center of objects in order of X-coordinate followed by Y-coordinate when Continuous output is ON.</p>
O.PIX Out Pixel Outputs area measurement of objects.	 <p>Outputs area measurement of the objects when Continuous output is ON. (in pixel unit)</p>
O.T.PIX Out Total Pixels	 <p>Outputs total value of area measurement of the objects when Continuous output is ON. (in pixel unit)</p>
O.LAND Out Detected count: Outputs detected object count.	 <p>Outputs detected count when Continuous output is ON.</p>
CONT Continuous output (Inspection Data Output Timing):	 <p>Outputs selected detecting data through RS-232C (serial communication) for every inspection.</p> <ul style="list-style-type: none"> ON: Outputs per inspection OFF: Outputs only when required by commands
IOINI: (OFF / ON) I/O Initial Type Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on	 <ul style="list-style-type: none"> OFF: Calls the product type No. that is set as an "Initial type" ON: Calls the product type No. for the types of the signals that were input to the I/O port
T.TRG: (ON / OFF) Teaching Trigger: Sets external trigger to ON (valid) or OFF (invalid)	
A.BACK: (ON / OFF) Answer back: Displays the gravity center positions of the detected objects as cross marks on the finder unit during inspections.	 <ul style="list-style-type: none"> ON: Display OFF: No

4.7.4 Teaching in TEACHING mode

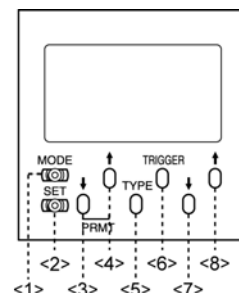
In TEACHING mode, you can make and save the following settings for each product type.

- Exposure time: 0.03 to 50.00 ms
- Binary level: To set a threshold value in order to obtain a binary image
- Inspection area size/position: Sets the area for scanning

When you pressed the TRIGGER button (<6>), the above values are saved except Exposure time and Binary level which is automatically adjusted. When you change the adjusted exposure time and binary level, after changing the value go out of TEACHING mode without pressing the TRIGGER button.

Operation in TEACHING mode

The number in < > in the table below represents the button number of the operation unit (see the figure on the right).



In INSPECTION (or RUN) mode	TEACHING mode ("TEACH" is displayed.)	
<p>Search area (within the blue frame)</p> <p>Gravity center of the objects (cross)</p>	<p>TEACH READY 1 150 193</p> <p>↓ <5></p> <p>Upper line- Binary level: 0 – 255 (default: 150)</p> <ul style="list-style-type: none"> • <3>: Decreases the value • <4>: Increases the value <p>Lower line-Exposure time: 0.03 to 50.00 ms (default: 1.93)</p> <ul style="list-style-type: none"> • <7>: Shortens the exposure time • <8>: Extends the exposure time 	<p>- Save the changed value without TEACHING</p> <p>If Teaching is not necessary, press the <1> after changing value in each step. The value is saved and it returns to RUN mode.</p>
	<p>TEACH READY 1 SIZE</p> <p>↓ <5></p> <p>SIZE: Resizes the inspection.</p>	
	<p>TEACH READY 1 MOVE</p> <p>↓ <6></p> <p>MOVE: Moves inspection area</p> <p><6>: Executes a teaching for the current product type</p> <p>Teaching for the current product type is executed.</p>	
	<p>TEACH READY 1 DONE</p> <p>↓ <5></p> <p>DONE: Indicates successful completion of teaching</p> <p>FAIL: Abnormal termination of teaching (The ALARM signal is output.)</p> <p><5>: Returns to the top.</p>	
	<p>TEACH READY 1</p> <p>↓ <2> + <5></p> <p>TEACH READY 2 193</p> <p>↓</p> <p>TEACH READY 7 193</p>	<p>- Type Switch</p> <p>You can always switch the product types by pressing the <2> and <5> buttons at the same time.</p> <p>Product type No.</p>



◆ NOTE

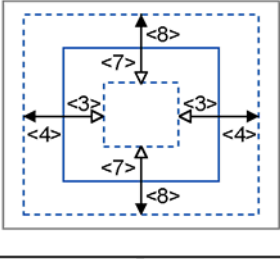
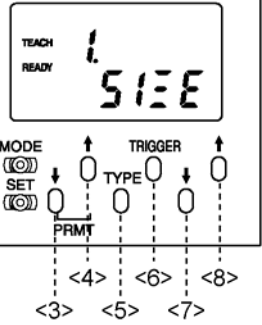
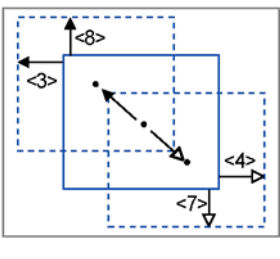
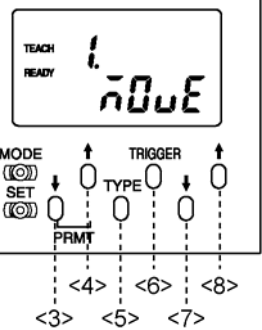
- If the ALARM signal is output after teaching is completed, the signal is held ON until teaching is successfully completed. As long as the unit keeps outputting the ALARM signal, it cannot properly execute an inspection. In this case, you have to execute a teaching again.
- Teaching with pressing the <6> TRIGGER button adjusts binary level and exposure time automatically.

When you only change the value of binary level and exposure time, change the value and then press the <1> button but the <6> button. Changed value will be saved and you will return to RUN mode.

Operation Unit cannot execute Teaching with specified binary level and exposure time.

To execute Teaching without changing the set binary level and exposure time (or automatic adjusting), use the setting dedicated software, "AETOOL".

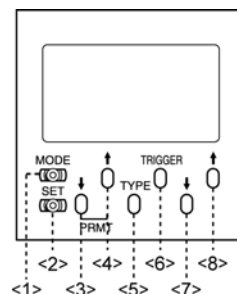
Resizing and moving the inspection area

Setting items	Description
 	<p>SIZE: Resize the inspection area size</p> <p>X direction (width)</p> <ul style="list-style-type: none"> • The <3> button: Reduces the width • The <4> button: Enlarges the width <p>Y direction (length)</p> <ul style="list-style-type: none"> • The <7> button: Reduces the length • The <8> button: Enlarges the length <p>The inspection area is displayed in blue.</p>
 	<p>MOVE : Movement of inspection area position</p> <ul style="list-style-type: none"> • The <3> button: Moves the inspection area to the left. • The <4> button: Moves the inspection area to the right. • The <8> button: Moves the inspection area up. • The <7> button: Moves the inspection area down

4.7.5 Setting Up Judgement Criteria in JUDGEMENT CRITERIA modes

Based on the base measurement saved by teaching, the allowable limits for OK judgement are specified each in X and Y direction in mm.

Operation in JUDGEMENT CRITERIA SETTING mode



In INSPECTION (or RUN) mode	In JUDGEMENT CRITERIA SETTING mode ("SET" is displayed.)
<p>Search area (within the blue frame)</p> <p>Gravity center of the objects (cross)</p>	<p>SET</p> <p>RMaP: Reference of maximum area value RMiP: Reference of minimum area value</p>
	<p>Displays maximum/minimum area values of the objects detected in the last execution of test, inspection, or teaching in mm² unit.</p>
	<p>Maximum and minimum values to set</p> <ul style="list-style-type: none"> • PMaP: Area – Upper limit • PMiP: Area – Lower limit <p>Sets upper/lower limits of area of objects in mm² unit.</p>
	<ul style="list-style-type: none"> • PMaA: Principal axis angle – Upper limit • PMiA: Principal axis angle – Lower limit <p>Sets upper/lower limits of principal axis angle of objects in 0.1-degree unit.</p>
	<ul style="list-style-type: none"> • PMaL: Maximum detected count (0 -500) • PMiL: Minimum detected count (0 -500) <p>Sets upper/lower limits of detected count of objects to judge as OK.</p>
	<ul style="list-style-type: none"> • <8>: Increases the value • <7>: Decreases the value
	To type No.2

4.7.6 Measurement Execution

The ways of measurement execution

Internal trigger: ON	Measurement is automatically executed by switching to RUN mode.
Internal trigger: OFF	After switching to RUN mode, input the TRIGGER signal to external devices or press the TRIGGER button.

Judged measurement results

The LightPixAE20 outputs these judgment results to parallel ports of OUT1 to OUT3

Judgement results		OUT2	OUT1
OK	When the number of detected objects satisfies the judgment criteria. (The objects of specified number are detected, which have certain size and principle axis angle.)	OFF	ON
NG	When the number of detected objects fails to satisfy the judgment criteria, or more than 501 objects are detected.	OFF	OFF



◆ NOTE

Switching between ON/OFF of Internal Trigger (I.TRR) can be set in CONFIGURATION mode.

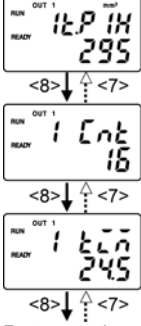

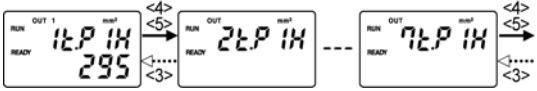


◆ REFERENCE

Parallel input/output timing chart: Page 118

Checking measurement data

When carrying out measurement in RUN mode, you can check the detected total area value, detected object count, and inspection time.

Display data switch	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">  <p>Return to the top.</p> </div> <div style="width: 50%;"> <p>Top line: Product type number and data type</p> <p>Data type:</p> <ul style="list-style-type: none"> • T.Pix: Total area (mm² unit) • Cnt: Detected count • Time: Calculation time <p>Bottom line: Data value</p> <ul style="list-style-type: none"> • Total area • Detected count <p>When judgment result is NG, the screen display is as the figure shown on the right.</p> <ul style="list-style-type: none"> • Calculation time: UP to 4-digit including the numbers under the decimal point </div> </div> <div style="text-align: right; margin-top: 20px;">  </div>
Product type switch	<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>The <3>, <4> and <5> buttons: Change the product types Once you switch the product types, the outputs to the ports of OUT1 to OUT3 are reset.</p> </div> </div>

Data range*


Unit type	ANE2000	ANE2010	ANE2020	ANE2030*
Data				
Area (mm ²)	0 to 2.00	0 to 10.00	0 to 30.00	0 to 80.00
Detected count	0 to 500			

*The view range of ANE2030 changes within the range of 70 x 56 to 100 x 80 depending on the installation position, but the measured data are converted into mm based on the range of view 80 x 70. Therefore, if you use the unit out of the view range of 80 x 70, the detected length differs from the actual size.

4.8 Detailed Functions in CONFIGURATION Mode


Item	Description	Application
I.SETT: (CANCEL / SET) Initial Setting:	Returns to the default settings for each item in CONFIGURATION (refer to the section describing CONFIGURATION mode for each application) section 4, "Inspection Applications" for more information on	All
SAVE: (CANCEL / SAVE) SAVE:	Saves the current configuration data To save the current configuration data: Select "SAVE" and press the TRIGGER button for three seconds. Once the data are saved, "DONE" appears on the operation unit.	All
TEACH: (OK / OK NG) Teaching:	Automatically input the allowable range according to the difference of the detection value after executing a teaching for OK product and NG product. OK: Executes a teaching for base OK product OK NG: Execute a teaching for NG product after executing a teaching for OK product. The allowable range is set to around the median between the detection values for OK product and NG product. You can change it in JUDGEMENT CRITERIA SETTING mode.	Color Area / Color Judgment / Color pattern Matching / Gray Pattern Matching / Edge Detection / Length Measurement
B.L.PTN: (ON/OFF10/OFF30/OFF60) Backlight Pattern:	Turns the backlight on the finder unit off at a certain time after operating the operation unit. The longer the backlight off time, the longer the expected service life of the backlight. Turn it on only when needed. <ul style="list-style-type: none"> ON: Always turns off. Never turns on. OFF10: Turns off after 10 minutes OFF30: Turns off after 30 minutes OFF60: Turns off after 60 minutes 	All
L.ON.OF: (ON / OFF) LED On / Off:	Allows you to select whether or not to use a built-in LED light. <ul style="list-style-type: none"> ON: The built-in LED emits per inspection execution OFF: The built-in LED does not emit. Please separately install lighting equipment for image processing. 	All
A.SAVE: (ON / OFF) Auto Save:	Automatically saves setting or changed data when the mode was changed from JUDGEMENT CRITERIA SETTING mode to INSPECTION mode or from TEACHING mode to INSPECTION mode <ul style="list-style-type: none"> ON: Activate the Auto Save function OFF: Cancel the Auto Save function (Save the setting or changed data manually before turning the unit off.) 	All
ST.NO: (1 to 99) Station Number:	Indicates the unit (station) number used for serial communication. If you want to connect multiple LightPix units through the RS-232C-to-RS485/RS485-to-RS232C conversion adapter a conversion adapter, allocate different station numbers to each unit.	All
BAUD.R: (9.6 to 57.6 kbps) Baud Rate:	Allows you to select communication speed for RS-232C communication. Set the same communication speed as the destination unit. Selectable communication speeds: 9.6 / 14.4 / 19.2 / 38.4 / 57.6 (kbps)	All
OUT.D: (0 to 160 ms) 20 ms Output Delay:	Waits the setting time after the original timing and outputs inspection results. After that, the READY signal is turned on, and the inspection time (READY signal OFF time) becomes longer by the set output delay time.	All

Item	Description	Application
CAP.D: (0 to 160 ms) 1 ms Capture Delay:	Indicates the waiting time for the LightPixAE20 to capture the image after the TRIGGER signal input But, the READY signal is turned off without delay after the TRIGGER signal is input, irrespective of the Capture Delay time. Inspection time (READY signal OFF time) will become longer by the amount of the Capture Delay time	All
I.TRR: (ON / OFF) Internal Trigger:	To select whether or not to execute an inspection by receiving the signal to from the external device <ul style="list-style-type: none"> ON: Automatic continuous inspections (no need to receive the TRIGGER signal from the external device) OFF: Executes an inspection for each TRIGGER signal input from the external device 	All
INI.T: (1 to 7) Initial Type:	Product type No. that is called when turning on the LightPixAE20 But, this function is available only if the I/O Initial Type function (, which calls the product type No. from the I/O port when the power was turned on) is set to "OFF".	All
T.TRG: (ON / OFF) Teaching Trigger:	When the TRIGGER signal is input from the external device, you can select whether or not execute a teaching. <ul style="list-style-type: none"> ON: TRIGGER signal on The LightPixAE20 executes a teaching after the TRIGGER signal input TRIGGER OFF: TRIGGER signal off The LightPixAE20 executes a teaching only when the TRIGGER button is pressed. It does not execute a teaching even when the TRIGGER signal is input. The setting of this function is effective only in TEACHING mode, not in other modes.	All
A.BACK: (ON / OFF) Answer Back:	To display detected position or extracted area on the Finder unit and the screen of AETOOL. <ul style="list-style-type: none"> ON: Activates the function and displays the items. OFF: Cancels the function and displays only images. Each application displays different items. For more information, refer to the field of Answer Back function in "Setting Up the LightPixAE20 in CONFIGURATION mode" of each application.	All

Item	Description	Application
V.IMG1 to 8: V.Image1 to 8:	<p>Displays the saved images (up to eight) and the inspection data. If no image is saved, "EMPTY" is displayed on the operation unit. If any images are saved, the measured data are displayed on the operation unit</p> <p>Example display: Color Area</p>  <p>If no image is saved, "ENPTY" is displayed. If any images are saved, the number of saved images (detection data) is displayed.</p> <ul style="list-style-type: none"> Erasing images: The saved images are removed when the main unit was turned off. You can also delete them by using AETOOL. Saving images on PC Using the software for the LightPixAE20 (AETOOL) saves the saved images in a bitmap form on PC. Refer to AETOOL help file for more details. <p>*When switching the image numbers, hold down the <7> and <8> buttons.</p>	All
SV.IMG: OFF / ALL / NG Save Image:	<p>Automatically saves the inspected images. Sets whether or not any images are save or when the images are saved.</p> <ul style="list-style-type: none"> OFF: Saves no image ALL: Saves the last captured images (up to eight) NG: Saves the last images judged as NG (up to eight) 	All
VER Version: Application version and type, operation unit version, system version and size of view range	<p>Application, operation unit, system version and view range</p> <ul style="list-style-type: none"> About each version n.nn:NN = n.nn: Version for the current application NN: Indicates the type of application 00: Color Area, 01 = Color Judgement, 02 = Color Pattern Matching, 03= Edge Detection 04: Peak Detection, 05 = Length Measurement n.nn:OP = Indicates the operation unit version n.nn:SY = Indicates the system version Size of view range: Differs depending on the product number ANE2000: 2. 1.6 ANE2010: 10. 8 ANE2020: 30. 25 ANE2030: 80. 70 ("80.70" is displayed, but actual size of view range differs depending on the installation distance. Size of view range 70: 56 – (installation distance: 140) – 100.80 (installation distance: 220) 	All
IOINI: (OFF / ON) I/O Initial Type:	<p>This function can call the product type No. for the types of the signals that were input to the I/O port when the power was turned on.</p> <ul style="list-style-type: none"> ON: Reads and calls the product type No. for the types of the signals that were input to the I/O port. The product type No. that was set as "Initial Type" while in CONFIGURATION mode is not available OFF: Calls the product type No. that was set as "Initial Type" while in CONFIGURATION mode. The product type No. for the types of the signals that were input to the I/O port is not available 	All

Item	Description	Application																								
SPEED: (High / Mid / Low) Speed:	<p>Select your desired inspection speed from the following three options. You can speed up the LightPixAE20 by changing the speed in the following order: Low -> Middle -> High</p> <p>Every time you change the speed, the “computation time” is also changed. Speed for each application is as the table shown below:(Unit: ms)</p> <table><tr><td></td><td>High</td><td>Middle</td><td>Low</td></tr><tr><td>Color Judgement</td><td>20</td><td>50</td><td>150</td></tr><tr><td>Color Pattern Matching</td><td>100</td><td>200</td><td>500</td></tr><tr><td>Gray Pattern Matching</td><td>100</td><td>200</td><td>500</td></tr><tr><td>Edge Detection</td><td>10</td><td>15</td><td>20</td></tr><tr><td>Length Measurement</td><td>15</td><td>20</td><td>30</td></tr></table> <p>If you set Speed to Middle or High, the unit scans the 352 pixels (horizontal) x 288 pixels (vertical) by skipping some of them. Therefore, the inspection results differ depending on the setting value.</p> <p>For the difference occurred by inspection speed setting in Color Pattern Matching and Gray Pattern Matching, refer to the pages describing on each checker.</p>		High	Middle	Low	Color Judgement	20	50	150	Color Pattern Matching	100	200	500	Gray Pattern Matching	100	200	500	Edge Detection	10	15	20	Length Measurement	15	20	30	Color Judgement / Color Pattern Matching / Gray Pattern Matching / Edge Detection/ Length Measurement
	High	Middle	Low																							
Color Judgement	20	50	150																							
Color Pattern Matching	100	200	500																							
Gray Pattern Matching	100	200	500																							
Edge Detection	10	15	20																							
Length Measurement	15	20	30																							
DIRC.T: Both / DX / DY Direction Type:	<p>Allows you to select a direction in which lengths are measured</p> <ul style="list-style-type: none">Both: Lengths are measured in both X and Y directionsDX: Lengths are measured only in the X (horizontal) directionDY: Lengths are measured only in the Y (vertical) direction	Length Measurement																								
OUT.T: Black / White Selects a color of inspection object	<p>Select a color (black or white) of the area to be inspected. Length Measurement and Feature Extraction inspect a binary image, so you select color (black or white) of the pixels to be target after binarizing the captured image.</p>	Length Measurement/ Feature Extraction																								
DETAL: (ON / OFF) Detail: Allows you to select the detailed settings of the computation conditions ON/OFF	<p>Color Pattern Matching function is used for detecting an image that matches the saved template having more than the certain degree of similarity</p> <ul style="list-style-type: none">ON: The detailed settings are available. Four detailed conditions are displayed.OFF: The detailed settings are unavailable. Four detailed conditions are not displayed. <p>Detailed conditions include REVISE, REVISE2, CANDIDATE1, and CANDIDATE2.</p>	Color Pattern Matching / Gray Pattern matching																								
REVIS: (0 to 50) Revise: The degree of similarity at the first step decreases by the setting value.	<p>Detailed conditions (DETAL): Available only if the Detail function is set to ON. The Revise function is used for detecting an image having more than the degree of similarity (0 – 100) from which the value set here was subtracted.</p> <p>Refer to the pages describing Color Pattern Matching and Gray Pattern Matching for more details.</p>	Color Pattern Matching / Gray Pattern Matching																								
REVI2: (0 to 50) Revise2: The degree of similarity at the second step decreases by the setting value.																										

Item	Description	Application
CAND1: (1 to 50) Candidate1: Number of candidates to image detection at the first step	<p>DETAL: Available only if the Detail function is set to ON. If multiple images having more than the set degree of similarity exist at the first and second steps, the LightPixAE20 detects the candidates of the number specified here.</p> <p>Refer to the pages describing Color Pattern Matching and Gray Pattern Matching for more details.</p>	Color Pattern Matching / Gray Pattern Matching
CONT (OFF / ON) Continuous output:	<p>To output detected data which has been set to output in advance through serial communication (RS-232C) in every inspection automatically.</p> <p>Setting "ON" outputs the data selected from the following items in every inspection in sequence.</p> <ul style="list-style-type: none"> • Total detected pixels • Detected count • Area (number of pixels) : per detecting object • Coordinate of gravity center (X, Y): per detecting object • Principal axis angle: per detecting object <p>Terminal code can be added. For details of communication methods, refer to Chapter 6.</p>	Feature Extraction
O.ANGLE (OFF / ON) Out Angle:	Selecting "ON" outputs data of principal axis angle through serial communication (RS232-C) in continuous outputting.	Feature Extraction
O.CORD (OFF / ON) Out Coordinate:	Selecting "ON" outputs data of X and Y coordinates of gravity center through serial communication (RS232-C) in continuous outputting.	Feature Extraction
O.PIX (OFF / ON) Out Pixel:	Selecting "ON" outputs data of area through serial communication (RS232-C) in continuous outputting. (in pixel unit)	Feature Extraction
O.T.PIX (OFF / ON) Out Total Pixels:	Selecting "ON" outputs total area of detected objects through serial communication (RS232-C) in continuous outputting. (in pixel unit)	Feature Extraction
O.LAND (OFF / ON)	Selecting "ON" outputs detected object count through serial communication (RS232-C) in continuous outputting.	Feature Extraction
E.CODE (NONE / CR / CRLF / EOT / ETH)	<p>To select type of terminal codes in continuous outputting.</p> <p>Terminal codes (ASCII code)</p> <ul style="list-style-type: none"> • NONE = no code • CR (0 DH) • CRLF (0 DH 0 AH) • EOT (04 H) • ETX (03 H) 	Feature Extraction
SORTT Sorting:	<p>Sorts the data of detected objects in the same order constantly. When outputting to the external devices, the data is output in sorted order.</p> <ul style="list-style-type: none"> • NO: No sorting • Area / Gravity X/ Gravity Y: Sorts data by the selected item 	Feature Extraction

Item	Description	Application
<p>SORTD Sorting order:</p>	<p>Sets sorting order, ascending or descending.</p> <p>When selecting "Area" in Sorting, the data is sorted descending order of area when setting "descending" for Sorting order, and vice versa.</p> <p>Sorted by "Area" in "descending" order...</p> <p>Result 1 3 2</p> 	<p>Feature Extraction</p>

Section 5

Parallel Communication

5.1 Operations through Parallel Communication

5.1.1 Using Input Signals from External Devices

Inputting signals to each cable from external devices enables the LightPixAE20 to perform the following operations.

Input	Operation	Used signal
Input: Operations triggered by inputting signals from external devices	Executes an inspection	TRIGGER signal
	Switches product types	TYPE1 to 3 signals
	Selects the product type No. that is called when the power was turned on	TYPE1 to 3 signals
	Switches to TEACHING mode	TEACH signal
	Teaching (Switches modes and executes a teaching)	TEACH signal + TRIGGER signal

5.1.2 Output Signals from the LightPix

The data output from the LightPixAE20 when executing a reading operation

After executing an inspection, the following signals are output to the parallel ports of OUT1 to OUT3. The output signals differ depending on the application and result.

Color Area

Judgment Results		OUT3	OUT2	OUT1
OK	Within the range	OFF	OFF	ON
NG	Out of the range	OFF	OFF	OFF

Color Judgment

Color (Product Type) No.	OUT3	OUT2	OUT1
0 N/A = All NG	OFF	OFF	OFF
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	ON	ON
4	ON	OFF	OFF
5	ON	OFF	ON
6	ON	ON	OFF
7	ON	ON	ON

Color Pattern Matching / Gray Pattern Matching

Judgement Results		OUT3	OUT2	OUT1
All OK	An image having more than the specified degree of similarity is detected. X- and Y-positions (distances) are within the range	ON	ON	ON
Image Detection X = OK	An image having more than the specified degree of similarity is detected. X-position (distance): Within the range Y-position (distance): Out of the limit	OFF	ON	ON
Image Detection Y = OK	An image having more than the specified degree of similarity is detected. X-position (distance): Out of the range Y-position (distance): Within the range	ON	OFF	ON
Image Detection	An image having more than the specified degree of similarity is detected, but X- and Y-position (distance) is out of range.	OFF	OFF	ON
No images having more than the specified degree of similarity are detected.		OFF	OFF	OFF

Edge Detection

Judgement Result		OUT3	OUT2	OUT1
OK	Within the base position +/- judgement criteria setting value	OFF	OFF	ON
NG	Except those above	OFF	OFF	OFF

Peak Detection

Judgement Result		OUT3	OUT2	OUT1
OK	Both X and Y distances are within the base position +/- Judgement Criteria Setting value	OFF	OFF	ON
NG	X and/or Y distance is out of range	OFF	OFF	OFF

Length Measurement

Judgement Results		OUT3	OUT2	OUT1
All OK	Both Max. and Min. are within the base position +/- Judgement Criteria Setting value	OFF	ON	ON
MAX:OK	Only maximum value is within the range.	OFF	ON	OFF
MIN: OK	Only minimum value is within the range.	OFF	OFF	ON
All NG	Both maximum and minimum values are out of range. Measurement of length failed.	OFF	OFF	OFF

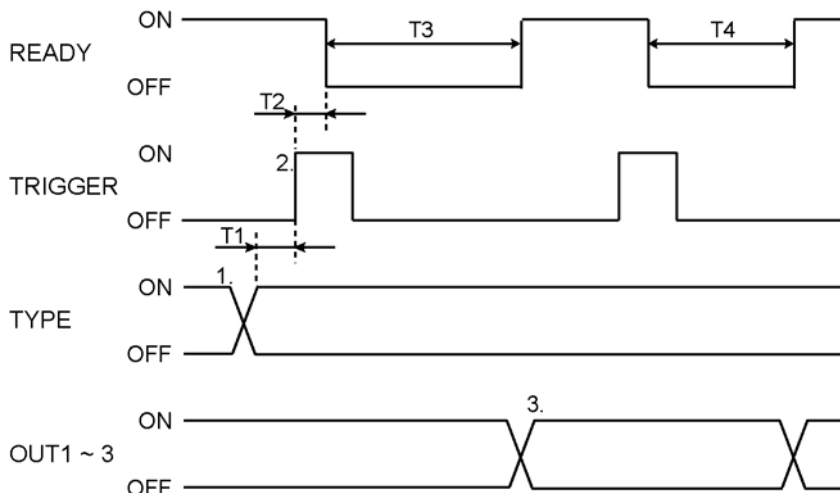
Feature Extraction

Judgement Results		OUT2	OUT1
OK	When the number of detected objects satisfies the judgment criteria. (The objects of specified number are detected, which have certain size and principle axis angle.)	OFF	ON
NG	When the number of detected objects fails to satisfy the judgment criteria, or more than 501 objects are detected.	OFF	OFF

5.2 Input/Output Timing

5.2.1 Performing a Reading Operation (Internal Trigger: OFF)

When you perform inspection by inputting the TRIGGER signal from external devices, follow the timing chart shown below. If you switch product types before executing an inspection, input the signals following the timing chart below.



1. Make sure the READY signal is ON, and then input TYPE 1-3 signals.

The signal is changed to the product type you set. Input signals for product switch within more than two milliseconds before the signal for inspection execution (trigger) signal is input ($T1 \geq 2 \text{ ms}$).

2. Make sure the READY signal is ON and input the TRIGGER signal for more than T2 (2 ms) ^{*1}.

It may take approximately max. 750 ms to change or read data through RS-232C communication, using external devices or to establish USB communication (AETOOL).

When the READY signal is off, the LightPixAE20 begins a reading operation.

If capture delay time (CAP.D) has been set, images are captured in the setting time after TRIGGER signal recognition.

T3: Inspection Time (, which varies depending on the application) Refer to page 31.

(But, when the product types are switched, the first reading time (T3) becomes 50 ms longer than the second or later reading time (T4).)

3. The LightPix output the inspection results to the ports of OUT1 to OUT3. The READY signal is turned ON.

If the Output Delay time (OUT.D) is set, inspection results are output to the ports of OUT1 to OUT3 in the set time after inspection completion, at the same time, the REDY signal is turned ON.



◆ NOTE

- *1) If you reset (turn off) the TRIGGER signal after confirming that the READY signal is off when using a PLC, the inspection time (T3) must be more than PLC scan time. If the inspection time is short, you can extend the inspection time using the Capture Delay and Output Delay functions.
- Refer to section 4.7, "Detailed Functions in CONFIGURATION" on page 97 for details of the settings of Capture Delay (CAP.D) and Output Delay (OUT.D).

5.2.2 Switching Product Types and Setting the Initial Product Type No.

What is product type switch?

Product type switch is to call a product type, for which you want to execute an inspection or a teaching, from product types of 1 to 7. You can switch the product types only by inputting the signals of the types for the product type No. to the I/O port.

To specify the initial product type No. when the power was turned on

You can call a certain product type when the power was turn on. Set the I/O Initial Type function to “ON” while in CONFIGURATION mode, and input the signals of the types for the desired product type to the I/O port before the power is turned on.

To switch product types:

You can call the desired product type No. by turning the TYPE signals 1 to 3 on/off as the table shown below.

TYPE No.	TYPE3	TYPE2	TYPE1
1	OFF	OFF	OFF
2	OFF	OFF	ON
3	OFF	ON	OFF
4	OFF	ON	ON
5	ON	OFF	OFF
6	ON	OFF	ON
7	ON	ON	OFF

5.2.3 Switching to TEACHING Mode

What is TEACHING mode switch?

TEACHING mode switch is to switch between RUN (VIEW) mode and TEACHING mode.

To switch between TEACHING mode and RUN/RUN VIEW mode:

The operation modes are switched only by changing the TEACH signal as the table shown below.

To switch between TEACHING mode and RUN/RUN VIEW mode:

TEACH	
ON	OFF
READING mode	RUN (RUN VIEW) mode



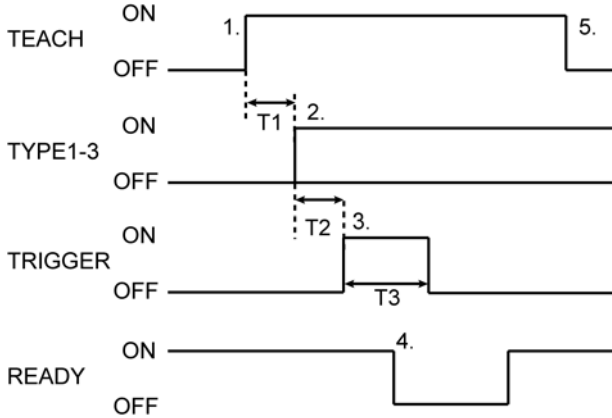
◆ NOTE

Only turning the signals on/off switches product types and operation modes. The statuses of signals TEACH and TYPE 1 to 3 is always monitored except when the LightPixAE20 executes an inspection. Therefore, after changing to the desired mode, maintain the status of these signals until the next time you switch product types.

5.2.4 Teaching

The LightPixAE20 can execute a teaching using the signals from the external devices based on the currently captured image, but exposure time and binary level may be changed after teaching execution. Therefore, execute a teaching only if there is no problem having these values changed.

Timing chart: Teaching for OK product only



1. Make sure the READY signal is ON and input the TEACH signal.
2. Input a product type, for which you want to perform a teaching, to the ports of TYPE 1-3 in more than two milliseconds (T1).
3. After two milliseconds (T2), input the TRIGGER signal.

Input the TRIGGER signal for the following time period.

Used inspection application	Time period of T3
Color Area, Color Judgement, Color Pattern Matching,	750 ms or longer
Edge Detection, Peak Detection, Length Measurement, Gray Pattern Matching, Feature Extraction	350 ms or longer

The READY signal is turned off and a teaching is executed. ("ADJ" is displayed on the operation unit.)

After the teaching is completed, the READY signal is turned on. If the unit failed to complete the teaching, the ALARM signal is turned on.

4. Turn the TEACH signal off and switch to INSPECTION (RUN, RUN VIEW) mode.

When the ALARM signal is turned on at the previous step, it keeps on until the teaching is successfully complete.

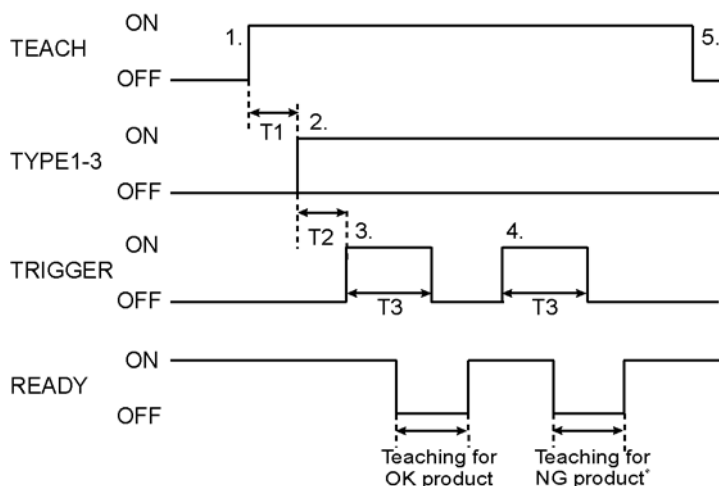


◆ NOTE

If the ALARM signal is output after teaching, adjust exposure time and binary level using the operation unit or AETOOL. As long as the unit keeps outputting the ALARM signal, it cannot execute an inspection properly.

Timing chart: Teaching for OK and NG products

If the TEACH function is set to OKNG in CONFIGURATION mode, execute a teaching following the instructions below:



1. Confirm that the READY signal is ON and input the TEACH signal.
2. Input a product type, for which you want to perform a teaching, to the ports of TYPE 1-3 in more than two milliseconds (T1).
3. Capture the OK product and input the TRIGGER signal after two milliseconds (T2).
The READY signal is turned off and the unit starts a teaching for OK product. ("ADJ" is displayed on the operation unit.)

Input the TRIGGER signal for the following period of time.

Used inspection application	Time period of T3
Color Area, Color Judgement, Color Pattern Matching	750 ms or longer
Edge Detection, Peak Detection, Length Measurement, Gray Pattern Matching	350 ms or longer

4. After capturing the NG product, confirm that the READY signal is ON and then input the TRIGGER signal.
(Time period of T3 is the same as that used for step 3.)

After the READY signal is turned off, the unit executes a teaching for NG product.

When the teaching was completed, the READY signal is turned on.

If the unit failed to complete a teaching, the ALARM signal is turned on.

5. Turn the TEACH signal off and switch to INSPECTION (RUN, RUN VIEW) mode.

If the ALARM signal is turned on at the previous step, this ALARM signal is held on until the unit successfully completes a teaching.



◆ NOTE

If the ALARM signal is output after teaching, adjust exposure time and binary level using the operation unit or AETOOL. As long as the unit keeps outputting the ALARM signal, it cannot execute an inspection properly.

Section 6

RS-232C Communication

6.1 Overview

6.1.1 Operations of RS-232C Port

In RS-232C communication for LightPixAE20, each inspection application has different functions of communication.

Operation Application	Read and change data by sending a command from external device to AE20	Continuous output of results per inspection execution
Color Area	Yes	No
Color Judgment	Yes	No
Color Pattern Matching	Yes	No
Gray Pattern Matching	Yes	No
Edge Detection	Yes	No
Peak Detection	Yes	No
Length Measurement	Yes	No
Feature Extraction	Yes	Yes

Read and change data by sending a command from external device to AE20

By sending a command from the external devices to LightPixAE20 and receiving the response, you can read the setting value of LightPixAE20 and inspection results, change the setting value, and execute an inspection and a teaching.

Continuous output of results per inspection execution

This is only for Feature Extraction. When “Continuous output” is set to “ON” in Configuration, every inspection outputs result data from AE20 to the external devices automatically. Data requirement by sending a command from the external devices is not necessary.

6.1.2 Specification of Communication

Communication Specification

Item		Specification
Communication Method		Full-duplex
Synchronous Method		Asynchronous
Communication Speed		1200, 2400, 4800, 9600, 19200, 38400, 57600 bit/s (initial value: 9600) Selectable in CONFIGURATION mode
Transmission Code		ASCII
Transmission Format	Bit Length	8 bits
	Stop Bit	1 bit
	Parity	No
	Flow Control	No
	BCC	Yes
	Terminal code	
	Continuous output	CR (0DH) / NONE: no terminal code / CR+LF (0DH 0AH) / EOT (04H) / ETX (03H)
	Command send	CR (0DH)

6.2 Auto Output of Inspection Result per Inspection (only for Feature Extraction)

Setting “Continuous output” to “ON” in Configuration, outputs setting inspection results in the format described in the following sections to the external devices in every inspection.

6.2.1 Output Data Options

Select outputting data in Configuration menu.

Detected count		The number of detected objects	
Total detected pixels		Total number of pixels of detected objects	
Object No. n*	Area	Area value of object (pixel)	Considering the output setting data as one set, outputs the set of the number of detected objects. Example) When two objects are detected, and Area and Principal axis angle are set to output. Area of No.1→ Angle of No.1→ Area of No.2→ Angle of No.2
	Gravity X	X-coordinate of gravity center of object	
	Gravity Y	Y-coordinate of gravity center of object	
	Principal axis angle	Principal axis angle of object	

*The order of object is changed by the setting of Sorting.

6.2.2 Format of Output Data

The data format in continuous outputting changes depending on judgment (OK/NG) and output setting item.

Format 1: When judgment is “OK”

Selecting output item

- The data sizes of every item are fixed and the digit having no data is filled with “0”.
- Principal axis angle is output being added “-” (minus symbol) in the first digit when its value is negative, and “0” when its value is positive.

<Output example>

Detected count = 1, Area = 150, Gravity X = 190, Gravity Y = 247,
Principal axis angle = -9.5, Terminal code = CR

Detected count	Total detected pixels	Object No.1				BCC	Terminal code
		Area	Gravity X	Gravity Y	Principal axis angle		
0 0 0 1	0 0 0 1 5 0	0 0 0 1 5 0	1 9 0	2 4 7	- 0 9 . 5	3 7	C _R

No selecting output item

O	K	Terminal code
---	---	---------------

When no item is set to output, the device outputs data as above.

Format 2: When judgment is “NG”

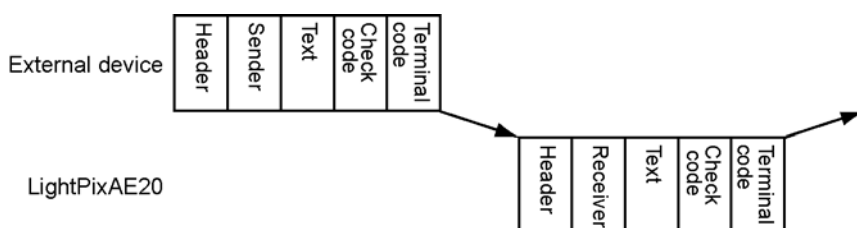
E	R	Terminal code
---	---	---------------

6.3 Data Read and Change by Commands

6.3.1 Command

Command	Code	Description
Data Area Read	RD	Reads the specified data area
Data Area Write	WD	Write the value the specified data area .This also enables you to make the unit execute an inspection and teaching.

6.3.2 Format of Command/Response Message



Each item

Name		Specified character (ASCII code)/Data	Range of values	Description
Header		% (25H) or < (3CH)	---	Beginning of a message <ul style="list-style-type: none"> • %: Number of characters between a header and a terminal code is less than 118. • <: Number of characters between a header and a terminal code is within the range from 119 to 2048.
Receiver/Sender		2-digit decimal	01 to 99	In command messages and response messages, the unit (station) No. of the LightPixAE20 receiving the command, message and sending the response message are shown respectively.
Text	Command	# (23H)	---	Indicates a command message
	Response: Normal	\$ (24H)	---	Indicates a normal response message
	Response: Error	! (21H)	---	Indicates a response message when an error occurred
	Error code	2-digit hexadecimal	00 to FF	Displays the details of the error when it occurred
Block Check code		2-digit hexadecimal	00 to FF	Detects an error in transmission data If you replace a block check code with two asterisks marks, a message can be transmitted without BCC from external device to the LightPix. Even in this case, the LightPix adds BCC to the response message.
Terminator		^C _R (0DH)	---	End of the message

6.3.3 Command Format : Reading Data Area (RD)

External device→LightPixAE20

% or <	Receiver: (Station No.)		#	R	D	D	Head register No.: Five characters				
	$\times 10^1$	$\times 10^0$	Fixed				$\times 10^4$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$

Terminal register No.: Five characters					BCC		C_R
$\times 10^4$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$	$\times 16^1$	$\times 16^0$	Fixed

LightPixAE20→external devices

If normal response consists of integers

% or <	Sender: (Device No.)		\$	R	D	Contents of the register (head): Four characters			
	$\times 10^1$	$\times 10^0$	Fixed			$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$

Contents of the register (terminal): Four characters				BCC		C_R
$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	$\times 16^1$	$\times 16^0$	Fixed
Low		High				

If normal response is a double-word type and consists of actual numbers

% or <	Sender (Station No.)		\$	R	D	Contents of the register: Four characters				Contents of the register (head): Four characters			
	$\times 10^1$	$\times 10^0$	Fixed			$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	$\times 16^5$	$\times 16^4$	$\times 16^7$	$\times 16^6$

Contents of the register (head): Four characters				Contents of the register (terminal): Four characters				BCC		C_R
$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	$\times 16^5$	$\times 16^4$	$\times 16^7$	$\times 16^6$	$\times 16^1$	$\times 16^0$	Fixed
Low		High		Low		High				

Error response

% or <	Sender: (Station No.)		!	Error code		BCC		C_R
	$\times 10^1$	$\times 10^0$	Fixed	$\times 16^1$	$\times 16^0$	$\times 16^1$	$\times 16^0$	Fixed



◆ NOTE

Actual numbers in a response message are in the IEEE format.

6.3.4 Command Format : Writing in Data Area (WD)

External device→LightPixAE20

Integers

% or <	Receiver: (Station No.)		#	W	D	D	Head register No.: Five characters					Terminal register No.: Five characters				
	$\times 10^1$	$\times 10^0$	Fixed				$\times 10^4$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$	$\times 10^4$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$

Writing data (head): Four characters				Writing data (terminal): Four characters				BCC		C_R
$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	$\times 16^1$	$\times 16^0$	
Low		High		Low		High				Fixed

Double-word type and actual values

% or <	Sender (Station No.)		#	W	D	D	Contents of the register (head): Four characters				Contents of the register (head): Four characters			
	$\times 10^1$	$\times 10^0$	Fixed				Low		$\times 16^1$	$\times 16^0$	High		$\times 16^3$	$\times 16^2$

Contents of the register (terminal): Four characters				Contents of the register (terminal): Four characters				BCC		C_R
$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	$\times 16^5$	$\times 16^4$	
Low		High		Low		High				Fixed

LightPixAE20→External devices

Normal response

% or <	Sender: (Station No.)		\$	W	D	BCC		C_R
	$\times 10^1$	$\times 10^0$	Fixed			$\times 16^1$	$\times 16^0$	

Error response

% or <	Sender: (Device No.)		!	Error code		BCC		C_R
	$\times 10^1$	$\times 10^0$	Fixed		$\times 16^1$	$\times 16^0$	$\times 16^1$	



◆ NOTE

Specify actual values in the IEEE format.

6.3.5 Notation Sytem for Data in Command/Response Messages

The data in command/response messages are described in the following two systems:

Decimal Data

$\times 10^n$: Decimal data

Condition	System	Description																					
Data register “2100” is specified.	<table><tr><td colspan="5">Register No.: Five characters</td></tr><tr><td>0</td><td>2</td><td>1</td><td>0</td><td>0</td></tr></table> ASCII characters	Register No.: Five characters					0	2	1	0	0	<p>The specified format for data register of WD command is as follows:</p> <table><tr><td colspan="5">Register No.: Five characters</td><td rowspan="2">ASCII characters</td></tr><tr><td>x 10⁴</td><td>x 10⁰</td><td>x 10³</td><td>x 10²</td><td>x 10¹</td></tr></table> <p>Just specify “02100” as decimal data.</p>	Register No.: Five characters					ASCII characters	x 10 ⁴	x 10 ⁰	x 10 ³	x 10 ²	x 10 ¹
Register No.: Five characters																							
0	2	1	0	0																			
Register No.: Five characters					ASCII characters																		
x 10 ⁴	x 10 ⁰	x 10 ³	x 10 ²	x 10 ¹																			

Hexadecimal Data

$\times 16^n$: Hexadecimal data

Condition	System	Description																								
Integer data "200" is specified.	<table><tr><td colspan="4">Writing data: Four characters</td></tr><tr><td>C</td><td>8</td><td>0</td><td>0</td></tr><tr><td colspan="2">Low</td><td colspan="2">High</td></tr></table> ASCII characters	Writing data: Four characters				C	8	0	0	Low		High		<p>Data format used for WD command is as follows:</p> <table><tr><td colspan="4">Writing data: Four characters</td></tr><tr><td>$\times 16^1$</td><td>$\times 16^0$</td><td>$\times 16^3$</td><td>$\times 16^2$</td></tr><tr><td colspan="2">Low</td><td colspan="2">High</td></tr></table> ASCII characters	Writing data: Four characters				$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	Low		High	
Writing data: Four characters																										
C	8	0	0																							
Low		High																								
Writing data: Four characters																										
$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$																							
Low		High																								
		<p>If the condition data "200" is represented in hexadecimal numbering system, it will be "00C8" for ASCII characters. If low and high are switched in accordance with the format above, the number will be "C800".</p>																								

6.3.6 List of Error Codes

Error code	Error type	Description
40H	BCC	A BCC error occurred in a command data.
41H	FORMAT	Headers or command start marks are out of range. <ul style="list-style-type: none"> Header: % or < Command start mark: #
		The data exceeding the upper limit was sent. <ul style="list-style-type: none"> For header "%", The number of characters between a header and terminator exceeded 118.
		For header "<" The number of characters between a header and terminator exceeded 2048.
		The numbers specified as a head and terminal word numbers do not match the numbers of the following data.
42H	NotSupport	Unsupported command was sent.
61H	DATA	Head word No. is not less than or equal to terminal word No.
		Head or terminal word No. is not specified in decimal numbering system.
		In WD command, writing data are not specified in hexadecimal numbering system.
		In WD command, a number out of the range specified by each command Eg, 0 or a value more than 8 was specified as initial product type.
		In WD command, when specifying start/end point and min./max. by using the command only one time, for example, if the start point in the area to be changed \geq the preset end point, these values should be reversed. When moving the area and changing the preset max./min. value largely, send the values by using the command each time.
62H	REGIST	Address out of the range specified by each command is assigned. For example, the addresses for reading area setting are within the range from 2200 to 2227, but an address between 2201 and 2228 is assigned.
63H	MODE	In WD command, the LightPixAE20 cannot receive the command. E.g., the WD command was sent in CONFIGURATION mode.
66H	ADDRESS	The number of the connected main unit does not match that of the main unit specified by the command.

6.3.7 Communication Conditions

The detailed descriptions of the conditions that the LightPixAE20 must fulfill in order to establish RS-232C communication are described below.

Communication mode

The LightPixAE20 has four modes, but it can establish RS-232C communication in two modes.

Communication mode	<ul style="list-style-type: none">• RUN (RUN VIEW) mode• TEACHING mode
No communication mode	<ul style="list-style-type: none">• CONFIGURATION mode• JUDGE MENT CRITERIA SETTING mode

Readable and writable items differ depending on the communication mode.
“Yes” in the table below indicates that the LightPixAE20 can read and write the items.

Type of item \ Mode		RUN (RUN VIEW)	TEACHING
Inspection	Inspection start	Yes	No
	LOCK	Yes	No
	Others	Yes	Yes
CONFIGURATION		Yes	No
TEACHING		No	Yes
JUDGE MENT CRITERIA SETTING		Yes	No

The LightPixAE20 cannot establish communication in communication mode.

In the following cases, the LightPixAE20 cannot receive any command messages even in communication mode.

While the LightPixAE20 is capturing images

The LightPixAE20 ignores the command message from external devices during image capturing and does not respond to the message.

In RUN (RUN VIEW) mode

Internal trigger setting	Communication method
OFF	<p>Send and receive data after the READY signal is restored (OFF to ON) and before a TRIGGER signal is input from external devices or in 0.03 to 50 ms after the READY signal is turned off. The LightPixAE20 can send and receive a command except when it executes image capture, but you should keep in mind that the reading time will be longer during communication.</p>
ON	<p>When Internal trigger is on, the READY signal turns off immediately after the READY signal restoration, so it is difficult to send and receive data at the specified READY signal ON time. Try to send a command from external devices to the LightPixAE20 every about 50 ms several times until the external devices receive a response from the LightPixAE20, resulting in increasing possibility of receiving the command.</p>

In TEACHING mode

Internal Trigger Setting	Communication method
ON or OFF	<p>In TEACHING mode, the LightPixAE20 is always capturing images regardless of the settings of an internal trigger and the READY signal keeps on. Since you cannot check when the device stops capturing images with external devices, try to send a command every about 50 ms several times until the LightPixAE20 responds to it, resulting in increasing the possibility of receiving the command. The device cannot receive it while executing a teaching.</p> <p>a = Image capture: 0.03 to 50 ms b = Communicable</p>

6.3.8 List of Data Registers for Each Application

Color Area / Color Judgement

Type of item	Item	Com-mand	Register No.	Setting value range	Remarks	
INSPECTION	Area value (pixel)	RD	1100-1101	0 - 101376	Double-word type <ul style="list-style-type: none">For Color Area, The detected area value (number of pixels) for the currently selected product typeFor Color Judgement, The detected area value (number of pixels) for the judged product type	
	Judgement result	RD	1102	0/1	1: OK 0: NG	
	Measurement time	RD	1103	-	Measurement time	
	Area value (mm ²)	RD	1104-1105	Depends on type of unit	Actual value and double-word type For Color Area, The detected area value (number of pixels) for the currently selected product type For Color Judgement, The detected area value (number of pixels) for the judged product type	
	Product type	RD/WD	1400	1-7	WD: Switches the product types RD: Reads the current product type	
	Inspection start	WD	1500	1	Starts an inspection	
	READY	RD	1600	0/1	1: ON	
	ALARM	RD	1601	0/1	0: OFF	
	LOCK	RD/WD	1602	0/1		
	Mode	RD/WD	1603	0-4	0: RUN mode 1: RUN/VIEW mode 2: TEACH mode 3: CONFIGURATION mode (support for RD) 4: JUDGEMENT CRITERIA SETTING mode (support for RD)	
	OUT1	RD	1604	0/1	1: ON	
	OUT2	RD	1605	0/1	0: OFF	
	OUT3	RD	1606	0/1		
TEACHING	Exposure time setting	RD/WD	2100	0003 -5000	Product type 1	WD: Used for running a teaching in data area 2500 using “1” (without exposure time adjustment).
			2101		Product type 2	
			2102		Product type 3	
			2103		Product type 4	
			2104		Product type 5	
			2105		Product type 6	
			2106		Product type 7	RD: Reads the current exposure time

Type of item	Item	Command	Register No.	Setting value range	Remarks
TEACHING	Setting of inspection area	RD/WD	2200	X:351-0	Product type 1: X coordinate at left upper
			2201	Y:287-0	Y Product type 1: Y coordinate at upper left
			2202		X Product type 1: X coordinate at lower right
			2203		Y Product type 1: Y coordinate at lower left
			2204 - 2207		Product type 2: X coordinate at upper left - Y coordinate at lower right
			2208 - 2211		Product type 3: X coordinate at upper left - Y coordinate at lower right
			2212 - 2215		Product type 4: X coordinate at upper left - Y coordinate at lower right
			2216 - 2219		Product type 5: X coordinate at upper left - Y coordinate at lower right
			2220 - 2223		Product type 6: X coordinate at upper left - Y coordinate at lower right
			2224		Product type 7: X coordinate at upper left - Y coordinate at lower right
	Teaching Results	RD	2300	0/1	0: OK 1: NG (The ALARM signal is also output.)
	Teaching Area setting	RD/WD	2400	X:351-0	Product type 1: X coordinate at upper left
			2401	Y:287-0	Product type 1: Y coordinate at upper left
			2402		Product type 1: X coordinate at lower right
			2403		Product type 1: Y coordinate at lower right
			2404 - 2407		Product type 2: X coordinate at upper left - Y coordinate at lower right
			2408 - 2411		Product type 3: X coordinate at upper left - Y coordinate at lower right
			2412 - 2415		Product type 4: X coordinate at upper left - Y coordinate at lower right
			2416 - 2419		Product type 5: X coordinate at upper left - Y coordinate at lower right
			2420 - 2423		Product type 6: X coordinate at upper left - Y coordinate at lower right
			2424 - 2427		Product type 7: X coordinate at upper left - Y coordinate at lower right
	Execution of a teaching for OK product	WD	2500	0/1	0: Adjustment of exposure time 1: No adjustment of exposure time (Execute a teaching using the current exposure time)
	Execution of a teaching for NG product	WD	2600	0	Execute a teaching for NG teaching (CONFIGURATION setting – type of teaching = “OK&NG” is selected 4100=1)

Type of item	Item	Command	Register No.	Setting value range	Remarks
CONFIGURATION	Computation Time	RD/WD	3100	1-3	1: Low / 2: Middle / 3: High (Available only for Color Judgement)
	Initial Product Type	RD/WD	3200	1-7	1-7
	I/O Initial type	RD/WD	3201	0/1	0: OFF (Calls the product type No. that is set as "Initial Type" when the power was turned on) 1: ON (Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on.)
	Internal Trigger	RD/WD	3300	0/1	0: ON / 1: OFF
	Capture Delay	RD/WD	3400	0-160	0-160
	Output Delay	RD/WD	3500	0-160	0-160
	Baud Rate	RD/WD	3600	96-576	(RS-232C Communication Speed) 96, 144, 192, 384, 576
	Station No.	RD/WD	3700	1-99	1-99
	LED On/Off Initial Setting)	RD/WD	3800	0/1	0: ON / 1: OFF
	Type of Teaching	WD	3900	1	
	Save Image Condition	RD/WD	4100	0-1	0: OK only / 1: OK&NG
	Teaching Trigger	RD/WD	4200	0-2	0: OFF / 1: All Images / 2: NG Image only
	Answer Back	RD/WD	4700	1/0	(Trigger signal receive when executing a teaching) 1: On (Receive trigger signal) 0: Off (Do not receive trigger signal)
	Backlight Pattern	RD/WD	4800	0/1	0: ON / 1: OFF
	Auto Save	RD/WD	4900	0-3	0: ON / 1: OFF10 / 2: OFF30 / 3: OFF60
JUDGEMENT CRITERIA SETTING	Max./Min. Area value	RD/WD	5000	0/1	0: ON (the Auto Save function is activated.) 1: OFF (the Auto Save function is canceled.)
		RD/WD	5100 - 5127	0 - 101376	Area value (the number of pixels) Product type 1: Max. = 5100&5101 Min. = 5102&5103 Product type 2: Max. = 5104&5105 Min. = 5106&5107 Product type 3: Max. = 5108&5109 Min. = 5110&5111 Product type 4: Max. = 5112&5113 Min. = 5114&5115 Product type 5: Max. = 5116&5117 Min. = 5118&5119 Product type 6: Max. = 5120&5121 Min. = 5122&5123 Product type 7: Max. = 5124&5125 Min. = 5126&5127
		RD/WD	5128 - 5155	Depends on the type of unit	Area value (mm ²) Product type 1: Max. = 5128&5129 Min. = 5130&5131 Product type 2: Max. = 5132&5133 Min. = 5134&5135 Product type 3: Max. = 5136&5137 Min. = 5138&5139 Product type 4: Max. = 5140&5141 Min. = 5142&5143 Product type 5: Max. = 5144&5145 Min. = 5146&5147 Product type 6: Max. = 5148&5149 Min. = 5150&5151 Product type 7: Max. = 5152&5153 Min. = 5154&5155

Color Pattern Matching / Gray Pattern Matching

Type of item	Item	Command	Register No.	Setting value range	Remarks
INSPECTION	Detection Distance (Unit: Pixel)	RD	1100	0 - 352	X-directional distance
			1101	0 - 288	Y-directional distance
	Judgement Results		1102	0/1	1: OK 0: NG
	Measurement Time		1103	---	
	Detection Distance (mm)		1104-1105	Depends on the Main unit	X-directional distance (mm)
			1106-1107		Y-directional distance (mm)
	Degree of Similarity		1108	0-100	The degree of similarity of a detected image (%)
	Product type	RD/WD	1400	1-7	WD: Switches product types RD: Reads the current product type
	Inspection Start	WD	1500	1	Starts an inspection
	READY	RD	1600	0/1	1: ON
	ALARM	RD	1601	0/1	0: OFF
	LOCK	RD/WD	1602	0/1	
	Mode	RD/WD	1603	0-2	0: RUN mode 1: RUN/VIEW mode 2: TEACH mode 3: CONFIGURATION mode (support for RD) 4: JUDGEMENT CRITERIA SETTING mode (support for RD)
	OUT1	RD	1604	0/1	1: ON
	OUT2	RD	1605	0/1	0: OFF
TEACHING	Exposure Time Setting	RD/WD	2100	0003	Product Type1
			2101	-5000	Product Type2
			2102		Product Type3
			2103		Product Type4
			2104		Product Type 5
			2105		Product Type 6
			2106		Product Type7
	Inspection Area Setting	RD/WD	2200	X:351-0 Y:287-0	Product type 1: X coordinate at upper left
			2201		Product type 1: Y coordinate at upper left
			2202		Product type 1: X coordinate at lower right
			2203		Product type 1: Y coordinate at lower right
			2204-2207		Product type 2: X coordinate at upper left - Y coordinate at lower right
			2208-2211		Product type 3: X coordinate at upper left - Y coordinate at lower right
			2212-2215		Product type 4: X coordinate at upper left - Y coordinate at lower right
			2216-2219		Product type 5: X coordinate at upper left - Y coordinate at lower right
			2220-2223		Product type 6: X coordinate at upper left - Y coordinate at lower right
			2224-2227		Product type 7: X coordinate at upper left - Y coordinate at lower right
	Teaching Results	RD	2300	0/1	0: OK 1: NG (The ALARM signal is also output.)

Type of item	Item	Command	Register No.	Setting value range	Remarks
TEACHING	Color Extraction Area setting (Only for Color Pattern Matching)	RD/WD	2400	X:351-0 Y:287-0	Product type 1: X coordinate at upper left
			2401		Product type 1: Y coordinate at upper left
			2402		Product type 1: X coordinate at lower right
			2403		Product type 1: Y coordinate at lower right
			2404-2407		Product type 2: X coordinate at upper left - Y coordinate at lower right
			2408-2411		Product type 3: X coordinate at upper left - Y coordinate at lower right
			2412-2415		Product type 4: X coordinate at upper left - Y coordinate at lower right
			2216-2219		Product type 5: X coordinate at upper left - Y coordinate at lower right
			2420-2423		Product type 6: X coordinate at upper left - Y coordinate at lower right
			2424-2427		Product type 7: X coordinate at upper left - Y coordinate at lower right
	Execution of a teaching for OK product	WD	2500	0/1	0: Adjustment of exposure time 1: No adjustment of exposure time (a teaching is executed using the current exposure time)
	Execution of a teaching for NG product	WD	2600	0	Execute a teaching for NG teaching (CONFIGURATION setting – type of teaching = “OK&NG” is selected 4100=1)
	Template area setting	RD/WD	2700	X:351-0 Y:287-0	Product type 1: X coordinate at upper left
			2701		Product type 1: Y coordinate at upper left
			2702		Product type 1: X coordinate at lower right
			2703		Product type 1: Y coordinate at lower right
			2704-2707		Product type 2: X coordinate at upper left - Y coordinate at lower right
			2708-2711		Product type 3: X coordinate at upper left - Y coordinate at lower right
			2712-2715		Product type 4: X coordinate at upper left - Y coordinate at lower right
			2216-2219		Product type 5: X coordinate at upper left - Y coordinate at lower right
			2720-2723		Product type 6: X coordinate at upper left - Y coordinate at lower right
			2724-2727		Product type 7: X coordinate at upper left - Y coordinate at lower right
CONFIGURATION	Computation Time	RD/WD	3100	1-3	1: Low / 2: Middle / 3: High (Available only for Color Judgement)
	Initial Product Type	RD/WD	3200	1-7	1-7
	I/O Initial type	RD/WD	3201	0/1	0: OFF (Calls the product type No. that is set as “Initial Type” when the power was turned on) 1: ON (Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on.)
	Internal Trigger	RD/WD	3300	0/1	0: ON / 1: OFF
	Capture Delay	RD/WD	3400	0-160	0-160
	Output Delay	RD/WD	3500	0-160	0-160
	Baud Rate	RD/WD	3600	96-576	(RS-232C Communication Speed) 96, 144, 192, 384, 576
	Station No.	RD/WD	3700	1-99	1-99
	LED On/Off	RD/WD	3800	0/1	0: ON / 1: OFF

Type of item	Item	Command	Register No.	Setting value range	Remarks
CONFIGURATION	Initial Setting)	WD	3900	1	
	Type of Teaching	RD/WD	4100	0-1	0: OK only / 1: OK&NG
	Save Image Condition	RD/WD	4200	0-2	0:OFF / 1:All Images / 2:NG Image only
	Teaching Trigger	RD/WD	4700	1/0	(Trigger signal receive when executing a teaching) 1: On (Receive trigger signal) 0: Off (Do not receive trigger signal)
	Answer Back	RD/WD	4800	0/1	0: ON / 1: OFF
	Backlight Pattern	RD/WD	4900	0-3	0: ON / 1: OFF10 / 2: OFF30 / 3: OFF60
	Auto Save	RD/WD	5000	0/1	0: ON (the Auto Save function is activated.) 1: OFF (the Auto Save function is canceled.)
	Detailed Setting	RD/WD	5400	0/1	1: ON (Make the detailed settings) 0: OFF (Not make the detailed settings)
	Number of Detected Candidates	RD/WD	5500	1-50	The first step
			5501	1-50	The second step Condition: Should be less than the value set for the first step
	Similarity Adjustment	RD/WD	5600	0-50	The first step
			5601	0-50	The second step
JUDGEMENT CRITERIA SETTING	Allowable Range (the number of pixels)	RD/WD	5100 - 5113	X: 0-357 Y:0-288	Product type 1: X = 5100 Y = 5101 / Product type 2: X = 5102 Y = 5103 / Product type 3: X = 5104 Y = 5105 / Product type 4: X = 5106 Y = 5107 / Product type 5: X = 5108 Y = 5109 / Product type 6: X = 5110 Y = 5111 / Product type 7: X = 5112 Y = 5113
	Allowable range (mm)	RD/WD	5114 - 5141	Depends on the type of unit	Actual values and double-word type Product type 1: X = 5114&5115 Y = 5116&5117 Product type 2: X = 5118&5119 Y = 5120&5121 Product type 3: X = 5122&5123 Y = 5124&5125 Product type 4: X = 5126&5127 Y = 5128&5129 Product type 5: X = 5130&5131 Y = 5132&5133 Product type 6: X = 5134&5135 Y = 5136&5137 Product type 7: X = 5138&5139 Y = 5140&5141
	Threshold of Similarity: (%)	RD/WD	5200 - 5213	0-100	Product type 1: 5200 / Product type 2: 5201 / Product type 3: 5202 / Product type 4: = 5204 / Product type 5: 5205 / Product type 6: 5205 / Product type 7: 5206
	Base Distance (the number of pixels)	RD	5300 - 5313	X: 0-357 Y:0-288	Product type 1: X = 5300 Y = 5301 / Product type 2: X = 5302 Y = 5303 / Product type 3: X = 5304 Y = 5305 / Product type 4: X = 5306 Y = 5307 / Product type 5: X = 5308 Y = 5309 / Product type 6: X = 5310 Y = 5311 / Product type 7: X = 5312 Y = 5313
	Base Distance (mm)	RD	5314 - 5341	Depends on the type of unit	Actual values and double-word type Product type 1: X = 5314&5315 Y = 5316&5317 Product type 2: X = 5318&5319 Y = 5320&5321 Product type 3: X = 5322&5323 Y = 5324&5325 Product type 4: X = 5326&5327 Y = 5328&5329 Product type 5: X = 5330&5331 Y = 5332&5333 Product type 6: X = 5334&5335 Y = 5336&5337 Product type 7: X = 5338&5339 Y = 5340&5341

Edge Detection

Type of item	Item	Com- mand	Data register No.	Setting value range	Remarks	
INSPECTION	Detection Edge Direction	RD	1100	0-3	0/1: X 2/3: Y	
	Judgement Results	RD	1102	0/1	1: OK 0: NG	
	Measureme nt Time	RD	1103	---	Measurement time	
	Detection Edge Position (mm)	RD	1104-1105	Depends on the type of unit	Actual values and double-word type The position of a detected edge (mm)	
	Product Type	RD/WD	1400	1-7	WD: Switches the product types RD: Reads the current product type	
	Inspection Start	WD	1500	1	Start an inspection	
	READY	RD	1600	0/1	1: ON	
	ALARM	RD	1601	0/1	0: OFF	
	LOCK	RD/WD	1602	0/1		
	Mode	RD/WD	1603	0-4	0: RUN mode 1: RUN/VIEW mode 2: TEACH mode 3: CONFIGURATION mode support for RD 4: JUDGEMENT CRITERIA SETTING mode (support for RD)	
	OUT1	RD	1604	0/1	1: ON	
	OUT2	RD	1605	0/1	0: OFF	
	OUT3	RD	1606	0/1		
TEACHING	Exposure Time Setting	RD/WD	2100	0003 -5000	Product Type 1	WD: Used for running a teaching in data area 2500 using "1" (without exposure time adjustment). RD: Reads the current exposure time
			2101		Product Type 2	
			2102		Product Type 3	
			2103		Product Type 4	
			2104		Product Type 5	
			2105		Product Type 6	
			2106		Product Type 7	
	Setting of inspection area	RD/WD	2200	X:351-0 Y:287-0	Product Type 1: X coordinate at upper left	
			2201		Product Type 1: Y coordinate at upper left	
			2202		Product Type 1: X coordinate at lower right	
			2203		Product Type 1: Y coordinate at lower right	
			2204 -2207		Product type 2: X coordinate at upper left - Y coordinate at lower right	
			2208 -2211		Product type 3: X coordinate at upper left - Y coordinate at lower right	
			2212 -2215		Product type 4: X coordinate at upper left - Y coordinate at lower left	
			2216 -2219		Product type 5: X coordinate at upper left - Y coordinate at lower right	
			2220 -2223		Product type 6: X coordinate at upper left - Y coordinate at lower right	
			2224 -2227		Product type 7: X coordinate at upper left - Y coordinate at lower right	

Type of item	Item	Com- mand	Data register No.	Setting value range	Remarks
TEACHING	Teaching Results	RD	2300	0/1	0: OK 1: NG (the ALARM signal is also output.)
	Binary Level	RD/WD	2400	0 - 255	Product type 1
			2401		Product type 2
			2402		Product type 3
			2403		Product type 4
			2404		Product type 5
			2405		Product type 6
			2406		Product type 7
	Execution of a teaching for OK product	WD	2500	0/1	0: Adjustment of exposure time 1: No adjustment of exposure time (a teaching is executed using the current exposure time)
	Execution of a teaching for NG product	WD	2600	0	Execute a teaching for NG teaching (CONFIGURATION setting – type of teaching = "OK&NG" is selected 4100=1)
CONFIGURATION	Computation Time	RD/WD	3100	1-3	1: Low / 2: Middle / 3: High (Available only for Color Judgement)
	Initial Product Type	RD/WD	3200	1-7	1-7
	I/O Initial Type	RD/WD	3201	0/1	0: OFF (Calls the product type No. that is set as "Initial Type" when the power was turned on) 1: ON (Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on.)
	Internal Trigger	RD/WD	3300	0/1	0: ON / 1: OFF
	Capture Delay	RD/WD	3400	0-160	0-160
	Output Delay	RD/WD	3500	0-160	0-160
	Baud Rate	RD/WD	3600	96-576	(RS-232C Communication Speed) 96, 144, 192, 384, 576
	Station No.	RD/WD	3700	1-99	1-99
	LED On/Off	RD/WD	3800	0/1	0: ON / 1: OFF
	Initial Setting	WD	3900	1	
	Type of Teaching	RD/WD	4100	0-1	0: OK / 1: OK&NG
	Save Image Condition	RD/WD	4200	0-2	0: OFF / 1: All Images / 2: NG Image Only
	Teaching Trigger	RD/WD	4700	1/0	(Trigger signal receive when executing a teaching) 1: On (Receive trigger signal) 0: Off (Do not receive trigger signal)
	Answer Back	RD/WD	4800	0/1	0: ON / 1: OFF
	Backlight Pattern	RD/WD	4900	0-3	0: ON / 1: OFF10 / 2: OFF30 / 3: OFF60
	Auto Save	RD/WD	5000	0/1	0: ON (the Auto Save function is activated.) 1: OFF (the Auto Save function is canceled.)

Type of item	Item	Com-mand	Data register No.	Setting value range	Remarks
JUDGEMENT CRITERIA SETTING	Allowable range (the number of pixels)	RD/WD	5100 - 5113	X: 0-357 Y:0-288	Product type 1: X = 5100 Y = 5101 / Product type 2: X = 5102 Y = 5103 / Product type 3: X = 5104 Y = 5105 / Product type 4: X = 5106 Y = 5107 / Product type 5: X = 5108 Y = 5109 / Product type 6: X = 5110 Y = 5111 / Product type 7: X = 5112 Y = 5113
	Allowable range (mm)	RD/WD	5114 - 5141	Depends on the type of unit	Actual values and double-word type Product type 1: X = 5114&5115 Y = 5116&5117 Product type 2: X = 5118&5119 Y = 5120&5121 Product type 3: X = 5122&5123 Y = 5124&5125 Product type 4: X = 5126&5127 Y = 5128&5129 Product type 5: X = 5130&5131 Y = 5132&5133 Product type 6: X = 5134&5135 Y = 5136&5137 Product type 7: X = 5138&5139 Y = 5140&5141
	Base Position (Distance): The number of pixels	RD	5200 - 5113	X: 0-357 Y:0-288	Product type 1: X = 5200 Y = 5201 / Product type 2: X = 5202 Y = 5203 / Product type 3: X = 5204 Y = 5205 / Product type 4: X = 5206 Y = 5207 / Product type 5: X = 5208 Y = 5209 / Product type 6: X = 5210 Y = 5211 / Product type 7: X = 5212 Y = 5213
	Base Position (Distance): mm	RD	5214 - 5241	Depends on the type of unit	Actual values and double-word type Product type 1: X = 5214&5215 Y = 5216&5217 Product type 2: X = 5218&5219 Y = 5220&5221 Product type 3: X = 5222&5223 Y = 5224&5225 Product type 4: X = 5226&5227 Y = 5228&5229 Product type 5: X = 5230&5231 Y = 5232&5233 Product type 6: X = 5234&5235 Y = 5236&5237 Product type 7: X = 5238&5239 Y = 5240&5241

Peak Detection

Type of item	Item	Com- mand	Data Register No.	Setting value range	Remarks	
INSPECTON	Detection Position (Unit: Pixel)	RD	1100	0 - 352	The X position of the detected point (pixel)	
		RD	1101	0 - 288	The Y position of the detected point (pixel)	
	Judgement Results	RD	1102	0/1	1: OK 0: NG	
	Measurement Time	RD	1103	-	Measurement time	
	Detection Position (mm))	RD	1104-1105	Depends on the type of unit	The X position of the detected point (mm)	Actual value and double-word type
		RD	1106-1107		The Y position of the detected point (mm)	
	Product Type	RD/WD	1400	1-7	WD: Switches the product types RD: Reads the current product type	
	Inspection Start	WD	1500	1	Starts an inspection	
	READY	RD	1600	0/1	1: ON 0: OFF	
	ALARM	RD	1601	0/1		
	LOCK	RD/WD	1602	0/1		
	Mode	RD/WD	1603	0-2	0: RUN mode 1: RUN/VIEW mode 2: TEACH mode 3: CONFIGURATION mode (support for RD) 4: JUDGEMENT CRITERIA SETTING mode (support for RD)	
	OUT1	RD	1604	0/1	1: ON 0: OFF	
	OUT2	RD	1605	0/1		
	OUT3	RD	1606	0/1		
TEACHING	Exposure Time Setting	RD/WD	2100	0003 -5000	Product type1	WD: Used for running a teaching in data area 2500 using “1” (without exposure time adjustment). RD: Reads the current exposure time
			2101		Product type2	
			2102		Product type3	
			2103		Product type4	
			2104		Product type5	
			2105		Product type6	
			2106		Product type7	
	Inspection Area Setting	RD/WD	2200	X:351-0 Y:287-0	Product type 1: X coordinate at upper left	
			2201		Product type 1: Y coordinate at upper left	
			2202		Product type 1: Y coordinate at lower right	
			2203		Product type 1: X coordinate at lower right	
			2204 - 2207		Product type 2: X coordinate at upper left - Y coordinate at lower right	
			2208 - 2211		Product type 3: X coordinate at upper left - Y coordinate at lower right	
			2212 - 2215		Product type 4: X coordinate at upper left - Y coordinate at lower right	
			2216 - 2219		Product type 5: X coordinate at upper left - Y coordinate at lower right	
			2220 - 2223		Product type 6: X coordinate at upper left - Y coordinate at lower right	
			2224 - 2227		Product type 7: X coordinate at upper left - Y coordinate at lower right	

Type of item	Item	Command	Data Register No.	Setting value range	Remarks
TEACHING	Teaching Results	RD	2300	0/1	0: OK 1: NG (The ALARM signal is also output)
	Binary Level	RD/WD	2400	0 - 255	Product type 1
			2401		Product type 2
			2402		Product type 3
			2403		Product type 4
			2404		Product type 5
			2405		Product type 6
			2406		Product type 7
	Execution of a teaching for OK product	WD	2500	0/1	0: Adjustment of exposure time 1: No adjustment of exposure time (a teaching is executed using the current exposure time)
	Execution of a teaching for NG product	WD	2600	0	Execute a teaching for NG teaching (CONFIGURATION setting – type of teaching = "OK&NG" is selected 4100=1)
CONFIGURATION	Computation Time	RD/WD	3100	1-3	1: Low / 2: Middle / 3: High (Available only for Color Judgement)
	Initial Product Type	RD/WD	3200	1-7	1-7
	I/O Initial Type	RD/WD	3201	0/1	0: OFF (Calls the product type No. that is set as "Initial Type" when the power was turned on) 1: ON (Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on.)
	Internal Trigger	RD/WD	3300	0/1	0: ON / 1: OFF
	Capture Delay	RD/WD	3400	0-160	0-160
	Output Delay	RD/WD	3500	0-160	0-160
	Baud Rate	RD/WD	3600	96-576	(RS-232C Communication Speed) 96,144, 192, 384, 576
	Station No.	RD/WD	3700	1-99	1-99
	LED On/Off	RD/WD	3800	0/1	0: ON / 1: OFF
	Initial Setting	WD	3900	1	
	Type of Teaching	RD/WD	4100	0-1	0: OK / 1: OK&NG
	Save Image Condition	RD/WD	4200	0-2	0:OFF / 1: All Images / 2: NG Image Only
	Teaching Trigger	RD/WD	4700	1/0	(Trigger signal receive when executing a teaching) 1: On (Receive trigger signal) 0: Off (Do not receive trigger signal)
	Answer Back	RD/WD	4800	0/1	0: ON / 1: OFF
	Backlight Pattern	RD/WD	4900	0-3	0: ON / 1: OFF10 / 2: OFF30 / 3: OFF60
	Auto Save	RD/WD	5000	0/1	0: ON (the Auto Save function is activated.) 1: OFF (the Auto Save function is canceled.)

Type of item	Item	Command	Data Register No.	Setting value range	Remarks
JUDGEMENT CRITERIA SETTING	Allowable range (the number of pixels)	RD/WD	5100 - 5113	X: 0-357 Y: 0-288	Product type 1: X = 5100 Y = 5101 / Product type 2: X = 5102 Y = 5103 Product type 3: X = 5104 Y = 5105 / Product type 4: X = 5106 Y = 5107 Product type 5: X = 5108 Y = 5109 / Product type 6: X = 5110 Y = 5111 Product type 7: X = 5112 Y = 5113
	Allowable range (mm)	RD/WD	5114 - 5141	Depends on the type of unit	Actual values and double-word type Product type 1: X = 5114&5115 Y = 5116&5117 Product type 2: X = 5118&5119 Y = 5120&5121 Product type 3: X = 5122&5123 Y = 5124&5125 Product type 4: X = 5126&5127 Y = 5128&5129 Product type 5: X = 5130&5131 Y = 5132&5133 Product type 6: X = 5134&5135 Y = 5136&5137 Product type 7: X = 5138&5139 Y = 5140&5141
	Base Position (the number of pixels)	RD	5200 - 5113	X: 0-357 Y: 0-288	Product type1: X = 5200 Y = 5201 / Product type 2: X = 5202 Y = 5203 Product type 3: X = 5204 Y = 5205 / Product type 4: X = 5206 Y = 5207 Product type 5: X = 5208 Y = 5209 / Product type 6: X = 5210 Y = 5211 Product type 7: X = 5212 Y = 5213
	Base Position (mm)	RD	5214 - 5241	Depends on the type of unit	Actual values and double-word type Product type1: X = 5214&5215 Y = 5216&5217 Product type 2: X = 5218&5219 Y = 5220&5221 Product type 3: X = 5222&5223 Y = 5224&5225 Product type 4: X = 5226&5227 Y = 5228&5229 Product type 5: X = 5230&5231 Y = 5232&5233 Product type 6: X = 5234&5235 Y = 5236&5237 Product type 7: X = 5238&5239 Y = 5240&5241

Length Measurement

Type of item	Item	Command	Data register No.	Setting value range	Remarks
INSPECTION	Detection Length (Unit: pixel)	RD	1100	0 - 352	X-directional minimum value
			1101	0 - 288	X-directional maximum value
			1102		Y-directional minimum value
			1103		Y-directional maximum value
	Judgement Results	RD	1104	0/1	1: OK 0: NG
	Measurement Time	RD	1105		
	Detection Length (mm)	RD	1106-1107	Depends on the type of unit	X-directional minimum value
			1108-1109		X-directional maximum value
			1110-1111		Y-directional minimum value
			1112-1113		Y-directional maximum value
	Product Type	RD/WD	1400	1-7	WD: Switches the product types RD: Reads the current product type
	Inspection Start	WD	1500	1	Starts an inspection
	READY	RD	1600	0/1	1: ON
	ALARM	RD	1601	0/1	0: OFF
TEACHING	Exposure Setting Time	RD/WD	2100	0003 -5000	Product type 1
			2101		Product type 2
			2102		Product type 3
			2103		Product type 4
			2104		Product type 5
			2105		Product type 6
			2106		Product type 7
					WD: Used for running a teaching in data area 2500 using "1" (without exposure time adjustment). RD: Reads the current exposure time
	INSPECTION AREA SETTING	RD/WD	2200	X:351-0 Y:287-0	Product type 1: X coordinate at upper left
			2201		Product type 1: Y coordinate at upper left
			2202		Product type 1: X coordinate at lower right
			2203		Product type 1: Y coordinate at lower right
			2204-2207		Product type 2: X coordinate at upper left - Y coordinate at lower right
			2208-2211		Product type 3: X coordinate at upper left - Y coordinate at lower right
			2212-2215		Product type 4: X coordinate at upper left - Y coordinate at lower right
			2216-2219		Product type 5: X coordinate at upper left - Y coordinate at lower right
			2220-2223		Product type 6: X coordinate at upper left - Y coordinate at lower right
			2224-2227		Product type 7: X coordinate at upper left - Y coordinate at lower right
	Teaching Results	RD	2300	0/1	0: OK 1: NG (the ALARM signal is also output.)

Type of item	Item	Com-mand	Data register No.	Setting value range	Remarks
TEACHING	Binary Level	RD/WD	2400	0 - 255	Product Type 1
			2401		Product Type 2
			2402		Product Type 3
			2403		Product Type 4
			2404		Product Type 5
			2405		Product Type 6
			2406		Product Type 7
CONFIGURATION	Execution of a teaching for product OK	WD	2500	0/1	0: Adjustment of exposure time 1: No adjustment of exposure time (a teaching is executed using the current exposure time)
	Execution of a teaching for NG product	WD	2600	0	Execute a teaching for NG teaching (CONFIGURATION setting – type of teaching = "OK&NG" is selected 4100=1)
	Computation Time	RD/WD	3100	1-3	1: Low / 2: Middle / 3: High (Available only for Color Judgement)
	Initial Product Type	RD/WD	3200	1-7	1-7
	I/O Initial Type	RD/WD	3201	0/1	0: OFF (Calls the product type No. that is set as "Initial Type" when the power was turned on) 1: ON (Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on.)
	Internal Trigger	RD/WD	3300	0/1	0: ON / 1: OFF
	Capture Delay	RD/WD	3400	0-160	0-160
	Output Delay	RD/WD	3500	0-160	0-160
	Baud Rate	RD/WD	3600	96-576	(RS-232C Communication Speed) 96, 144, 192, 384, 576
	Station No.	RD/WD	3700	1-99	1-99
	LED On/Off	RD/WD	3800	0/1	0: ON / 1: OFF
	Initial Setting	WD	3900	1	
	Type of Teaching	RD/WD	4100	0-1	0: OK / 1: OK&NG
	Save Image Condition	RD/WD	4200	0-2	0: OFF / 1: All Images / 2: NG Image Only
	Teaching Trigger	RD/WD	4700	1/0	(Trigger signal receive when executing a teaching) 1: On (Receive trigger signal) 0: Off (Do not receive trigger signal)
	Computation Time	RD/WD	3100	1-3	1: Low / 2: Middle / 3: High (Available only for Color Judgement)
	Initial Product Type	RD/WD	3200	1-7	1-7
	Answer Back	RD/WD	4800	0/1	0: ON / 1: OFF
	Backlight Pattern	RD/WD	4900	0-3	0: ON / 1: OFF10 / 2: OFF30 / 3: OFF60
	Auto Save	RD/WD	5000	0/1	0: ON (the Auto Save function is activated.) 1: OFF (the Auto Save function is canceled.)
JUDGEMENT CRITERIA SETTING TEACHING	Allowable Range: Min. (the number of pixels)	RD/WD	5100 - 5113	X: 0-357 Y: 0-288	Product type 1: X = 5100 Y = 5101 / Product type 2: X = 5102 Y = 5103 / Product type 3: X = 5104 Y = 5105 / Product type 4: X = 5106 Y = 5107 / Product type 5: X = 5108 Y = 5109 / Product type 3 Product type 6: X = 5110 Y = 5111 / Product type 7: X = 5112 Y = 5113

Type of item	Item	Command	Data register No.	Setting value range	Remarks
JUDGEMENT CRITERIA SETTING TEACHING	Allowable Range: Min. (the number of pixels) (mm)	RD/WD	5114 - 5141	Depends on the type of unit	Actual values and double-word type Product type 1: X = 5114&5115 Y = 5116&5117 Product type 2: X = 5118&5119 Y = 5120&5121 Product type 3: X = 5122&5123 Y = 5124&5125 Product type 4: X = 5126&5127 Y = 5128&5129 Product type 5: X = 5130&5131 Y = 5132&5133 Product type 6: X = 5134&5135 Y = 5136&5137 Product type 7: X = 5138&5139 Y = 5140&5141
	Allowable Range: Min. (the number of pixels)	RD/WD	5200 - 5113	X: 0-357 Y: 0-288	Product Type 1: X = 5200 Y = 5201 / Product Type 2: X = 5202 Y = 5203 / Product Type 3: X = 5204 Y = 5205 / Product Type 4: X = 5206 Y = 5207 / Product Type 1: X = 5208 Y = 5209 / Product Type 6: X = 5210 Y = 5211 Product Type 7: X = 5212 Y = 5213
	Allowable range: Max. (mm)	RD/WD	5214 - 5241	Depends on the type of unit	Actual values and double-word type Product Type 1: X = 5214&5215 Y = 5216&5217 Product Type 2: X = 5218&5219 Y = 5220&5221 Product Type 3: X = 5222&5223 Y = 5224&5225 Product Type 4: X = 5226&5227 Y = 5228&5229 Product Type 5: X = 5230&5231 Y = 5232&5233 Product Type 6: X = 5234&5235 Y = 5236&5237 Product Type 7: X = 5238&5239 Y = 5240&5241
	Inspection object min. value (the number of pixels)	RD/WD	5300 - 5313	X: 0-357 Y: 0-288	Product Type 1: X = 5300 Y = 5301 / Product Type 2: X = 5302 Y = 5303 / Product Type 3: X = 5304 Y = 5305 / Product Type 4: X = 5306 Y = 5307 / Product Type 5: X = 5308 Y = 5309 / Product Type 6: X = 5310 Y = 5311 Product Type 7: X = 5312 Y = 5313
	Inspection object min. value (mm)	RD/WD	5314 - 5341	Depends on the type of unit	Actual values and double-word type Product Type 1: X = 5314&5315 Y = 5316&5317 Product Type 2: X = 5318&5319 Y = 5320&5321 Product Type 3: X = 5322&5323 Y = 5324&5325 Product Type 4: X = 5326&5327 Y = 5328&5329 Product Type 5: X = 5330&5331 Y = 5332&5333 Product Type 6: X = 5334&5335 Y = 5336&5337 Product Type 7: X = 5338&5339 Y = 5340&5341
	Base Length: Min. (pixel)	RD	5400 - 5413	X: 0-357 Y: 0-288	Product Type 1: X = 5400 Y = 5401 / Product Type 2: X = 5402 Y = 5403 / Product Type 3: X = 5404 Y = 5405 / Product Type 4: X = 5406 Y = 5407 / Product Type 5: X = 5408 Y = 5409 / Product Type 6: X = 5410 Y = 5411 Product Type 7: X = 5412 Y = 5413
	Base Length: Min. (mm)	RD	5414 - 5441	Depends on the type of unit	Actual values and double-word type Product Type 1: X = 5414&5415 Y = 5416&5417 Product Type 2: X = 5418&5419 Y = 5420&5421 Product Type 3: X = 5422&5423 Y = 5424&5425 Product Type 4: X = 5426&5427 Y = 5428&5429 Product Type 5: X = 5430&5431 Y = 5432&5433 Product Type 6: X = 5434&5435 Y = 5436&5437 Product Type 7: X = 5438&5439 Y = 5440&5441
	Base Length: Man. (pixel)	RD	5500 - 5513	X: 0-357 Y: 0-288	Product Type 1: X = 5500 Y = 5501 / Product Type 2: X = 5502 Y = 5503 / Product Type 3: X = 5504 Y = 5505 / Product Type 4: X = 5506 Y = 5507 / Product Type 5: X = 5508 Y = 5509 / Product Type 6: X = 5510 Y = 5511 Product Type 7: X = 5512 Y = 5513
	Base Length: Man. (mm)	RD	5514 - 5541	Depends on the type of unit	Actual values and double-word type Product Type 1: X = 5514&5515 Y = 5516&5517 Product Type 2: X = 5518&5519 Y = 5520&5521 Product Type 3: X = 5522&5523 Y = 5524&5525 Product Type 4: X = 5526&5527 Y = 5528&5529 Product Type 5: X = 5530&5531 Y = 5532&5533 Product Type 6: X = 5534&5535 Y = 5536&5537 Product Type 7: X = 5538&5539 Y = 5540&5541

Feature Extraction

Type of item	Item	Com- mand	Data register No.	Setting value range	Remarks	
INSPECTION	Total detected Pixels	RD	1100 - 1101	0 - 101376	Total number of pixels comprising the objects which satisfies the condition.	
	Detected Count	RD	1102	0 - 500	Number of objects which satisfies the detect condition.	
	Judgement Result	RD	1103	0/1	1: OK 2: NG	
	Measure- ment Time	RD	1104	---	Measurement time	
	Product Type	RD/WD	1400	1-7	WD: Switches the product types RD: Reads the current product type	
	Inspection Start	WD	1500	1	Start an inspection	
	READY	RD	1600	0/1	1: ON 0: OFF	
	ALARM	RD	1601	0/1		
	LOCK	RD/WD	1602	0/1		
	Mode	RD/WD	1603	0-2	0: RUN mode 1: RUN/VIEW mode 2: TEACH mode 3: CONFIGURATION mode (support for RD) 4: JUDGEMENT CRITERIA SETTING mode (support for RD)	
	OUT1	RD	1604	0/1	1: ON 0: OFF	
	OUT2	RD	1605	0/1		
	OUT3	RD	1606	0/1		
TEACHING	Exposure Time Setting	RD/WD	2100	0003 -5000	Product Type 1	WD: Used for running a teaching in data area 2500 using "1" (without exposure time adjustment). RD: Reads the current exposure time
			2101		Product Type 2	
			2102		Product Type 3	
			2103		Product Type 4	
			2104		Product Type 5	
			2105		Product Type 6	
			2106		Product Type 7	
	Setting of inspection area	RD/WD	2200	X:351-0 Y:287-0	Product Type 1: X coordinate at upper left	
			2201		Product Type 1: Y coordinate at upper left	
			2202		Product Type 1: X coordinate at lower right	
			2203		Product Type 1: Y coordinate at lower right	
			2204 -2207		Product type 2: X coordinate at upper left - Y coordinate at lower right	
			2208 -2211		Product type 3: X coordinate at upper left - Y coordinate at lower right	
			2212 -2215		Product type 4: X coordinate at upper left - Y coordinate at lower left	
			2216 -2219		Product type 5: X coordinate at upper left - Y coordinate at lower right	
			2220 -2223		Product type 6: X coordinate at upper left - Y coordinate at lower right	
			2224 -2227		Product type 7: X coordinate at upper left - Y coordinate at lower right	
	Teaching Results	RD	2300	0/1	0: OK 1: NG (the ALARM signal is also output.)	

Type of item	Item	Command	Data register No.	Setting value range	Remarks
TEACHING	Binary Level	RD/WD	2400	0 - 255	Product type 1
			2401		Product type 2
			2402		Product type 3
			2403		Product type 4
			2404		Product type 5
			2405		Product type 6
			2406		Product type 7
	Teaching Execution	WD	2500	0/1	0: Adjustment of exposure time 1: No adjustment of exposure time (a teaching is executed using the current exposure time)
CONFIGURATION	Object color	RD/WD	1700	1-3	0: Black / 1: White
	Initial Product Type	RD/WD	3200	1-7	1-7
	I/O Initial Type	RD/WD	3201	0/1	0: OFF (Calls the product type No. that is set as "Initial Type" when the power was turned on) 1: ON (Calls the product type No. for the types of the signals that were input to the I/O port when the power was turned on.)
	Internal Trigger	RD/WD	3300	0/1	0: ON / 1: OFF
	Capture Delay	RD/WD	3400	0-160	0-160
	Output Delay	RD/WD	3500	0-160	0-160
	Baud Rate	RD/WD	3600	96-576	(RS-232C Communication Speed) 96, 144, 192, 384, 576
	Station No.	RD/WD	3700	1-99	1-99
	LED On/Off	RD/WD	3800	0/1	0: ON / 1: OFF
	Initial Setting	WD	3900	1	
	Type of Teaching	RD/WD	4100	0-1	0: OK / 1: OK&NG
	Save Image Condition	RD/WD	4200	0-2	0: OFF / 1: All Images / 2: NG Image Only
	Teaching Trigger	RD/WD	4700	1/0	(Trigger signal receive when executing a teaching) 1: ON (Receive trigger signal) 0: OFF (Do not receive trigger signal)
	Answer Back	RD/WD	4800	0/1	0: ON / 1: OFF
	Backlight Pattern	RD/WD	4900	0-3	0: ON / 1: OFF10 / 2: OFF30 / 3: OFF60
	Auto Save	RD/WD	5000	0/1	0: ON (the Auto Save function is activated.) 1: OFF (the Auto Save function is canceled.)
	Continuous Output	RD/WD	5100	0/1	0: ON (Outputs continuously) 1: OFF
	Extracted Count Output	RD/WD	5101	0/1	0: ON (Outputs) 1: OFF (No output)
	Total Number of Pixels Output	RD/WD	5102	0/1	

Type of item	Item	Command	Data register No.	Setting value range	Remarks
CONFIGURATION	Number of Pixels per Object Output	RD/WD	5103	0/1	0: ON (Outputs) 1: OFF (No output)
	Principal Axis Angle Output	RD/WD	5104	0/1	
	Terminal Code	RD/WD	5105	0-3, 99	0: CR, 1: CR+LF, 2: EOT, 3: EXT, 99: no code
	Sorting	RD/WD	5500	0/1	0: No sorting / 1: Area / 2: Gravity center X / 3: Gravity center Y
	Sorting Direction	RD/WD	5501	0/1	0: Descending 1: Ascending
JUDGEMENT CRITERIA SETTING	Area range (number of pixels)	RD/WD	5200- 5227	0 - 101376	Product type 1:Max = 5200-5201, Min = 5202-5203 Product type 2:Max = 5204-5205, Min = 5206-5207 Product type 3:Max = 5208-5209, Min = 5210-5211 Product type 4:Max = 5212-5213, Min = 5214-5215 Product type 5:Max = 5216-5217, Min = 5218-5219 Product type 6:Max = 5220-5221, Min = 5222-5223 Product type 7:Max = 5224-5225, Min = 5226-5227
	Area range (mm ²)	RD/WD	5228- 5243	Depends on the type of unit	Actual values and double-word type Product type 1:Max = 5228-5229, Min = 5230-5231 Product type 2:Max = 5232-5233, Min = 5234-5235 Product type 3:Max = 5236-5237, Min = 5238-5239 Product type 4:Max = 5240-5241, Min = 5242-5243 Product type 5:Max = 5244-5245, Min = 5246-5247 Product type 6:Max = 5248-5249, Min = 5250-5251 Product type 7:Max = 5252-5253, Min = 5254-5255
	Principal Axis Angle Range	RD/WD	5300- 5313	-899 - +900	Product type 1: Max = 5300 Min = 5301 Product type 2: Max = 5302 Min = 5303 Product type 3: Max = 5304 Min = 5305 Product type 4: Max = 5306 Min = 5307 Product type 5: Max = 5308 Min = 5309 Product type 6: Max = 5310 Min = 5311 Product type 7: Max = 5312 Min = 5313 *Registers 10-fold values of actual angle (-89.9 to +90.0)
	Detected Count Range	RD/WD	5400- 5413	0 - 500	Product type 1: Max = 5400 Min = 5401 Product type 2: Max = 5402 Min = 5403 Product type 3: Max = 5404 Min = 5405 Product type 4: Max = 5406 Min = 5407 Product type 5: Max = 5408 Min = 5409 Product type 6: Max = 5410 Min = 5411 Product type 7: Max = 5412 Min = 5413

Section 7

About AETOOL and GT11

7.1 AETOOL

7.1.1 Overview of AETOOL

The AETOOL is software exclusively for LightPixAE20. Before using this software, install it to the PC connected to the LightPixAE20 with USB cable (AB type).

Features of the AETOOL

The key features of this software are shown in the table below

- Transferring the inspection application to the main unit:
You can freely switch the applications for LightPixAE20.
- Setting up inspection conditions and displaying operation status
The LightPixAE20 can executes all of the operations you can perform with both the operation unit and the finder unit.
- Backing up configuration data and downloading backup configuration data:
Backups the configuration data, saves the data as a file on PC and downloads the data to the main unit. Thus, if you use multiple main units under the same reading conditions, you can copy and use the data in individual main units.
- Documenting configuration data:
Writes out the backup configuration data in the CSV format.

The followings listed below are included in the AETOOL

- AETOOL software (for displaying operation status of the LightPixAE20 or the settings)
- AETOOL Help
- System Transfer (used for changing or updating the LightPixAE20 software)
- Installation manual of USB driver
- This LightPixAE20 operation manual (for the main unit)

AETOOL operating environment

Item	Configuration
PC	IBM PC / AT converter
Supported OS	Windows 98® SE / Windows® Me / Windows® 2000 / Windows® XP
CPU	PentiumⅢ 600M Hz or more
Memory	128MB or more
Required storage capacity	25MB or more
USB	Ver. 1.1
Display color	High Color (16 bits) or more
Resolution	1024 x 768 or more

Windows® 98 SE, Windows® Me, Windows® 2000 and Windows® XP are registered trademarks of Microsoft Corporation in the United States and other countries.

7.1.2 Obtaining and Installing the AETOOL

How to obtain the AETOOL

You can download this software from the following website (for our image processing devices).
The file size is approximately 12 M.

"<http://www.nais-j.com/vision/uacs/>"

How to install a USB driver:

Follow the instructions below to install the AETOOL onto your computer first, then USB driver before use.

1. **Run the LightPix_AETOOL_Jpn.exe downloaded from our website.**
After an installation dialog appears on the monitor, install following the message
2. **.When selecting "Panasonic MEW Vision" > "LightPixAE20" from the Windows* start menu, you see "About USB driver" on the monitor. Read the descriptions on the installation of a USB driver and follow the instruction for your OS to install.**



◆ NOTE

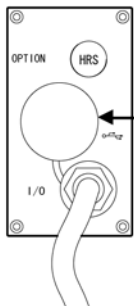
Refer to AETOOL Help for details of operation instructions.

* Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

7.1.3 Connecting to a Computer

When connecting to a computer to which the AETOOL installed, use an AB type USB cable (commercially available).

Bottom of the main unit



AB TYPE cable for USB 2.0(1.1)
(Max. connection distance: 5m)

Designated tool: AETOOL Installed PC



7.2 GT11

7.2.1 Functions of GT11

Using Matsushita protocol "MEWTOOL", you can display and change the settings of the LightPixAE20 on GT11, or display reading data or judgment results on GT11.

You can use it mainly for controlling the LightPixAE20 or checking reading data while being accessible each other, but the GT11 can communicate with LightPixAE20 only if versions and setting values of GT11 and GTWIN meet the following conditions:

- GTWIN version: 2.62 or later
- GT firmware version: 1.020 or later. If GT11 version is before 1.020, update the software to 1.020 or later following the steps below:

Select "NAiS Terminal" > "GTWIN" > "Tools" > "GT Ver_UP" from the Windows start menu.

- Set the communication conditions for the GT configuration as follows:

Retry: 255 times and Waiting time: 0 sec

Since the LightPixAE20 does not receive any serial (RS-232C) commands while capturing images, it may ignore transmissions from the GT11. Therefore, increase the retry time up to the upper limit and set waiting time to 0 sec. so that the GT11 can execute retries one after another (in this case, the device executes retries every about 50 ms). But, even if the waiting time is set to 0 sec., the LightPixAE20 cannot receive all transmission data but receive the data once every five retries



◆ NOTE

Only the firmware of GT11 version 1.020 or later executes retries every about 50 ms even if the waiting time is set to 0 sec, so any other display unit than GT11 cannot be used (as of Jan., 2005).

7.2.2 Sample Data for GT11

You can get sample data for the GT11 that are needed for connecting it to the LightPixAE20 from the following website. If you download the sample data, you can get the guide as well.

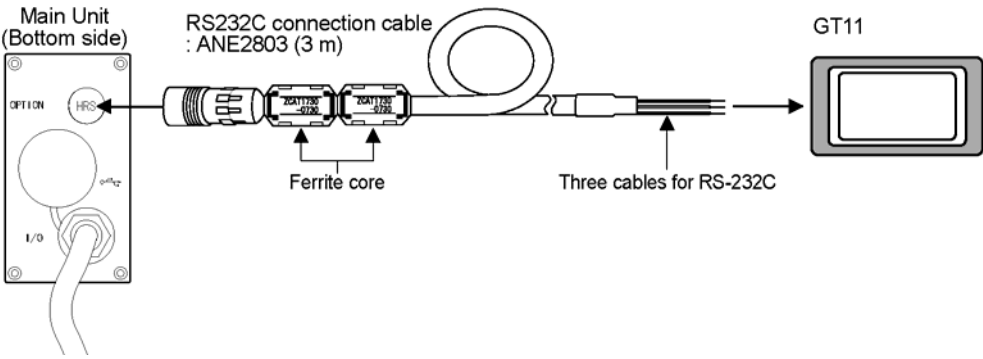
"<http://www.mew.co.jp/ac/e/fasys/vision/download/>"

7.2.3 Connection to the GT11

Connection

Use optional cable ANE2803 or ANE2823 to connect the LightPixAE20 to the GT11.

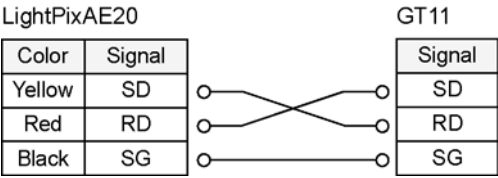
Connecting to the GT11 with the RS-232C connection cable ANE2803



Wiring with three cables for RS232C

Cable color	Signal
Yellow	SD
Red	RD
Black	SG

Example connection with the GT11



Section 8

General Specifications, Product Numbers and Dimensions

8.1 General Specifications

General Specifications (in common with all units)

Item	Specification
Rated voltage	24V DC
Allowable voltage range	21.6 to 26.4V DC (with ripples)
Rated current consumption	0.5A or less
Operating ambient temperature	0 to + 40 °C
Storage ambient temperature	-20 to + 60 °C (without icing and dew condensation)
Operating/storage ambient humidity	35 to 85 % RH (without icing and dew condensation at 25°C)
Allowable momentary power failure	10 ms or less
Insulation resistance	100MΩ or more (500 V DC, an insulating-resistance tester is used ^{*1} .)
Breakdown voltage	500V AC per min. (600V AC per second ^{*1})
Noise resistance	1000 V pulse width 50 ns / 1 μs (Noise Simulator Method was used.)
Degree of protection	IP67 ^{*2}
Vibration resistance	10 to 55 Hz 1 sweep per minute, amplitude 1.5 mm, 30 minutes each in X/Y/Z direction
Shock resistance	196m / s ² , 5 times each in X/Y/Z direction
Weight	Approx. 300g (a main unit), Approx. 200g (an operation or a finder unit)

^{*1}

The insulation resistance test is performed after removing a barrister and condenser from the primary side of the built-in power supply unit. Cut-off current: 10 mA

^{*2} Examined with USB cable removed and water-proof cap attached

Main unit

Item			Specification			
Model			ANE2000	ANE2010	ANE2020	ANE2030
Installation distance (mm)			15 (+/-0.5)	45 (+/-2.5)	55 (+/-5)	170 (140 to 220)
View range (mm)			2 x 1.6	10 x 8	30 x 25	80 x 70 (70 x 56 to 100 x 80)
Resolution (mm)			0.02	0.1	0.3	0.5
Light-sensitive element			Color C-MOS			
Number of effective pixels			352 pixels (horizontal) x 288 pixels (vertical), 100 thousand pixels			
Light source for view range marker			Red LED			
Exposure time			Shutter timing and interlocking (0.03 to 50 ms)			
Input/ Output	Serial		RS-232C port (max. speed: 57,600 bps)			
	Parallel Mini D-sub 15pin	Input	Photo-coupler, Five inputs (Trigger: 1 bit, mode switch: 1 bit, product type switch: 3 bits)			
		Output	Photomos output, Five outputs (READY: 1 bit, ALARM: 1 bit, reading result output: 3 bits)			
	USB	PC I / F	USB 1.1 (supports for Windows 98® SE / Windows® Me / Windows® 2000 / Windows® XP)			
Light source for capturing images			White LED			
Expected service life of light source for capturing images			Light intensity drops to 50% under the condition of over 30,000-hour operation (at 25°C, internal trigger: ON, computation time: High)			

Operation unit

Item	Specification
Display	Three-colors and seven-segmented LCD display
Number of switches (buttons)	8
Port for a specified device	Connects to the port for main unit

*Use an optional cable ANE2813 or ANE2823 when connecting with the main unit. Max. communication distance: 10m (without a finder unit), 3m (with a finder unit)

Finder unit

Item	Specification
Display	2-inch color LCD display
Backlight	White LED
Service life of backlight	40,000h (operating temperature: 25°C)

Optional cables: ANE2803, ANE2813, ANE2823

Item	Specification
Connection	ANE2803: Main unit - RS-232C port ANE2813: Main unit - operation unit ANE2823: Main unit - RS232C port and operation unit
Cable length	3m
Weight	Approx. 300g

8.2 A List of Product Numbers

Main unit

Product name	View range (mm)	Product number
Main unit	2 x 1.6	ANE2000
	10 x 8	ANE2010
	30 x 25	ANE2020
	80 x 70 (70 x 56 to 100 x 80)	ANE2030

The main unit comes with the item below.

Installation instruction (1)

Operation and finder units

Product name	Product number
Operation unit	ANE11
Finder unit	ANE12

The operation unit comes with the items below.

Mounting frame for operation unit (1)

Installation instruction (1)

The finder unit comes with the items below.

Operation unit with a mounting frame for finder unit (1)

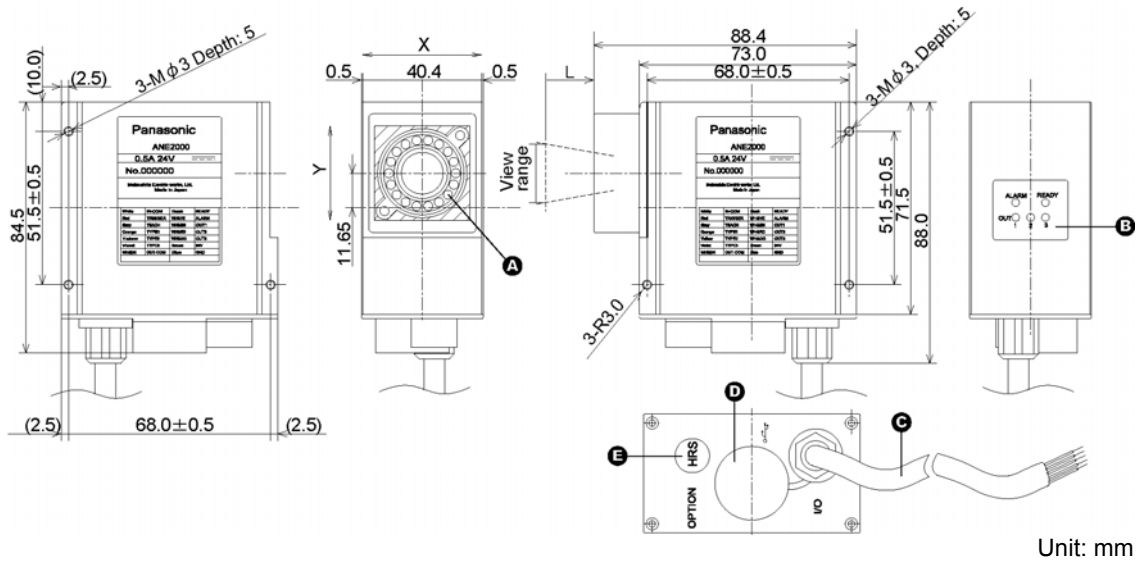
Installation instruction (1)

Cables

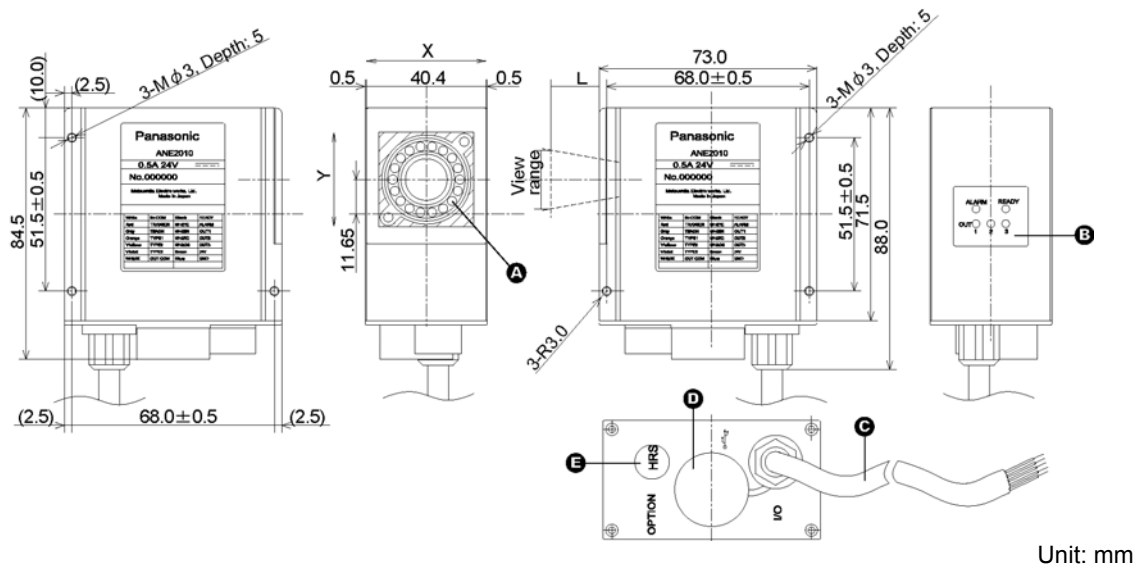
Product name	Product number
RS-232C communication cable (length: 3m): Main unit – external device	ANE2803
Connection cable (3m): Main unit – operation unit	ANE2813
Two-way cable: Main unit - Operation unit and external device (RS-232C communication)	ANE2823

8.3 Dimensions

Main Unit: ANE2000

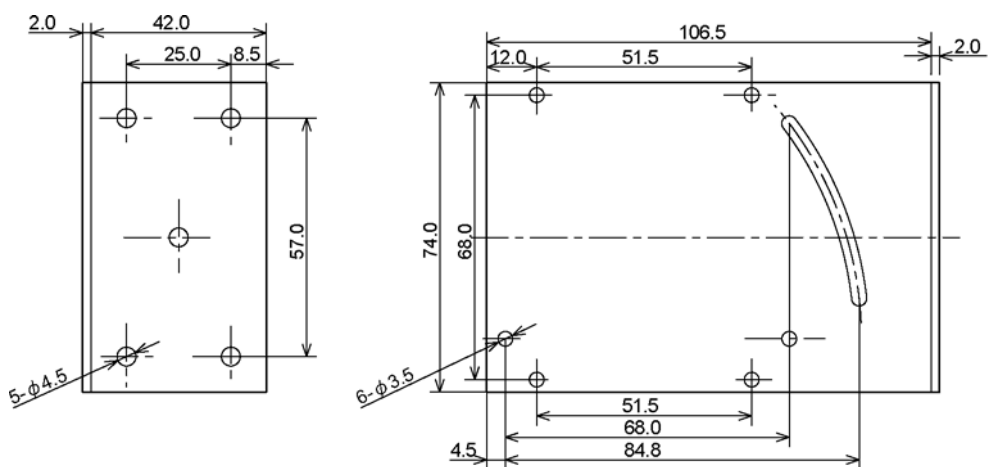


Main Unit: ANE2010/ANE2020/ANE2030

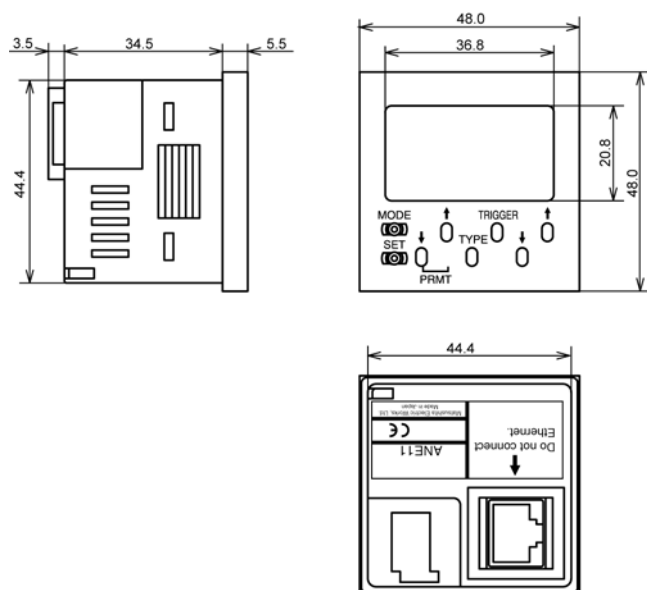


- A: Capturing part
- B: LED lamp
- C: Power I/O cable (approx. 3m)
- D: USB connector
- E: Connector for optional cable
- L: Installation distance (mm)

Mounting plate

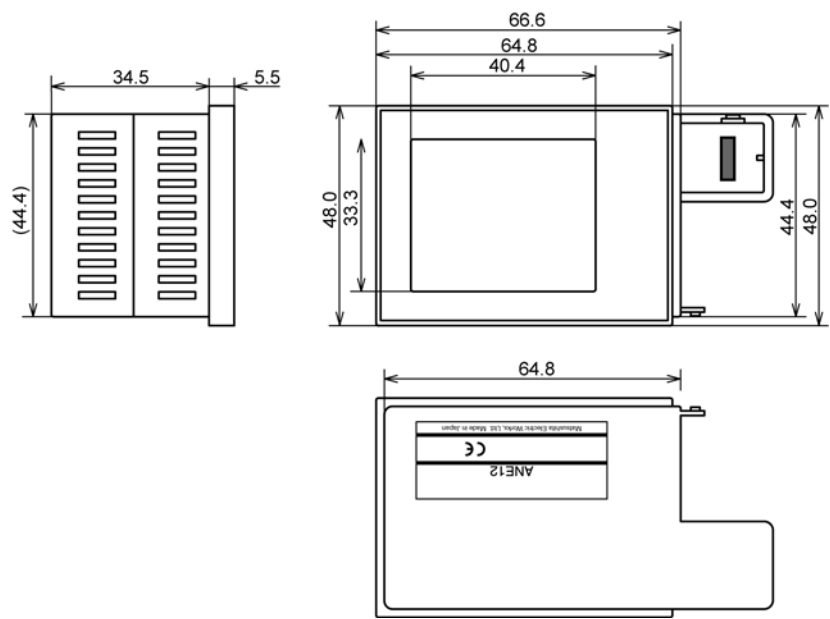


Operation unit



Unit: mm

Finder unit



Unit: mm

Record of Changes

Manual No.	Date	Descriptions
ARCT1F406E	May 2005	First Edition
ARCT1F406E-1	January 2006	The 2nd Edition (For AE20 Ver.1.20) <ul style="list-style-type: none">• Correction of errors in writing• Addition of descriptions of the I/O Initial Type function
ARCT1F406E-2	August 2006	The 3rd Edition <ul style="list-style-type: none">• Correction of errors in writing• Addition of descriptions about grounding
ARCT1F406E-3	February 2007	The 4th Edition (supporting AE20 version 1.30) <ul style="list-style-type: none">• Addition of descriptions about the new applications: Gray Pattern Matching and Feature Extraction