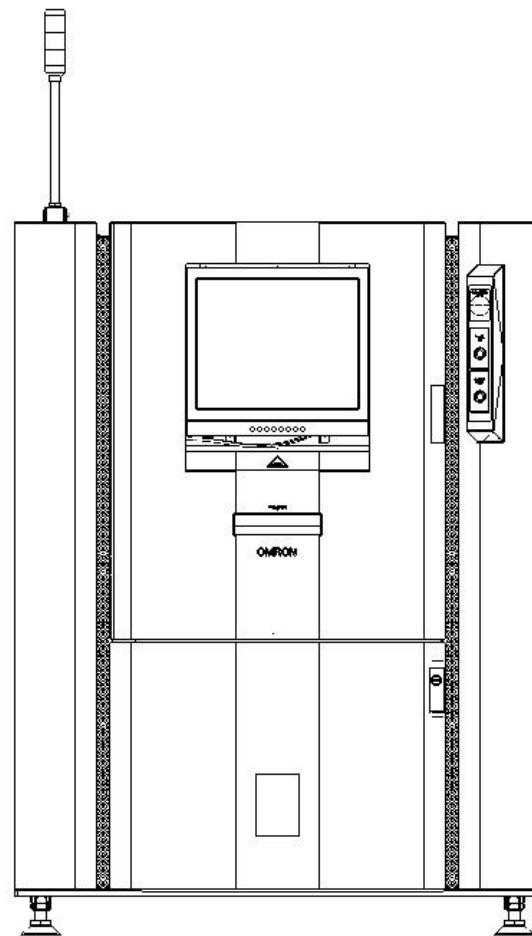


**OMRON**

VT-S1080/S1040/Z600/S730-H/S730  
/S720/S530/S500

PCB Inspection System  
**VT-S1080/S1040/Z600/S730-H/S730  
/S720/S530/S500**

Inspection Logic Manual



# Before You Begin

Thank you for purchasing PCB Inspection System  
VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500.

PCB inspection system VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500 is a machine that inspects solder and component implementation status and displays the inspection results. This manual describes the information such as functions, performance and usage necessary to use the PCB inspection system VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500.

When using the PCB inspection system

VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500, observe the following:

- Read this manual carefully to understand the contents well, and make the proper use of this system accordingly.
- Keep this manual safely for ready reference at any time.
- For the basic operation of this system, also read the relevant manuals carefully to understand the contents well, and then make the proper use of this system accordingly.

## ● Intended Readers

Readers of this manual should have undergone previous PCB inspection system  
VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500 training with Omron Corporation.

PCB Inspection System VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500  
Inspection Logic Manual

Before You Begin	Before You Begin, Table of Contents
Chapter 1	Inspection Logic
Chapter 2	Position Adjustment and Extraction
Chapter 3	Component Unit Inspection
Chapter 4	Lead Inspection
Chapter 5	Land Inspection
Chapter 6	Component Surrounding Inspection
Chapter 7	Oblique Inspection
Chapter 8	PCB/Component Block Unit Mark

Read and Understand this Manual

Please read and understand this manual before using the products. Please consult your OMRON representative if you have any questions or comments.

## Terms and Conditions Agreement

Please observe the conditions (including precautions and warnings described in the manuals, catalogs, and specifications) of this product that are specified by OMRON for use, storage and disposal. The ordering or use of OMRON products implies your agreement to the Terms and Conditions described below, unless otherwise is specifically agreed. However, if there is any inconsistency between this Terms and Conditions Agreement and the description in this product's specification, the description in this product specification take precedence.

### 1. Definition

The definitions used in these Terms and Conditions are as follows:

- (1) Catalogues: Catalogs, specifications, instructions and manuals of OMRON products, including electronically provided information available on the OMRON electronic components information website, etc.
- (2) Usage conditions: Usage conditions, rating, performance, operating environment, handling instructions, cautions, prohibited use, etc. of OMRON products described in specifications, documentations or manuals.
- (3) Customer application: Application of OMRON products by customers which incorporates and/or uses OMRON products into/for components, electronic boards, devices, facilities or systems that are manufactured by customers.
- (4) Deliverable: Setting of OMRON product, Inspection program and Library created on OMRON product, include deliverable of Teaching service that Omron engineer creates, tunes and provide technical guidance on behalf of customers, etc.
- (5) Fitness: Refers to the (a) Fitness, (b) performance, (c) non-infringement of third-party intellectual property, (d) compliance with laws and regulations and (e)conformity to various standards of the OMRON products and Deliverable under the use for "Customer's Purpose".

### 2. Caution on Descriptions Using Catalogues and Use OMRON products

Attention is required to the following points for information obtained from Catalogues and Use OMRON products:

- (1) Rated values and performance values are the product of tests performed for separate single conditions, including but not limited to temperature and humidity. OMRON does not warrant rated values and performance values for multiple combined conditions.
- (2) Reference data are provided for reference only. OMRON does NOT warrant that OMRON products work properly at all times in the range of reference data.
- (3) Application examples are provided for reference only. Please confirm the fitness of OMRON products and Deliverable in your application and use your own judgment to determine the appropriateness of using them in such application. OMRON does NOT warrant the Fitness of OMRON products under such applications.
- (4) OMRON may discontinue the production of OMRON products or change the specifications of them for the purpose of improving such products or other reasons entirely at its own discretion.

### 3. Coverage

#### ①Warranty period

OMRON warrants that products shall be free of material defects and or workmanship for a period of one year after the date of purchase or the date when installed at the specified location.

(Excepting in the case where there is additional description in Catalogues)

#### ②Scope of warranty

- 1) If the User discovers defect of OMRON products (substantial non-conformity

with the manual), and return it to OMRON within the above warranty period, OMRON will replace OMRON products without charge by offering media or download from OMRON's website. And if the User discovers defect of media which is attributable to OMRON and return it to OMRON within the above warranty period, OMRON will replace defective media without charge.

- 2) If OMRON is unable to replace defective media or correct OMRON products, the liability of OMRON and the User's remedy shall be limited to the refund of the license fee paid to OMRON for the product.

#### 4. Limitation of Liability

- ①The above warranty shall constitute the user's sole and exclusive remedies against OMRON and there are no other warranties, expressed or implied, including but not limited to, warranty of merchantability or fitness for particular purpose. In no event, OMRON will be liable for any lost profits or other indirect, incidental, special or consequential damages arising out of use of the product.
- ②OMRON shall have no liability for defect of the product based on modification or alteration to the product by the user or any third party. OMRON shall not be responsible and/or liable for any loss, damage, or expenses directly or indirectly resulting from the infection of OMRON products, any software installed thereon or any computer equipment, computer programs, networks, databases or other proprietary material connected thereto by distributed denial of service attack, computer viruses, other technologically harmful material and/or unauthorized access.
- ③OMRON shall have no liability for software developed by third parties other than Omron based on this product or any consequence thereof.

#### 5. Applicable Conditions

User shall not use OMRON products for the purpose that is not provided in the attached user manual.

#### 6. Change in Specification

Specifications and accessories of OMRON products may be changed at any time based on improvements and other reasons.

#### 7. Export Controls

Customers of OMRON products shall comply with all applicable laws and regulations of Japan and/or other relevant countries with regard to security export control, when exporting OMRON products and/or technical documents or providing such products and/or documents to a non-resident. OMRON may not provide customers with OMRON products and/or technical documents s

## Meanings of Signal Words

### ● Indication and meaning for safe use

To ensure the safe use of inspection logic, we use several safety icons to alert the reader to certain safety issues in this manual. The warning messages listed here indicate extremely important safety issues. Be sure to follow these guidelines. The icons and their meanings are as follows:



### WARNING

Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.



### CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

## Meanings of Alert Symbols

The following alert symbols are used in this manual.

	Indicates general caution, warning, or danger.
	Indicates the possibility of explosion under specific conditions.
	Indicates the possibility of electric shock under specific conditions.
	Indicates the possibility of injury due to high temperature under specific conditions.
	Indicates the possibility of hand injury under specific conditions.
	Users of the system are requested to connect the ground wire for systems with a safety ground terminal safety and without fail.

## Alert statements in this Manual

The following alert statements apply to the products in this manual. Each alert statement also appears at the locations needed in the manual to attract your attention.

<b>WARNING</b>	
Serious injury may occasionally occur. Follow the installation procedures and be sure to install the system on a level foundation capable of supporting the weight of inspection equipment.	
Serious electric shock may occasionally occur. Never fail to ground the system.	
Fire or explosion may occur. Do not disassemble, break, heat, short-circuit between electrodes, or throw the battery into fire.	
Serious injury may occasionally occur. Do not place hands to the side PCB transfer section.	
Security Measures Security measures to prevent unauthorized access Take the following measures to prevent unauthorized access to our products. <ul style="list-style-type: none"><li>• Install physical controls so that only authorized personnel can access controlsystems and equipment.</li><li>• Reduce connections to control systems and equipment via networks to prevent access from untrusted devices.</li><li>• Install firewalls to shut down unused communications ports and limit communications hosts and isolate control systems and equipment from the IT network.</li><li>• Use a virtual private network (VPN) for remote access to control systems and equipment.</li><li>• Adopt multifactor authentication to devices with remote access to control systems and equipment.</li><li>• Scan virus to ensure safety of USB drives or other external storages before connecting them to control systems and equipment.</li></ul>	
Data input and output protection Validate backups and ranges to cope with unintentional modification of input/output data to control systems and equipment. <ul style="list-style-type: none"><li>• Checking the scope of data</li><li>• Checking validity of backups and preparing data for restore in case of falsificationand abnormalities</li></ul>	
Data recovery Backup data and keep the data up-to-date periodically to prepare for data loss.	
When using an intranet environment through a global address, connecting to an unauthorized terminal or to an unauthorized server may result in network security issues such as spoofing and tampering. You must take sufficient measures such as restricting access to the terminal, using a terminal equipped with a secure function, and locking the installation area by yourself.	

When constructing an intranet, communication failure may occur due to cable disconnection or the influence of unauthorized network equipment. Take adequate measures, such as restricting physical access to network devices, by means such as locking the installation area.	
When using a device equipped with the SD Memory Card function, there is a security risk that a third party may acquire, alter, or replace the files and data in the removable media by removing the removable media or unmounting the removable media. Please take sufficient measures, such as restricting physical access to the Controller or taking appropriate management measures for removable media, by means of locking the installation area, entrance management, etc., by yourself.	

 CAUTION	
Electric shock may occasionally occur. Do not connect or disconnect the cables, when power is ON.	
Burns may occasionally occur. Do not connect or disconnect the cables, when power is ON.	
Injury may occasionally occur. Take caution not to bump against the front door if it needs to be open during maintenance or other operation on the system.	
Injury may occasionally occur. Be careful not to pinch your fingers when opening or closing the front door.	

## Precautions for Safe Use

Observe the following precautions for safe use of the products.

(1) Use the system at a location which meets the following conditions:

- Temperature of 10 to 35 °C
- Humidity of 35 to 80%
- No direct sunlight
- No possibility of dew condensation
- No spray of water, oil, or chemicals
- No water leakage or water

(2) Store the system in a location which meets the following conditions:

- Temperature of 0 to 40 °C
- Humidity of 35 to 80%
- No direct sunlight
- No possibility of dew condensation
- No spray of water, oil, or chemicals
- No water leakage or water

(3) When changing the monitor angle, take care not to trap your fingers under the monitor.

(4) To use the system safely, for the connecting part of conveyor, etc. installed in the upstream/downstream of the system, have a cover ready and mount it in accordance with the unit to be installed to prevent your hand or finger from entering from the loading/unloading port of the system.

(5) Use the rated voltage and power cable specified in the power supply specifications.

(6) Tighten the power cable with the tightening torque of 2.8N·m when connecting it to the breaker terminal block, and make sure that the cable is securely connected to prevent contact failure.

(7) When replacing a belt, make sure that the system power and main breaker are turned OFF.

(8) To replace the UPS battery, turn OFF the system power and main breaker. Make sure that the UPS power is turned OFF before starting replacement.

(9) Replacement of the battery must be performed with the system power and main breaker turned OFF, to prevent damage to the high precision CPU unit mechanism as well as malfunction due to electrostatics.

(10)When replacing, install a new battery within 5 minutes after the power is turned OFF. If the system remains without battery for more than 5 minutes, the stored data may be lost.

(11)Leakage, explosion, self-heating or fire may occur to the battery. Never short-circuit between the electrodes (+ and -), charge, demolish, heat, dispose or expose it in fire or to a strong shock. Any battery, which has been exposed to a strong shock caused by e.g. a fall on the floor, may leak. Therefore, do not use such a battery.

(12)When lubricating the system, make sure that the system power and main breaker are turned OFF.

(13)If grease contacts your skin during lubrication, sufficiently wash it off using water and soap.

(14)When cleaning the system, make sure that the system power and main breaker are turned OFF.

(15)Do not make rail adjustment with a PCB remaining inside in the Forcible Pass mode. The PCB may be damaged.

(16)Do not ride on the top plate. This may dent the plate resulting in an unexpected operation.

(17)If the system is operated without an UPS, data might be broken in the case of a power outage.

(18)If disposing this system, observe the instructions of the local government.

(19)Use a PCB to be inspected within the specified dimensions.

(20)When inserting the head into the machine, be careful of the head as there is a top plate.

- (21) Be sure to use the left switch in the machine to adjust the rail width in forced pass mode, and be careful not to touch the operating part while adjusting the width.
- (22) Be sure to check that the moving PCB is on the rail.
- (23) Do not stare at the illumination or projector during the inspection.

## Precautions for Correct Use

Observe the following precautions to prevent failure to operate, malfunctions, or undesirable effects on product performance.

- (1) When the door lock is released and the front door is opened, the interlock is activated. Do not open the door during operation except when necessary, such as when removing a PCB.
- (2) When the machine is operating normally, the door lock is engaged and the front door cannot be opened. The front door can only be opened and closed when a dialog is displayed prompting the user to confirm that no PCBs or foreign objects remain in the machine, or when the emergency stop switch is pressed.
- (3) Do not touch the camera or lens as they are adjusted at the time of shipment. Touching the camera or lens may affect the inspection performance.
- (4) Be sure to lock cables and connectors with locking mechanisms before use.
- (5) Do not connect a network or storage device that could be infected with a virus.
- (6) OMRON will deliver and relocate the machine. After delivery and installation, be sure to contact OMRON sales office before moving the machine.
- (7) Allow space for operation and maintenance before and after the machine. Also, avoid installing or covering the fan blowing space.
- (8) Avoid installing on soft floors such as carpets.
- (9) The customer is required to examine the loading/unloading outlet cover necessary for the installation of the machine, and create a loading/unloading outlet cover and a bracket for mounting the cover.
- (10) Do not touch components inside the machine when loading/unloading PCBs from the front cover.
- (11) Excessive tension of the belt may cause the belt to break. Be sure to follow the specified method.
- (12) Host link communication does not work with the dual lane specification.
- (13) If the UPS battery deteriorates, data in the computer may be damaged in the event of a power failure. If an error is detected, replace the battery immediately.
- (14) Use only recommended grease.
- (15) Wipe off the attached older grease with a waste cloth before applying new grease. Wipe off grease with a waste cloth even in the case that there is fallen grease below the stroke end.
- (16) The applied grease might fly off the lubricated parts. So, after lubrication is completed, wipe off the excessive grease with a waste cloth before using the system. Unless wiping off grease enough, grease or oil might drip from the LM guide due to the motion of the system, so wipe it off with a waste cloth.
- (17) When stopping the conveyor in the forced pass mode, make sure that there are no PCBs in the inspection machine and that no PCBs are being pulled into the inspection machine before stopping the conveyor. If the conveyor is stopped while the PCB is being transported or in the machine, the PCB may not be transported downstream.
- (18) When loading/unloading a PCB start the operation after ensuring that there is no foreign object in the operating part.
- (19) Do not impact the machine.
- (20) Do not store outside or in a humid place.

- (21)Do not turn off the main breaker while the system is terminating. Doing so may damage the hard disk.
- (22)Turning the power supply on and off repeatedly may damage the machine. If you turn the power off, wait at least 3 minutes before turning it on.
- (23)Do not save the back-ups of inspection programs and libraries on a CR-R/RW or DVD±R/RW, or their files will become read-only in attribute and fail to work normally when read into this system.
- (24)Since normal operation of this system has been verified in factory settings, do not apply any OS service pack or security patch, change the settings or update the driver. If you try any without our consent, it will be construed as a remodeling of the system, and will not be guaranteed.
- (25)The maintainer must manage the keys.
- (26)Be sure to remove the belt replacement jig after adjusting the belt tension. Doing so may cause damage to the machine.
- (27)If the belt is frayed, normal PCB transfer may not be possible. Cut off the fray.
- (28)To prevent damage to the machine, make sure that no foreign matter has fallen into the machine before using it or when opening the door during use.

### ● Notification

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may take appropriate measures.

This system individual unit may not comply with EC directive requirements.  
Use this system alone and do not use the system in other application.

**Related Manuals and Their Content**  
The following is a list of related manuals.

#### An Explanation of PCB Inspection System Operation

- PCB Inspection System Operation Manual
    - VT-S1080/S1040/Z600 ..... (5634588-9)
    - VT-S730-H..... (2808363-1)
    - VT-S730 ..... (8100647-9)
    - VT-S720 ..... (5338141-8)
    - VT-S530 ..... (4099496-8)
    - VT-S500 ..... (2233199-4)
- Contains information on the operation of the PCB inspection system.

#### About the Daily Maintenance, Hardware and Basic Operations of PCB Inspection System

- PCB Inspection System Maintenance Manual
  - VT-S1080/S1040/Z600 ..... (5634421-1)
  - VT-S730-H..... (2808941-9)
  - VT-S730 ..... (8000609-2)
  - VT-S720 ..... (9066163-3)
  - VT-S530 ..... (3110062-8)
  - VT-S500 ..... (1898351-0)

The daily and periodical maintenance, hardware and basic operations of the PCB inspection system are explained.

#### An Explanation of Inspection Logic

This Logic Manual

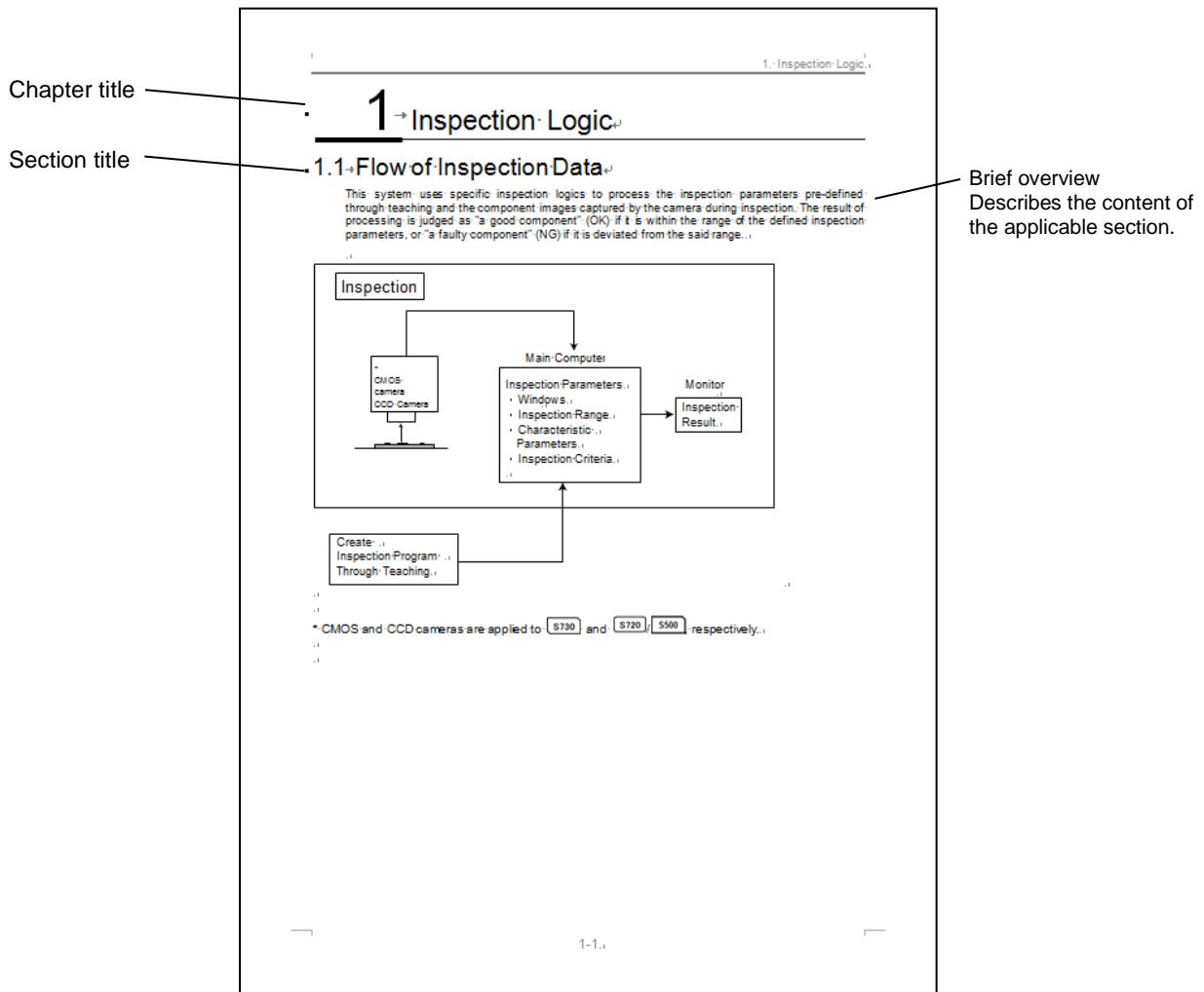
- VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500 Inspection Logic Manual
    - ..... (8600371-0)
- Contains information on inspection logics of  
VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500.

#### An Explanation of Teaching

- v-TS Teaching Manual
    - ..... (8800381-5)
- Contains information on how to operate the teaching system of PCB inspection system, how to conduct teaching of an inspection program, etc.

# How to read this manual

It describes major layout and notations.



	Describes explanation of the related content.
No symbol	Describes the contents regarding the inspection logic common to VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500.
<b>S1080</b>	Describes the contents regarding the inspection logic of VT-S1080.
<b>S1040</b>	Describes the contents regarding the inspection logic of VT-S1040.
<b>Z600</b>	Describes the contents regarding the inspection logic of VT-Z600.
<b>S730</b>	Describes the contents regarding the inspection logic of VT-S730-H/S730.
<b>S720A</b>	Describes the contents regarding the inspection logic of VT-S720A.
<b>S530</b>	Describes the contents regarding the inspection logic of VT-S530A.
<b>S500</b>	Describes the contents regarding the inspection logic of VT-S500.

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# 1 Inspection Logic

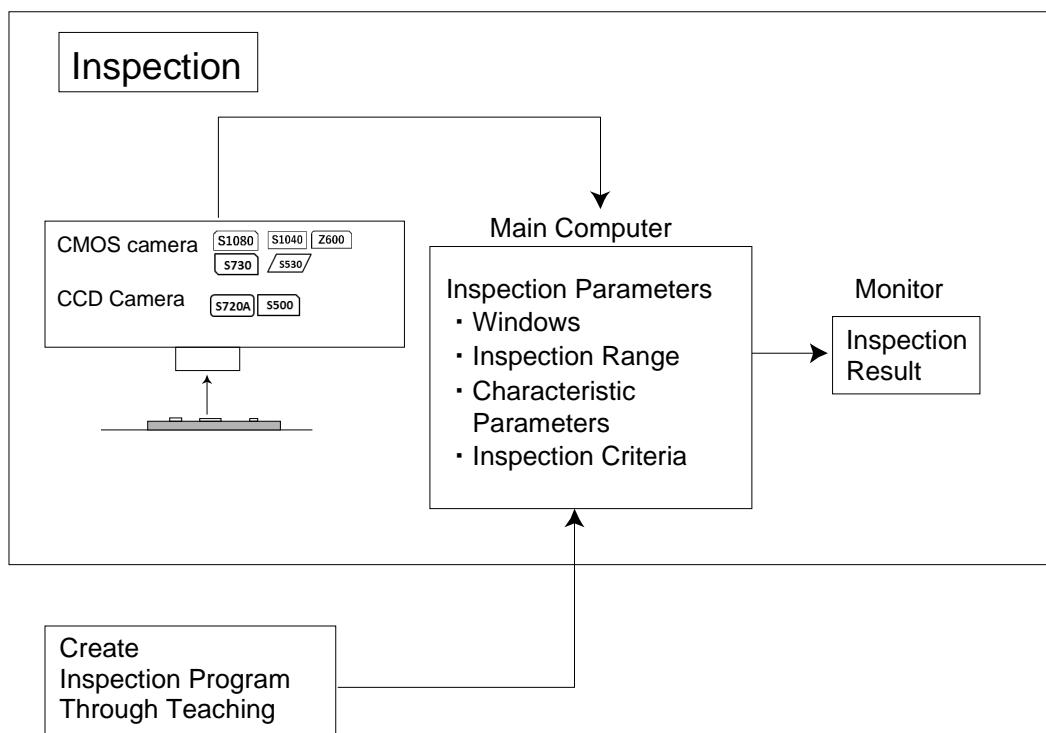
\* The description regarding the inspection logic is as follows.

No symbol: Common for VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500,

**S1080** : S1080 **S1040** : S1040 **Z600** : Z600 **S730** : S730-H/S730 **S720A** : S720A **S530** : S530 **S500** : S500

## 1.1 Flow of Inspection Data

This system uses specific inspection logics to process the inspection parameters pre-defined through teaching and the component images captured by the camera during inspection. The result of processing is judged as "a good component" (OK) if it is within the range of the defined inspection parameters, or "a faulty component" (NG) if it is deviated from the said range.



## 1.2 Inspection Parameter

The inspection parameters refer to a set of parameters configured with four elements: "Window", "Inspection Range", "Characteristic Parameter" and "Inspection Criteria" and form the smallest unit of inspection data.

For each "Window" in an inspection parameter set, "Inspection Range", "Characteristic Parameter" and "Inspection Criteria" are specified.

Example) Inspection Parameters for "Component Presence" Logic

Window:	Inspection Range	Inside Component Unit Window
Component Unit Window	Characteristic Parameter:	Colors of PCB, land and solder except the component unit color and electrode color
	Inspection Criteria:	[Matching Rate] (%)

Window	The area of inspection shown on the captured image.
Inspection Range	The area inside the Window for actual inspection.
Characteristic Parameter	<p>The characteristics found on camera-captured image required for inspection.</p> <p>A characteristic parameter is composed of characteristic color parameters. The characteristic parameter used for inspection is predetermined according to the types of the window and logic.</p>
Inspection Criteria	<p>The criteria to judge if the inspection result is OK or NG.</p> <p>The criteria values for inspection items such as a fillet or bridge (e.g. size, distance between lands) shown in the captured image are specified.</p> <p>The value inside the bracket ([ ]) in the table above ([Matching Rate] (%)) stands for a set criteria value.</p>

## 1.3 Component Types and Inspection Logics

PCB inspection machine VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500 uses the inspection logics shown in the table below.

The types of inspection logics that can be used vary depending on the machine model, component type inspected.

The component types in the table represent conceptual inspection targets composed of a single or multiple inspection windows and their classification is intended for easy and convenient management of the component library and inspection results as well as teaching operation.

Component Category	Component Type	Inspection Window	Inspection Logic	S1080 S730	S720A	S1040 S530	Z600 S500
Visible Component On Land	Chip Resistor Chip Capacitor Other Chip Components Resistor Array (Micro-Lead) Resistor Array (Castellated Electrode) Other Arrays (Non-Lead) MELF Component 2-Pin Mini-Mold Package	Inspection Range Window	Solder Ball Solder Bridge Foreign Material (Around Component) Solder Ball (Oblique) Solder Bridging (Oblique)	Yes Yes Yes Yes Yes	Yes Yes Yes No Yes	Yes Yes Yes No No	Yes Yes Yes No No
	Internal L-lead Component Electrolytic Capacitor Transistor Power Transistor SOP QFP SOJ QFJ Connector Other Lead Components SON(Micro-Lead) QFN(Micro-Lead) SON(Non-Lead) QFN(Non-Lead) Other Non-Lead Components	Component Unit Window	Component Extraction Missing Component Wrong Component Wrong Polarity Wrong Polarity/Height Flipped Component Component Offset Component Height Lifted Component Distance Error OCR Component Light Intensity Judgment 2D Code (Component)	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes No Yes Yes Yes No Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes No Yes Yes Yes No Yes Yes Yes Yes Yes Yes
		Lead Window	Lead Horizontal Extraction Lead Toe Extraction Lead Horizontal Extraction (Oblique)	Yes Yes Yes	Yes Yes Yes	Yes Yes No	Yes Yes No

		Lead Toe Extraction (Oblique)	Yes	Yes	No	No
		Lead Offset	Yes	Yes	No	No
		Lead Offset (Oblique)	Yes	Yes	No	No
		Lead Posture - Lifted Lead	Yes	No	Yes	No
		Lead Posture - Coplanarity	Yes	No	Yes	No
		Lead Posture - Lead Protrusion	Yes	Yes	Yes	Yes
		Lead Posture - Lead Area	Yes	Yes	Yes	Yes
		Lead Posture - Exposed Lead Toe	Yes	Yes	Yes	Yes
		Lead Posture - Lead Dispersion	Yes	Yes	Yes	Yes
		Lead Posture - Lead Side Bend	Yes	Yes	Yes	Yes
		Lead Posture (Oblique) - Lead Height	Yes	Yes	No	No
		Lead Posture (Oblique) - Lead Area	Yes	Yes	No	No
		Lead Posture (Oblique) - Exposed Lead Toe	Yes	Yes	No	No
		Lead Posture (Oblique) - Lead Dispersion	Yes	Yes	No	No
		Lead Height	Yes	No	Yes	No
		Lead Presence - Area	Yes	Yes	Yes	Yes
Land Window	Fillet	Fillet	Yes	Yes	Yes	Yes
		Exposed Land	Yes	Yes	Yes	Yes
		Land Error	Yes	Yes	Yes	Yes
		Foreign Material (On Land)	Yes	Yes	Yes	Yes
		Exposed Land (Oblique)	Yes	Yes	No	No
		Land Error (Oblique)	Yes	Yes	No	No

Component Category	Component Type	Inspection Window	Inspection Logic	S1080 S730	S720A	S1040 S530	Z600 S500
	Insertion Component (Bottom Surface)	Inspection Range Window	Solder Ball Solder Bridge Foreign Material (Around Component) Solder Ball (Oblique) Solder Bridging (Oblique)	Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes	Yes Yes Yes No No	Yes Yes Yes No No
		Component Unit Window					
		Lead Window	Electrode Toe Extraction Lead Presence - Area Lead Presence - Center of Gravity Lead Presence - Dispersion Lead Bend Lead Height	Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes No	Yes Yes Yes Yes Yes Yes	No Yes Yes Yes Yes No
		Land Window	Fillet Exposed Land Land Error Foreign Material (Exposed Land) Blow Hole Exposed Land (Oblique) Land Error (Oblique)	Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes No No	Yes Yes Yes Yes Yes Yes No

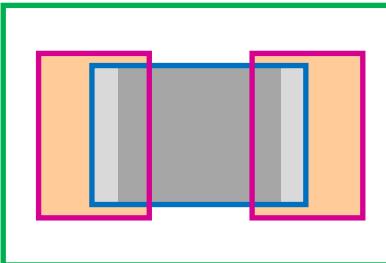
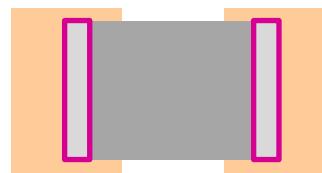
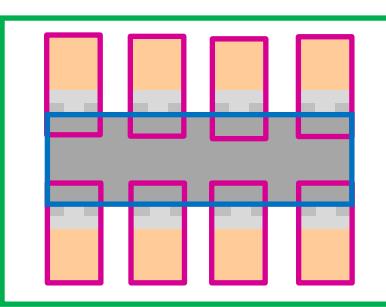
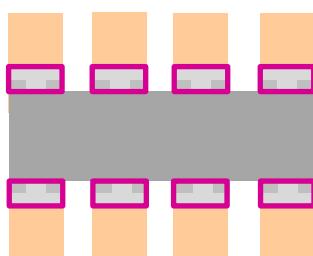
Component Category	Component Type	Inspection Window	Inspection Logic	S1080 S730	S720A	S1040 S530	Z600 S500
Invisible Component On Land	BGA/CSP Other Bottom Surface Electrode Components Insertion Component (Top Surface)	Inspection Range Window	Solder Ball	Yes	Yes	Yes	Yes
			Solder Bridging	Yes	Yes	Yes	Yes
			Foreign Material (Around Component)	Yes	Yes	Yes	Yes
	Component Unit Window	Component Extraction Component Presence Wrong Component Wrong Polarity Flipped Component Component Offset OCR Component Light Intensity Judgment 1D/2D Code (Component)	Component Extraction	Yes	Yes	Yes	Yes
			Component Presence	Yes	Yes	Yes	Yes
			Wrong Component	Yes	Yes	Yes	Yes
			Wrong Polarity	Yes	Yes	Yes	Yes
			Flipped Component	Yes	Yes	Yes	Yes
			Component Offset	Yes	Yes	Yes	Yes
			OCR	Yes	Yes	Yes	Yes
			Component Light Intensity Judgment	Yes	Yes	Yes	Yes
			1D/2D Code (Component)	Yes	Yes	Yes	Yes
Special Components	1D/2D Code	1D/2D Code Window	1D/2D Code	Yes	Yes	Yes	Yes
	Bad Mark	Bad Mark Window	Bad Mark	Yes	Yes	Yes	Yes
	Criteria Mark	Criteria Mark Window	Criteria Mark	Yes	Yes	Yes	Yes
	Fiducial Adjustment	Fiducial Adjustment Window	Fiducial Adjustment	Yes	Yes	Yes	Yes

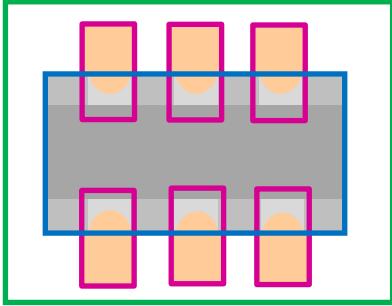
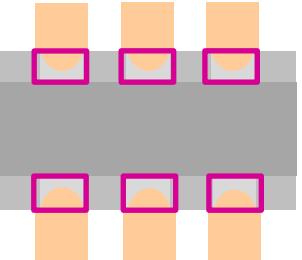
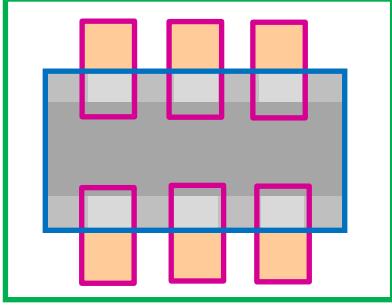
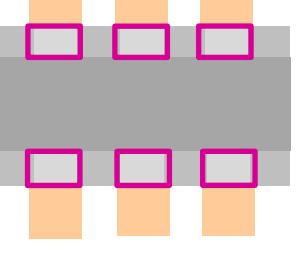
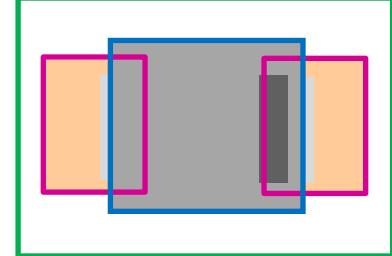
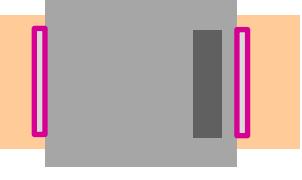
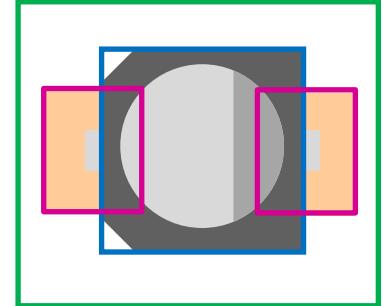
## 1.4 Component Types and Individual Windows

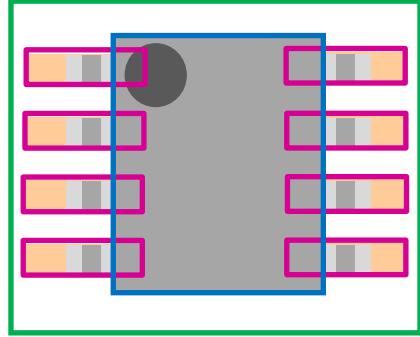
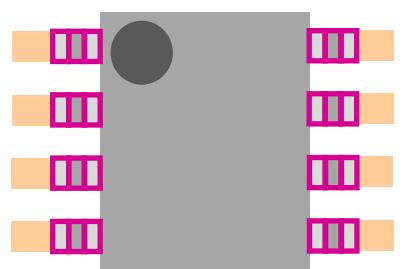
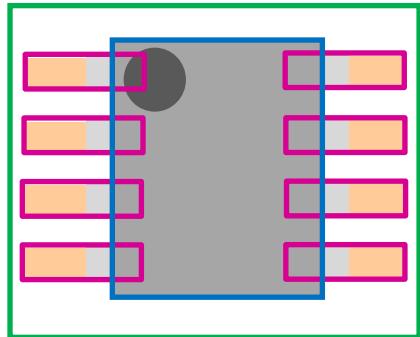
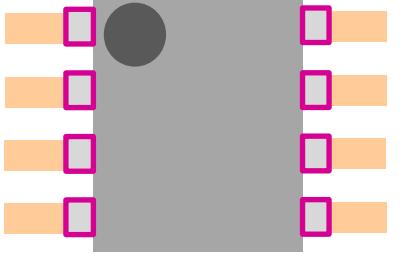
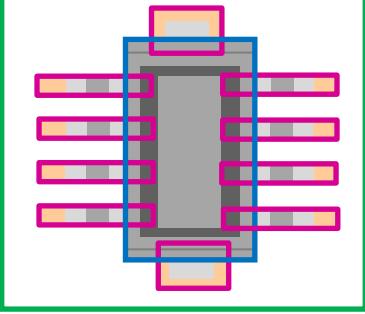
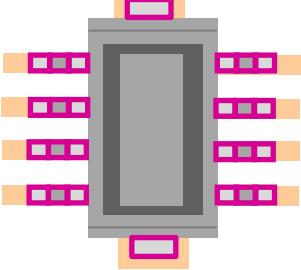
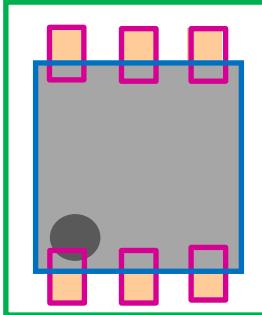
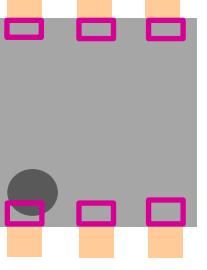
Component inspection is conducted against the inspection range within a specified window.

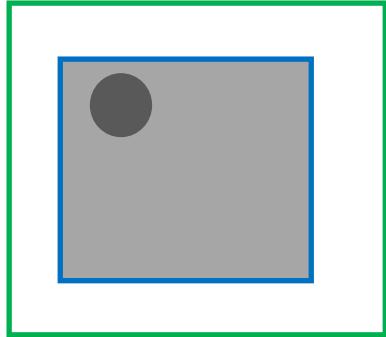
The following table shows examples where windows for individual component types are positioned for inspection.

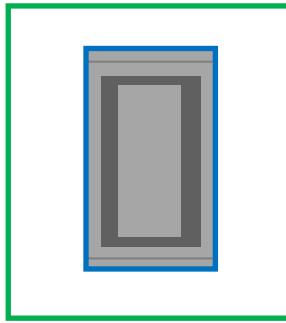
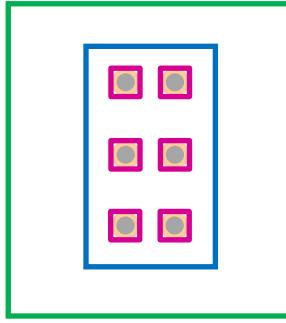
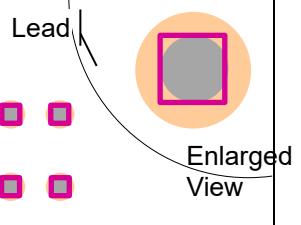
Inspection Range Window	Position the window to include the land and sufficient blank space around it.
Component Unit Window	Position the window to match the component size.
Land Window	Position the window to match the land size.
Electrode Window	Position the window to match the electrode size. To position a window over a gull-wing electrode, align the inflection points of the window on the individual border lines among the electrode's "shoulder", "slope" and "foot" sections.

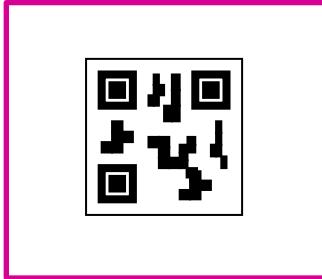
Component Type	Inspection Range Window (Green) Component Unit Window (Blue) Land Window (Red)	Electrode Window
Chip Resistor Chip Capacitor Other Chip Components MELF Component		
Resistor Array (Micro-Lead)		

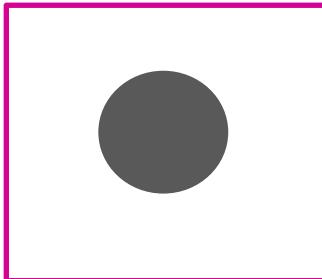
Component Type	Inspection Range Window (Green) Component Unit Window (Blue) Land Window (Red)	Electrode Window
Resistor Array (Castellated Electrode )	 A diagram showing a resistor array with three columns of resistors. A green rectangular window labeled 'Inspection Range Window' covers the top row of resistors. A blue rectangular window labeled 'Component Unit Window' covers the middle row. Red rectangular windows labeled 'Land Window' cover the bottom row.	 A diagram showing the same resistor array from a top-down perspective. It features three vertical columns of orange rectangular pads, each with a small red square at its center, representing the electrode windows.
SON (Non-Lead) QFN (Non-Lead) Other Arrays (Non-Lead)	 A diagram showing a component array with three columns of resistors. A green rectangular window labeled 'Inspection Range Window' covers the top row of resistors. A blue rectangular window labeled 'Component Unit Window' covers the middle row. Red rectangular windows labeled 'Land Window' cover the bottom row.	 A diagram showing the same component array from a top-down perspective. It features three vertical columns of orange rectangular pads, each with a small grey square at its center, representing the electrode windows.
2-Pin Mini-Mold Package Inward L-Lead Package Transistor Power Transistor	 A diagram showing a 2-pin mini-mold package. A green rectangular window labeled 'Inspection Range Window' covers the top and bottom leads. A blue rectangular window labeled 'Component Unit Window' covers the central body area. Red rectangular windows labeled 'Land Window' cover the two side lead areas.	 A diagram showing the same 2-pin mini-mold package from a top-down perspective. It features two vertical orange rectangular pads, each with a small black rectangle at its center, representing the electrode windows.
Electrolysis Capacitor	 A diagram showing an electrolysis capacitor with a central circular element. A green rectangular window labeled 'Inspection Range Window' covers the top and bottom leads. A blue rectangular window labeled 'Component Unit Window' covers the central circular element. Red rectangular windows labeled 'Land Window' cover the two side lead areas.	 A diagram showing the same electrolysis capacitor from a top-down perspective. It features two vertical orange rectangular pads, each with a small grey circle at its center, representing the electrode windows.

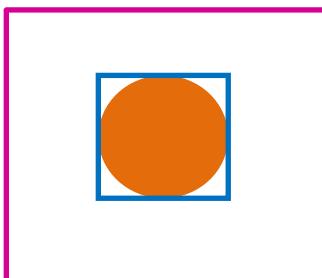
Component Type	Inspection Range Window (Green) Component Unit Window (Blue) Land Window (Red)	Electrode Window
SOP QFP		
SOJ QFJ		
Connector Other Lead Packages		
SON (Micro-Lead) QFN (Micro-Lead) Other Non-Lead Packages		

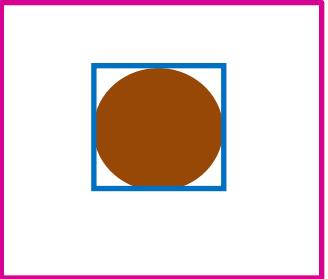
Component Type	Inspection Range Window (Green) Component Unit Window (Blue) Land Window (Red)	Electrode Window
BGA, CSP Other Bottom Surface Electrode Components		

Component Type	Inspection Range Window (Green) Component Unit Window (Blue) Land Window (Red)	Electrode Window
Insertion Component (Top Surface)		
Insertion Component (Bottom Surface)		 <p>Lead</p> <p>Enlarged View</p>

Component Type	2D Code Window
1D/2D Code	

Component Type	Bad Mark Window
Bad Mark	

Component Type	Criteria Mark Window (Blue) Range window (Red)
Criteria Mark	

Component Type	Fiducial Adjustment Window
Fiducial Adjustment	

## 1.5 Inspection Procedure

Inspection procedures use predetermined inspection logics and corresponding inspection parameters.

Example) Component Presence Inspection

Inspection Range: Inside the Component Unit Window

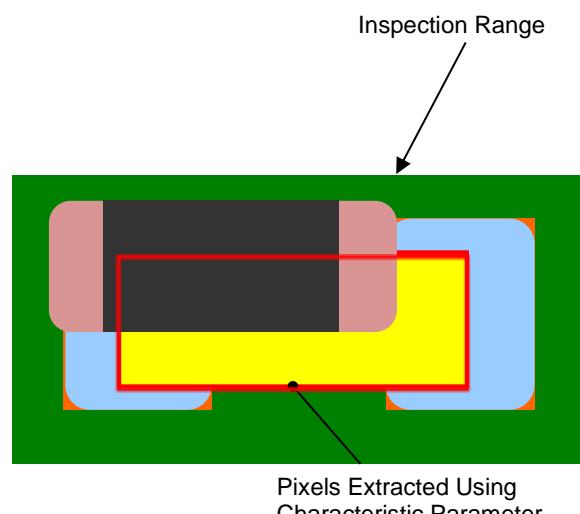
Characteristic Parameter: Colors other than the component unit and electrode colors from the PCB color, land color and solder color.

Inspection Criteria: Matching Rate (%)

1. Inspection is conducted against the inside area of a predetermined inspection range (e.g. window).

If an exclusion window has been configured,  
the range is excluded from the inspection  
range.

For component presence inspection, the  
entire area of the Component Unit Window  
is the inspection target.



2. The pixels matching the colors set in the characteristic parameter are extracted.

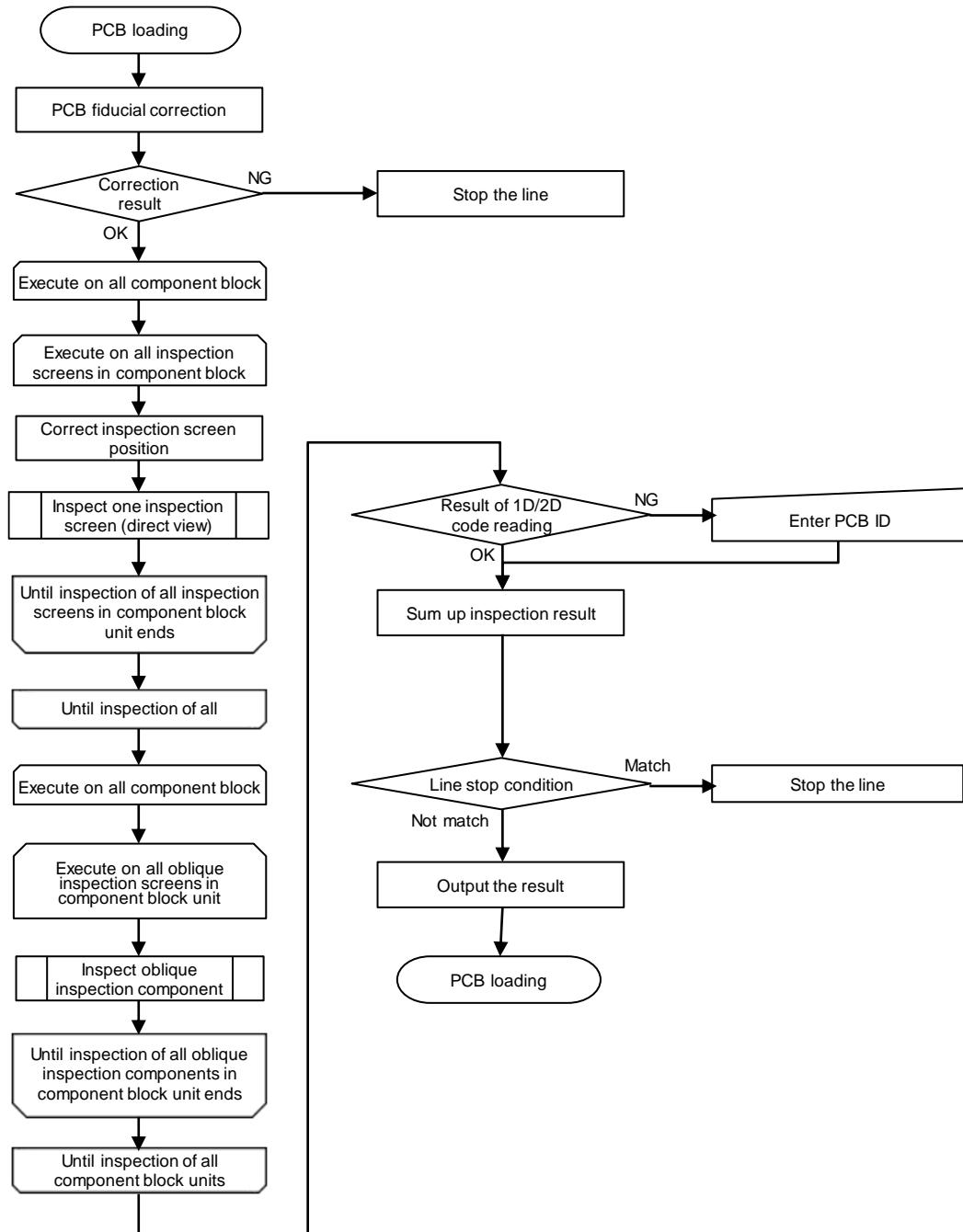
On missing component inspection, pixels excluding "Missing Exclusion Color" from "PCB Color", "Exposed Land Color" and "Solder Color" are extracted.

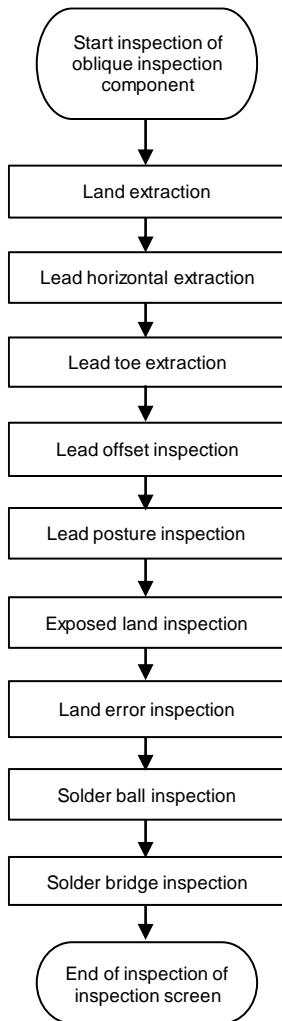
3. The inspection result is judged as "NG" (Missing Component) if the ratio of the pixel area extracted in Step 2 to the inspection range area is larger than the "Matching Rate (%)".  
Otherwise, the result is judged as "OK" (the component is present).

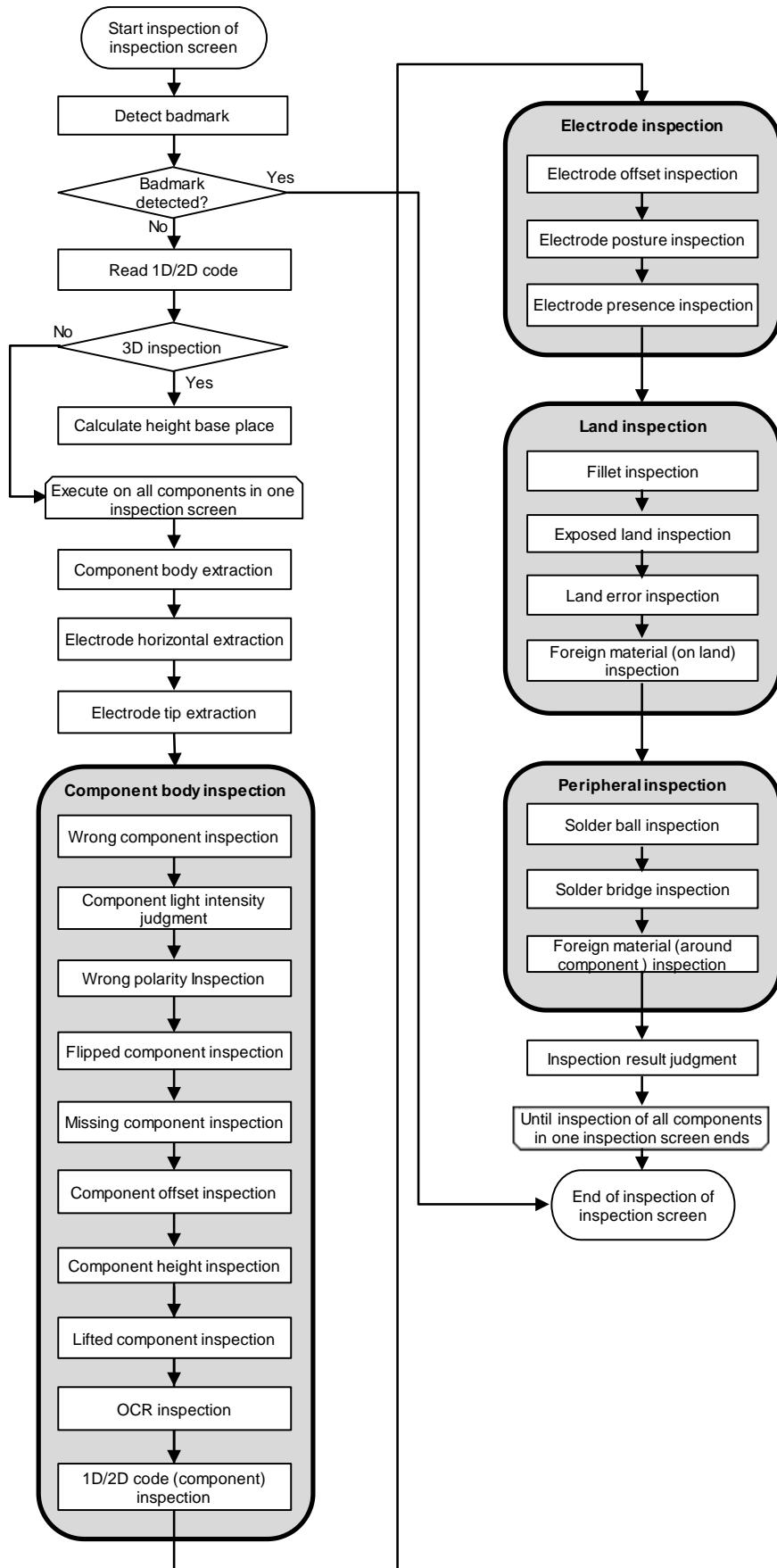
## 1.6 Flow of Inspection

This section describes the overall inspection flow for each model of PCB inspection machine.

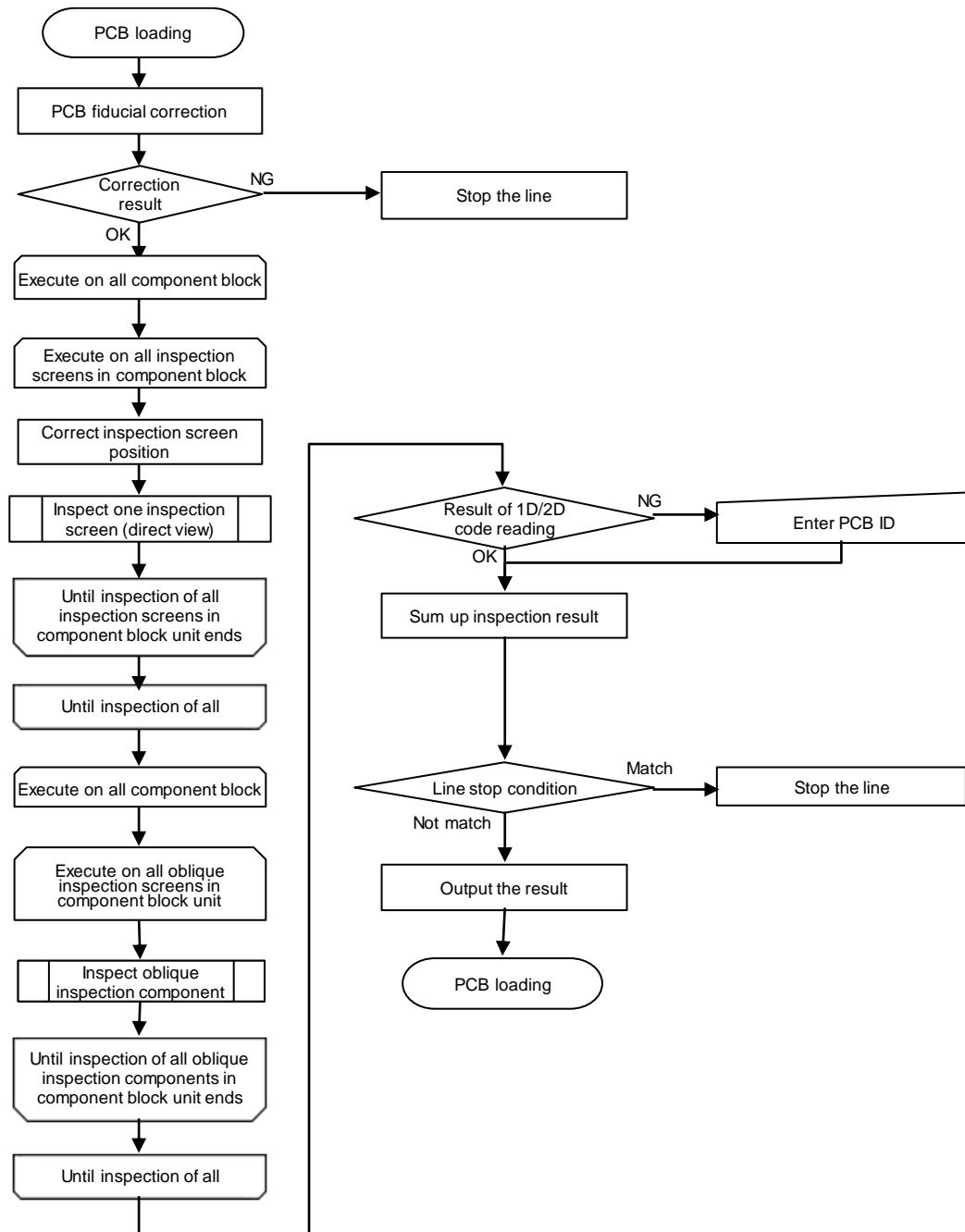
The following chart shows the overall inspection flow of the VT-S1080/S730-H/S730.

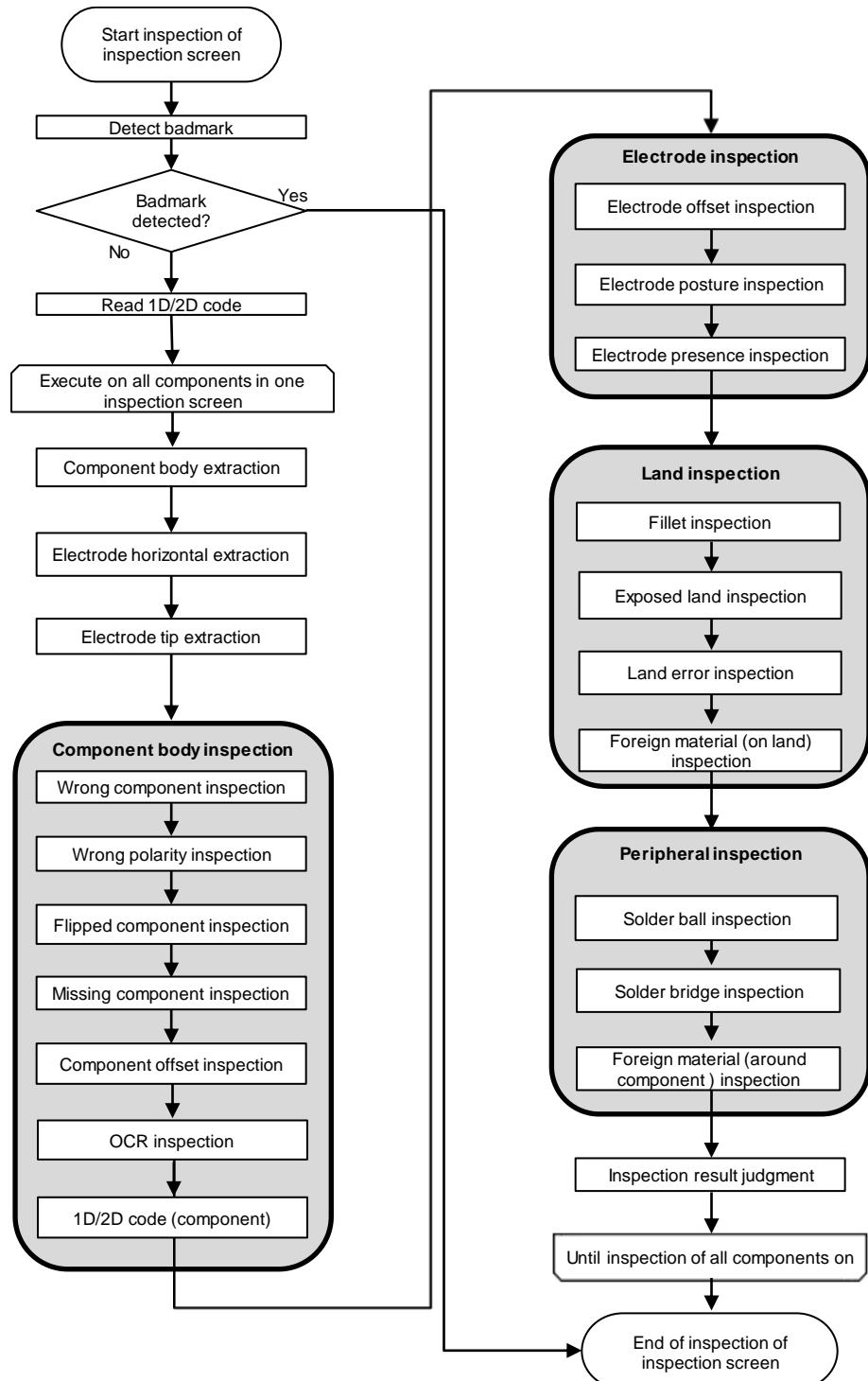


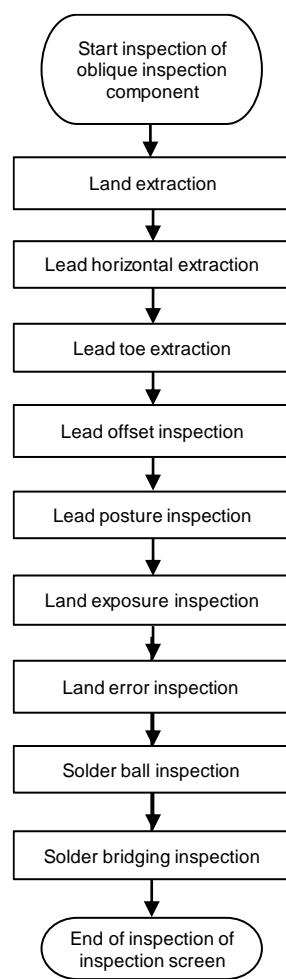




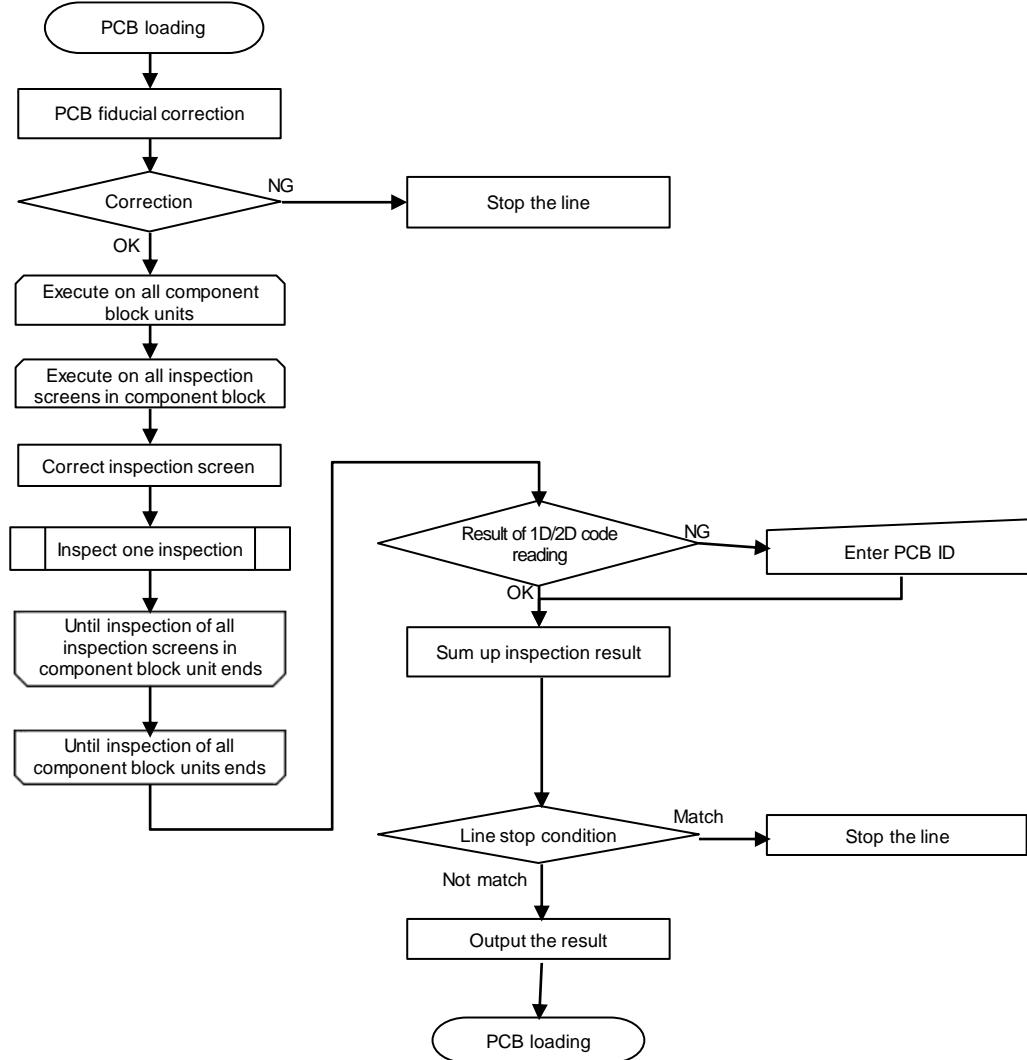
The following chart shows the overall inspection flow of the VT-S720.

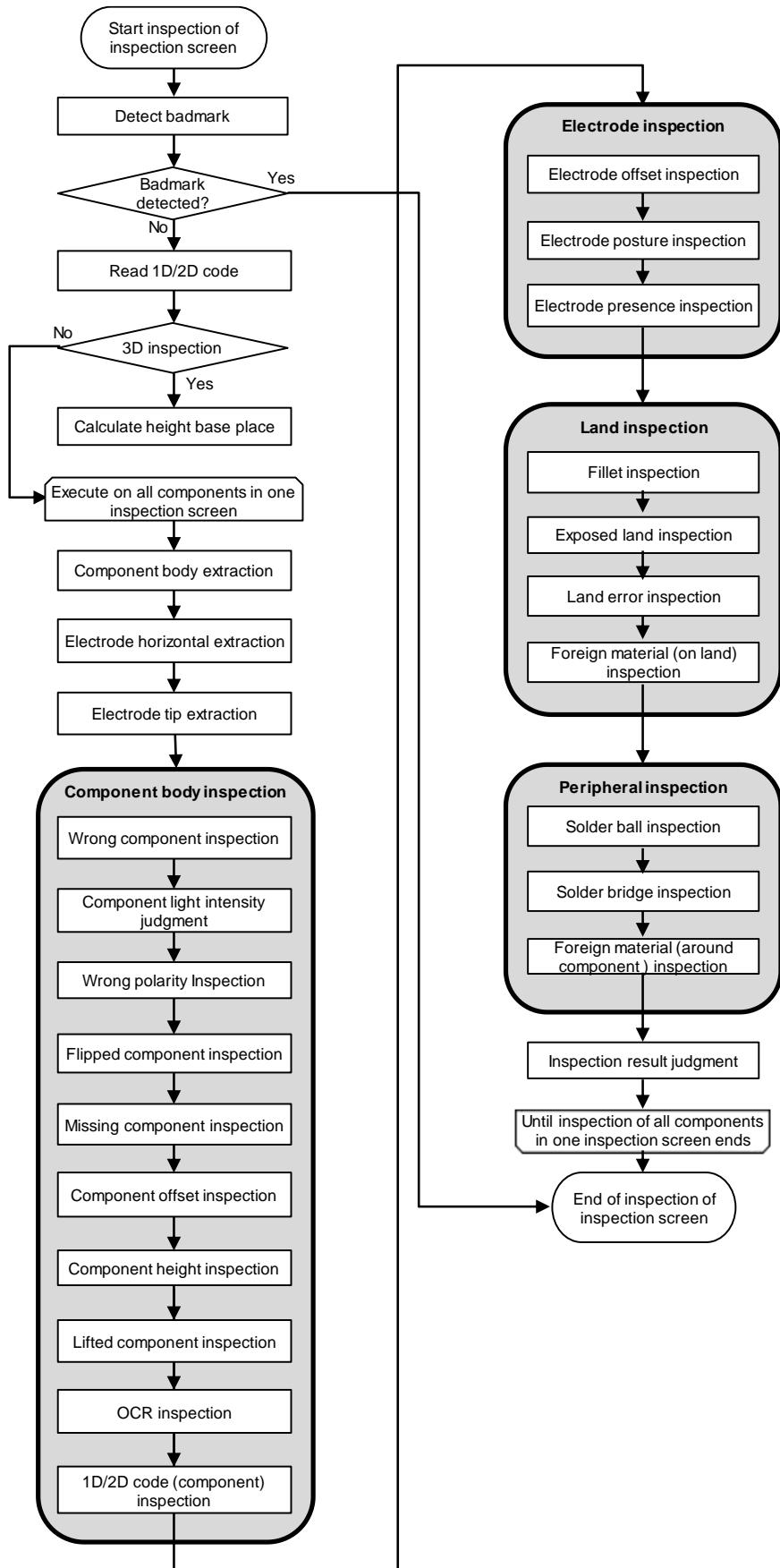




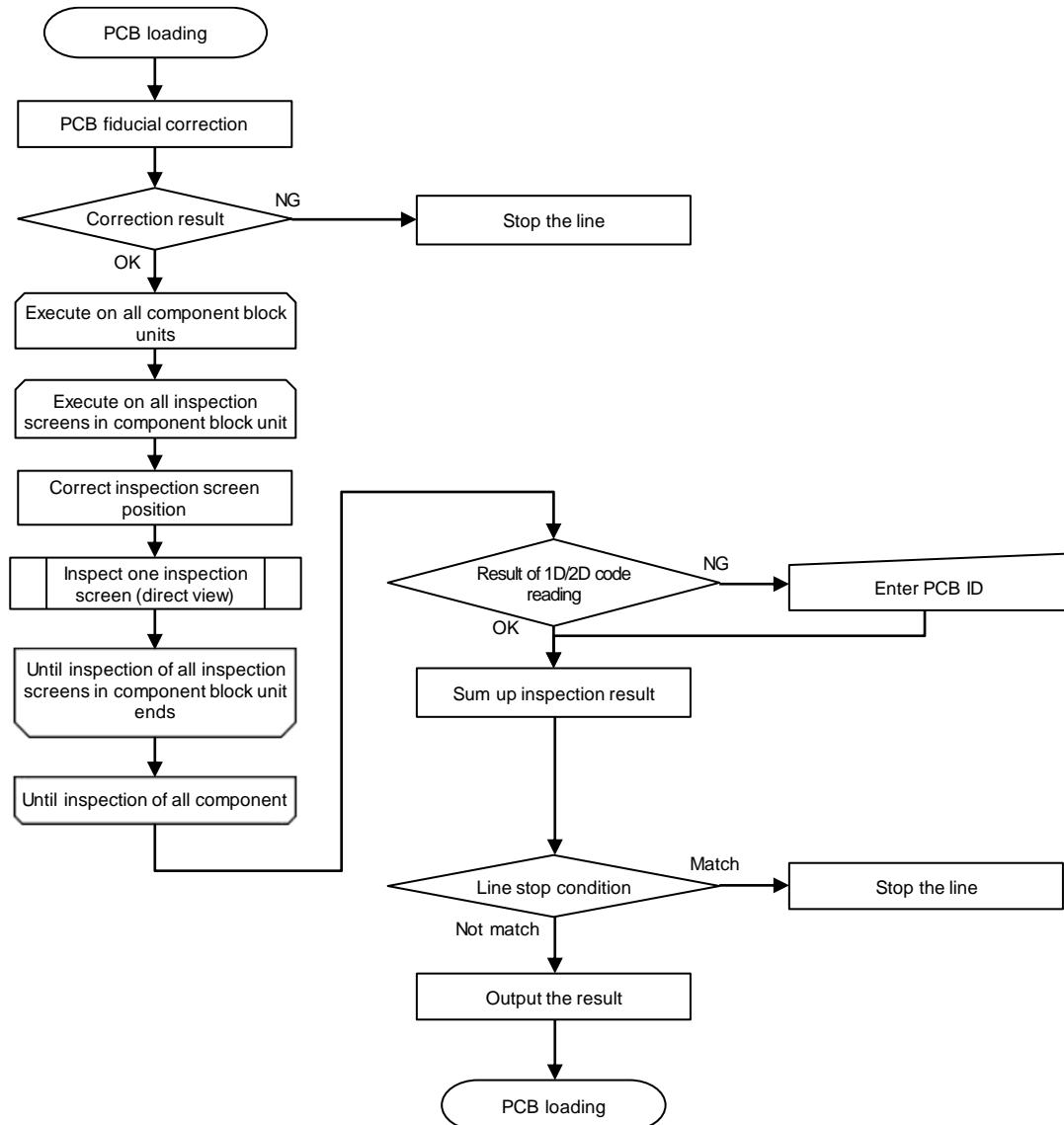


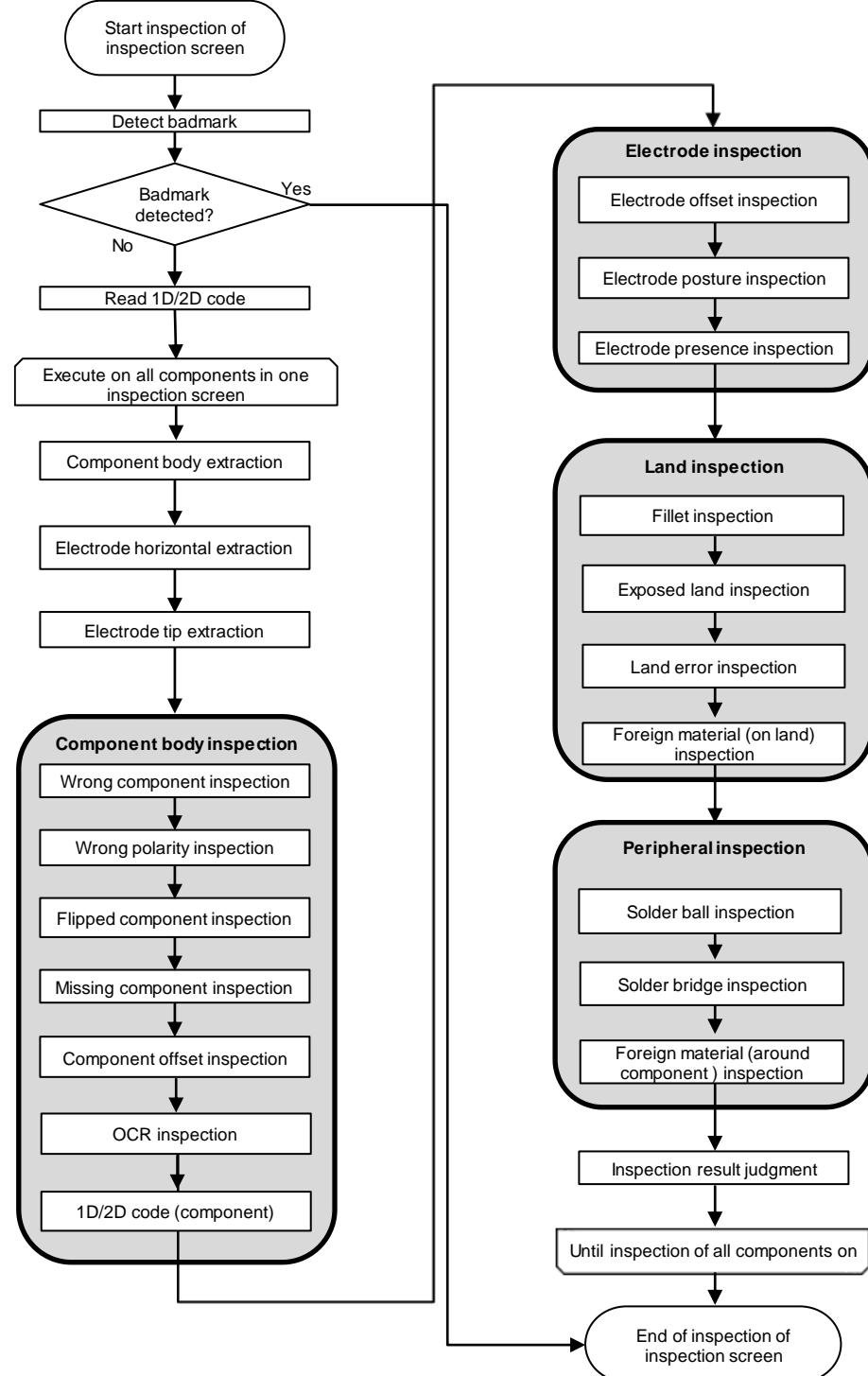
The following chart shows the overall inspection flow of the VT-S1040/S530.





The following chart shows the overall inspection flow of the VT-Z600/S500.





## 1.7 Fault (NG) Codes

Inspection results are output in the corresponding fault names and fault codes.

The list below shows the fault names and codes output by the  
VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500.

If multiple inspection items are judged "NG" in the same component or window, the code number and its name are displayed from the top.

Fault Name	Fault Code	S1080 S730	S720A	S1040 S530	Z600 S500
OK	0	Yes	Yes	Yes	Yes
No Inspection	1	Yes	Yes	Yes	Yes
No Inspection (Bad Mark)	2	Yes	Yes	Yes	Yes
No Inspection (Oblique Inspection Unavailable)	3	Yes	Yes	No	No
Bad Mark Detection	9	Yes	Yes	Yes	Yes
Position Adjustment Failure	11	Yes	Yes	Yes	Yes
1D/2D Read Error	20	Yes	Yes	Yes	Yes
Not Inspected (1D/2D Read Error)	21	Yes	Yes	Yes	Yes
Implementation error	109	Yes	Yes	Yes	Yes
Wrong Polarity	132	Yes	Yes	Yes	Yes
Wrong Component	131	Yes	Yes	Yes	Yes
Flipped Component	133	Yes	Yes	Yes	Yes
X-offset (PCB)	134	Yes	Yes	Yes	Yes
Y-Offset (PCB)	135	Yes	Yes	Yes	Yes
X-offset (Component)	174	Yes	Yes	Yes	Yes
Y-offset (Component)	175	Yes	Yes	Yes	Yes
Component Skew	136	Yes	Yes	Yes	Yes
Component Height High	137	Yes	No	Yes	No
Component Height Low	138	Yes	No	Yes	No
Side Overhang	140	Yes	Yes	Yes	Yes
End Overhang	141	Yes	Yes	Yes	Yes
End Overlap	142	Yes	Yes	Yes	Yes
Lead Posture (Longer Lead)	143	Yes	Yes	Yes	Yes
Lead Posture (Larger Area)	144	Yes	Yes	Yes	Yes
Lead Posture (Exposed Toe)	145	Yes	Yes	Yes	Yes
Lead Absence	146	Yes	Yes	Yes	Yes
Lead Posture (Dispersion)	147	Yes	Yes	Yes	Yes
Lead Posture (Side Bend)	148	Yes	Yes	Yes	Yes
Lead Posture (Height (Oblique))	149	Yes	Yes	Yes	No
Foreign Material (Around Component)	150	Yes	Yes	Yes	Yes
Foreign Material (Full View)	151	Yes	Yes	Yes	Yes
Solder Ball	152	Yes	Yes	Yes	Yes
Solder Bridging	153	Yes	Yes	Yes	Yes
Lifted Lead	154	Yes	No	Yes	No
Lead Posture (Coplanarity)	155	Yes	No	Yes	No
Lead Height: High	158	Yes	No	Yes	No

Lead Height Low	159	Yes	No	Yes	No
Wettability Error (Land Side)	160	Yes	Yes	Yes	Yes
Wettability Error (Lead Side)	161	Yes	Yes	Yes	Yes
Wettability Error (The Side of Lead)	162	Yes	Yes	Yes	Yes
Fillet Low	163	Yes	Yes	Yes	Yes
Fillet High	164	Yes	Yes	Yes	Yes
Fillet Short	165	Yes	Yes	Yes	Yes
End Joint Width Short	166	Yes	Yes	Yes	Yes
Side Joint Length Short	167	Yes	Yes	Yes	Yes
Exposed Land	168	Yes	Yes	Yes	Yes
Land Error	169	Yes	Yes	Yes	Yes
Foreign Material (On Land)	170	Yes	Yes	Yes	Yes
Component Tilt (0°)	171	Yes	No	Yes	No
Component Tilt (90°)	172	Yes	No	Yes	No
Component Parallel Lift	173	Yes	No	Yes	No
OCR	176	Yes	Yes	Yes	Yes
Lead X-offset	177	Yes	Yes	Yes	Yes
Lead Y-offset	178	Yes	Yes	Yes	Yes
Lead Component Skew	179	Yes	Yes	Yes	Yes
Lead Absence (Center of Gravity)	185	Yes	Yes	Yes	Yes
Lead Absence (Dispersion)	186	Yes	Yes	Yes	Yes
Lead Bend	187	Yes	Yes	Yes	Yes
Blow Hole	188	Yes	Yes	Yes	Yes
Solder Ball (Inter-Land)	220	Yes	Yes	Yes	Yes
Solder Bridge (Inter-Land)	221	Yes	Yes	Yes	Yes
Missing Component	130	Yes	Yes	Yes	Yes
Exposed Land (Oblique)	300	Yes	Yes	No	No
Solder Ball (Oblique)	301	Yes	Yes	No	No
Solder Bridge (Oblique)	302	Yes	Yes	No	No
Lifted Lead (Exposure (Oblique))	304	Yes	Yes	No	No
Lifted Lead (Dispersion (Oblique))	305	Yes	Yes	No	No
Land Error (Oblique)	306	Yes	Yes	No	No
Side Overhang (Oblique)	307	Yes	Yes	No	No
End Overhang (Oblique)	308	Yes	Yes	No	No
End Overlap (Oblique)	309	Yes	Yes	No	No
Lead Area (Oblique)	310	Yes	Yes	No	No
Hight Measurement Failure	350	Yes	No	Yes	No
Projector Light Intensity Low	351	Yes	No	Yes	No
Projector Light Intensity High	352	Yes	No	Yes	No
Reference Mark Detection Failure	360	Yes	Yes	Yes	Yes
2D Reading Error (Component)	380	Yes	Yes	Yes	Yes

Yes: Displayed No: Not displayed

# 2 Position Correction and Extraction

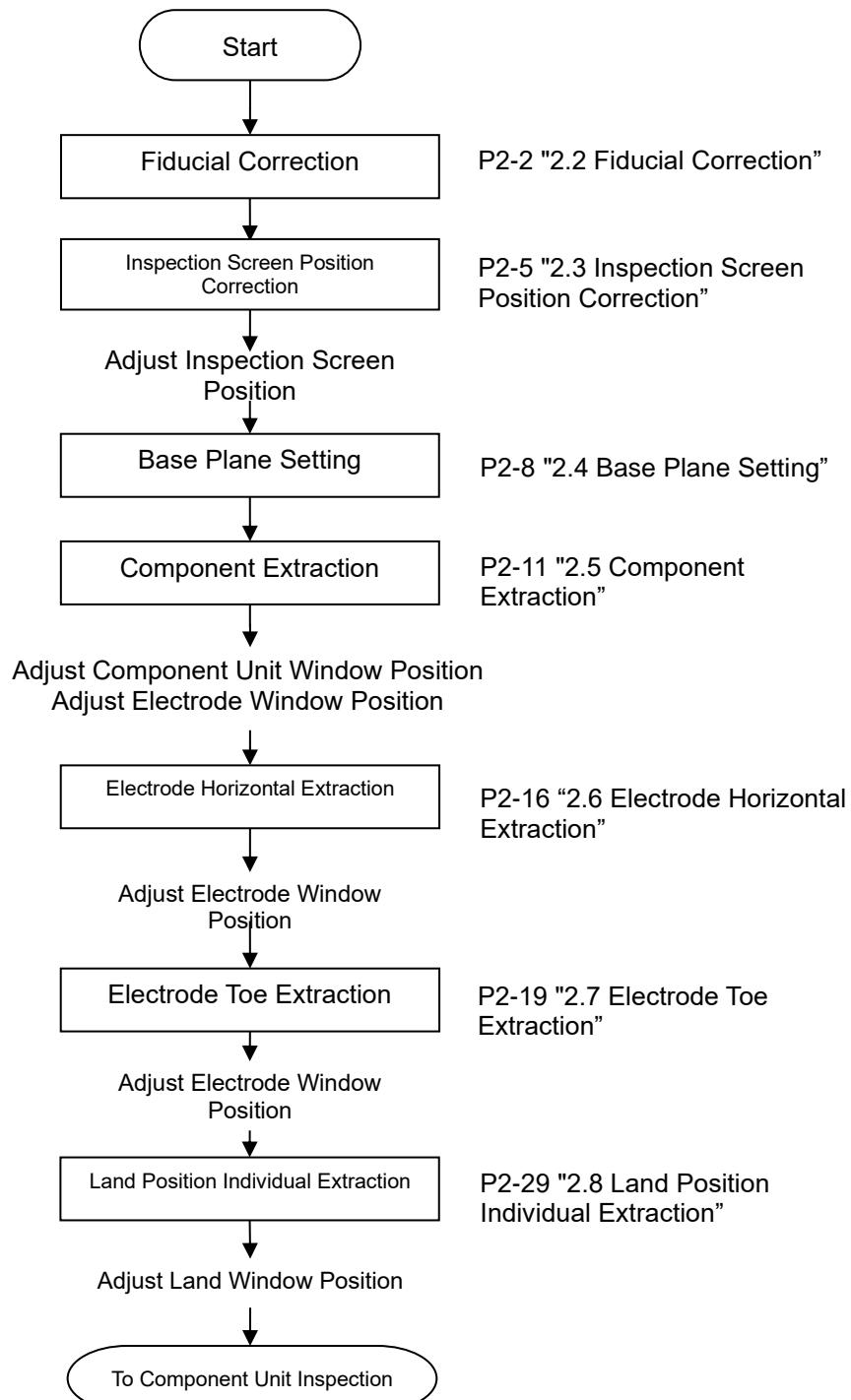
\* The description regarding the inspection logic is as follows.

No symbol: Common for VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500,

**S1080** : S1080 **S1040** : S1040 **Z600** Z600 **S730** : S730-H/S730 **S720A** : S720A **S530** : S530 **S500** : S500

## 2.1 Flow of Position Correction and Extraction

This section explains the inspection logics used for component position correction and extraction. The following chart shows the flow of position correction and extraction.



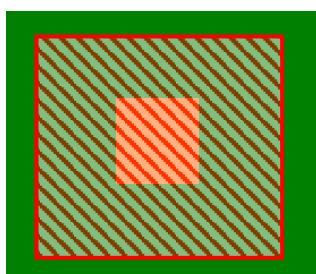
## 2.2 Fiducial Correction

### ■ Outline

This system detects fiducial marks on the PCB in the Fiducial Correction Window, based on which it adjusts the camera imaging position.

### ■ Inspection Range (Correction Range)

Shaded Area Below (Inside Range Window)



### ■ Characteristic Parameter

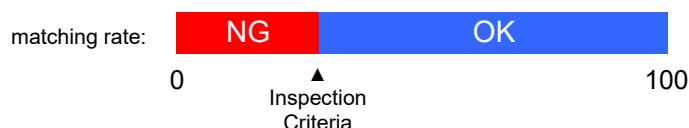
Fiducial Mark Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
Fiducial Correction			
Matching rate (%)	<input type="text"/> - 100		



### ■ Processing Detail

#### [Case: Template matching]

1. The system binarizes the image in the inspection range using the characteristic parameters.
2. Then it searches for the most matching portion between the image created in Step 1 and the pre-registered model and measures the matching rate of the image with the model.
3. If the result obtained in Step 2 exceeds the "matching rate (%)", the system adjusts the position using the offset from the center position (reference position). If the result is below "matching rate (%)", the "Position Correction Failure" judgment is output.

#### [Case: Template matching+ Shape detection (Circle)]

1. The system binarizes the image in the inspection range using the characteristic parameters.
2. Then it searches for the most matching portion between the image created in Step 1 and the pre-registered model and measures the matching rate of the image with the model. If the result is below "matching rate (%)", the "Position Correction Failure" judgment is output.

- 
3. Move the fiducial correction window to the position searched in step 2, and create an edge image within that area.
  4. Calculate the position of the center of gravity of the luminance of the image obtained in step 3.
  5. Correct the coordinates obtained in step 4 as the correction value for the amount of misalignment.

**[Case: Template Matching + Shape Detection (Square)]**

1. Within the inspection area, create a binarized image using the feature parameters.
2. Search for the point where the image created in step 1 and the pre-registered model most closely match, and measure the match rate with the model. If the result obtained here is less than the “agreement rate”, it is judged as “position correction failure”.
3. Move the fiducial correction window to the position searched in step 2, and create a grayscale image within that area.
4. Calculate the position of the center of gravity of the luminance of the image obtained in step 3.
5. Correct the coordinates obtained in step 4 as the correction value for the amount of misalignment.

**Fault Output: Position Correction Failure  
Fault Code: 11**

### Fiducial Mark

#### Recommended Fiducial Mark Shapes



Minimum vertical and horizontal size of the fiducial mark is a standard is 200 $\mu\text{m}$  ~.

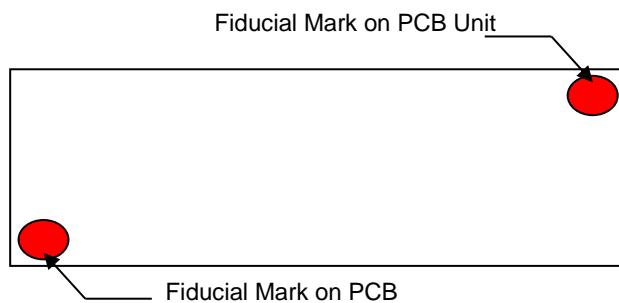
#### Material

- Cu foil, Au plating, solder plating
- If the mark surface is partly soldered, high-precision recognition is impossible.

#### Note:

1. A fiducial mark should have a sufficient contrast with its surrounding.
2. The system may not recognize fiducial marks if the PCB is excessively warped. In this case, fiducial marks require a test for proper recognition.
3. There should be no Cu foils, silk printing, punches, or any other objects that may cause recognition errors within the designated window.
4. Fiducial correction must be specified at two locations on the PCB for PCB fiducial correction. For S1080, S730, S730-H, and S530, do not use PCB holes whose height cannot be measured because a processing to correct the 3D height error using fiducial marks was performed.

### PCB fiducial correction: Adjusts an entire PCB



## 2.3 Inspection Screen Position Correction

### ■ Outline

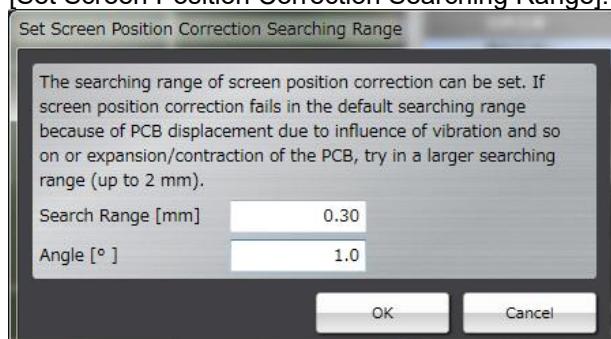
This system recognizes the lands or wiring patterns in the inspection screen and adjusts the position of the entire captured inspection screen image.

### ■ Correction Range

See the tables below (default).

Correct Block Position Individually	Screen Correction (Screen Unit)	Fiducial Correction (PCB Unit)
OFF	XY: $\pm 0.16\text{mm}$ Angle: $\pm 0.0\text{deg.}$	Specify by the size of XY range window. Default: $\pm 1.2\text{ mm}$
ON (Ver.2.10A or later)	XY: $\pm 0.16\text{mm}$ Angle: $\pm 0.0\text{deg.}$	
ON (Ver.2.00 or before)	XY: $\pm 0.8\text{mm}$ Angle: $\pm 0.0\text{deg.}$	

The Correction Range can be changed by navigating to [Settings] > [Inspection Program Settings] > [Set Screen Position Correction Searching Range].



\*To change the angle of the Correction Range, [Correct Block Position Individually] must be set to ON.

The inspection screen position correction includes the individual block position correction function. This function determines the visual field so that a single visual field does not inspect plural individual parts.

This function is useful when each individual block has variability in position gap (orientation or amount) in flexible PCBs.

When using the inspection screen position correction function, be sure to note the followings:

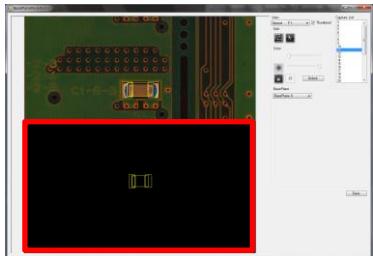
- 1) The inspection time will be longer because of increased number of inspection visual field.
- 2) The matching rate by the pattern matching using binarized images may be lower due to a large search area of position correction, resulting in an increased risk of failure in position correction.

For the operation after the inspection screen position correction is switched ON/OFF, be sure to note the followings:

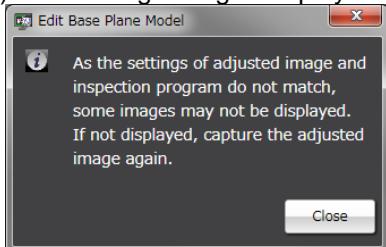
The teaching operation (such as PCB test and Reference Level Model Edit) using the adjusted images may not be correctly performed as follows because of the changed inspection visual field.

#### [Phenomenon]

- 1) Over-detection occurs (at PCB test)
- 2) A black image is displayed (at Reference model editing)  
(example: Red frames on the Reference Level Model Edit screen)



- 3) A warning dialog is displayed (example: at the Reference Level Model Edit screen starts up)



To act on this problem, obtain the correction image after switching ON/OFF.

• The Reference Level Model Editing is valid for S1080/S1040 and S730-H/ S730 and S530.



For the reference level model editing, refer to "2.16.4 Editing a Reference Level Model" in the v-TS Teaching Manual.

## ■ Feature Parameters

### Position Correction Colors

\*When the position correction criterion is land: Color showing on the land

\*When the position correction criterion is wiring pattern: Color of the wiring pattern

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

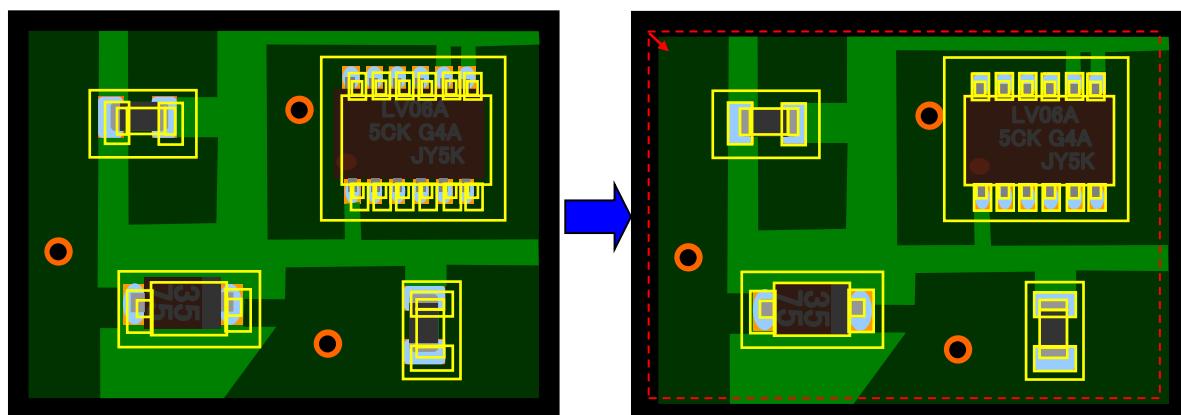


## ■ Inspection Criteria

Not Specified

## ■ Processing Detail

1. Characteristic parameters are used in the correction range to create a binarized image.
2. In the image created in the step 1, if land is selected for the position correction criterion, the system searches a location that most matches the shape of the land window provided in teaching. If wiring pattern is selected for the position correction criterion, the system searches a location that most matches the shape of the wiring pattern used for teaching.
3. The inspection screen is moved to the position searched in the step 2.



Fault Output: None  
Ft Code: None

S730 S530  
S730 S530

## 2.4 Base Plane Setting

### ■ Outline

3D profile of a PCB plane is recognized in the inspection screen and a PCB curve of the captured entire inspection image is corrected so that the land plane height should be 0.

### ■ Correction Range

Specify a base plane under the following conditions:

PCB curve : +/-2.0 mm max. (after being clamped)

PCB plane inclination : +/-5.0 degrees max. (after being clamped)

### ■ Characteristic Parameter

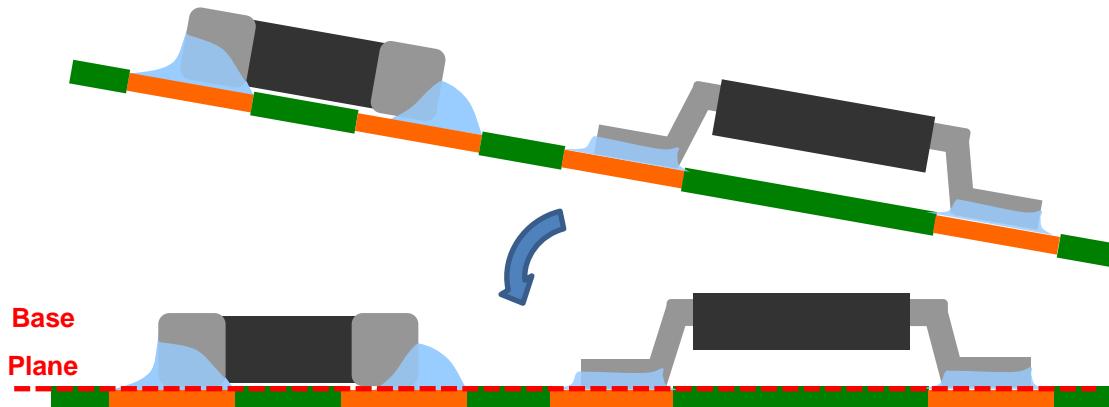
Not Specified

### ■ Inspection Criteria

Not Specified

### ■ Processing Detail

1. 3D profile of the PCB plane is measured in the inspection screen.
2. A plane approximation or quadratic surface approximation of the PCB plane 3D profile measured in Step 1 is calculated.
3. The height of plane or surface approximated in Step 2 is subtracted from the PCB plane 3D profile in the inspection screen. The PCB curve is corrected so that the land plane height should be 0.



**Fault Output: Height Measurement Failed**  
**Fault Code: 350**

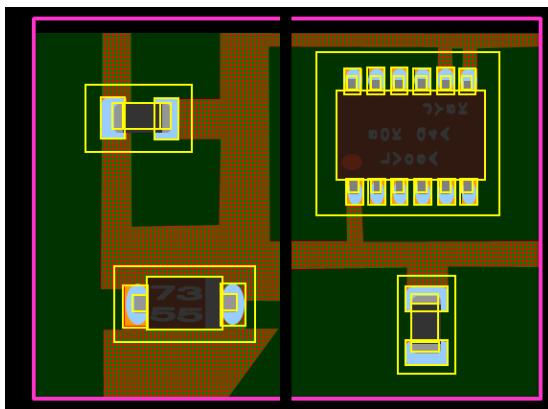
**[Division Setting of Base Plane]**

Perform a division setting for the base plane when unable to approximate the PCB plane in the inspection image with one plane.

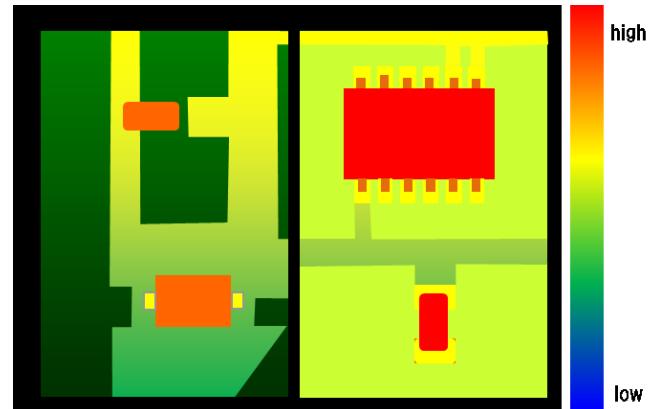
(Example: When there are multiple component block units in the inspection image and the PCB height differs on each component block unit. When the height variation of the PCB plane varies intricately in the flexible PCBs.)



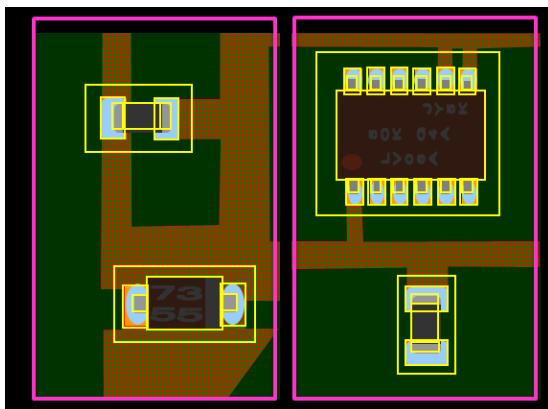
For settings, refer to "2.16.4 Editing a Reference Level Model" on v-TS teaching manual.



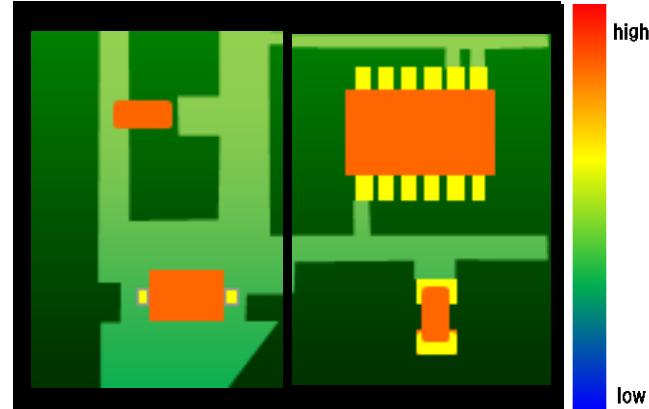
**Bad example:** There are more than two component block units in the inspection image and the base plane is not divided.



The component cannot be inspected correctly (right component block unit) because the PCB plane of two component block units cannot be approximated on one plane.



**Good example:** There are more than two component block units in the inspection image and the base plane is divided by component block unit.



The component can be inspected correctly because the base plane is configured by approximation by component block unit.

**[Surface Approximation of Base Plane]**

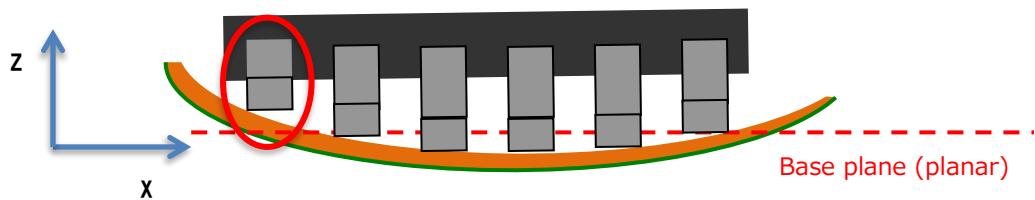
When the PCB plane within the inspection image cannot be approximated due to a bent PCB plane, this function allows the surface approximation of the base plane.

(Example: when the height of PCB planes varies in the flexible PCB likely to bend)

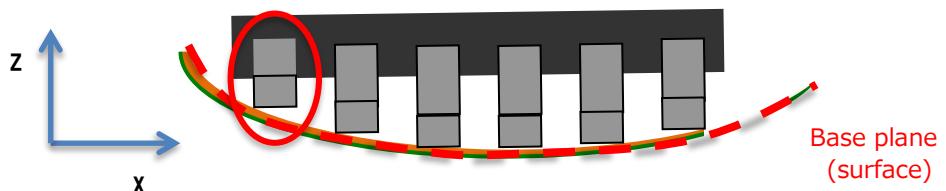


For the setting procedure, refer to "2.16.4 Editing a Reference Level Model" in the v-TS Teaching Manual.

NG: The base plane is planar, and a warp of the curved surface cannot be corrected (SOP lead part)



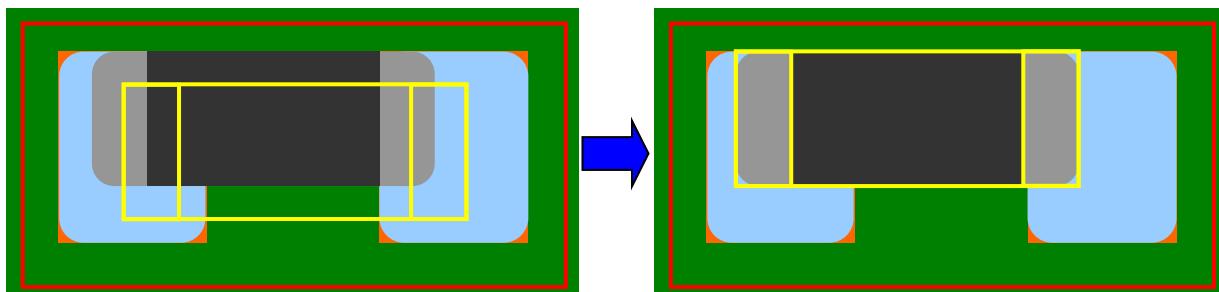
OK: Surface approximation of the base plane can also correct the warp of curved surface. (SOP lead part)



## 2.5 Component Extraction

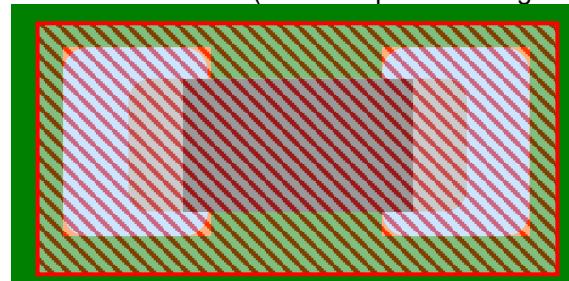
### ■ Outline

This system extracts the component in the Inspection Range Window, based on which it adjusts the positions of the Component Unit Window and Electrode Windows to be referred to during component unit and electrode inspection.



### ■ Inspection Range

Shaded Area Below (Inside Inspection Range Window)



### ■ Characteristic Parameter

[Extraction method: color] color of the component unit surface and electrode

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

[Extraction method: height] N/A

\*Component Surface and Electrode Colors

S730      S530  
S730      S530

### ■ Inspection Criteria

Only component extraction (No measurement and inspection) is provided.

If the component is mounted with an anglewise offset (skewed), the position is followed and adjusted by a value within the "Angle Measuring Range (°)".

Inspection Item	Setting Value	Measurement Value	Judge
■Component Extraction			
Extraction Method	<input checked="" type="radio"/> Color <input type="radio"/> Height		
Angle Measuring Range (°)	0 -	<input type="text"/>	

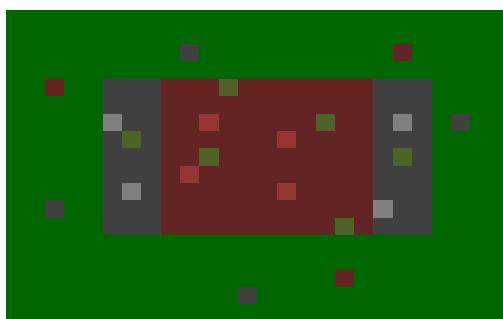
Angle Measuring Range: Measuring Range Non Measuring Range



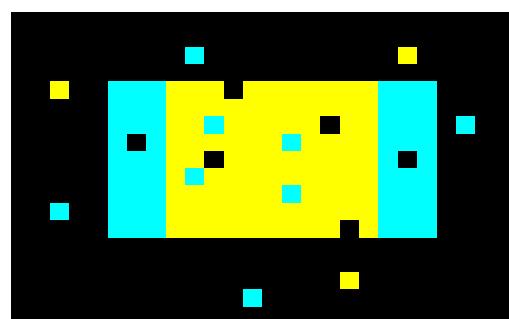
### ■ Processing Detail

#### [Case: Color]

- Characteristic parameters are used in the correction range to create a ternarized image.
  - The ternarization includes "component body surface color", "electrode color", and "other colors".
  - The electrode color is prioritized over the component surface color to be the characteristic parameter if they are the same color.



Ternarized Image

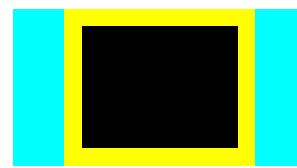


▲  
Set Value

- In the image created in the step 1, the system measures the matching rate of the shape (model) of the Component Window and electrode window provided in teaching excluding the exclusion window, to search a location with the highest matching rate.
  - The area configured in the exclusion window is not used for matching rate measurement.



Inspection Area



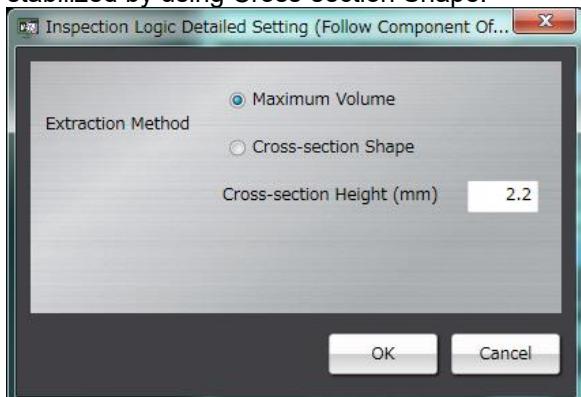
Model (without exclusion window)

- The Component Window and Electrode Window are moved to the location searched in the step 2.

S10  
S730 S530

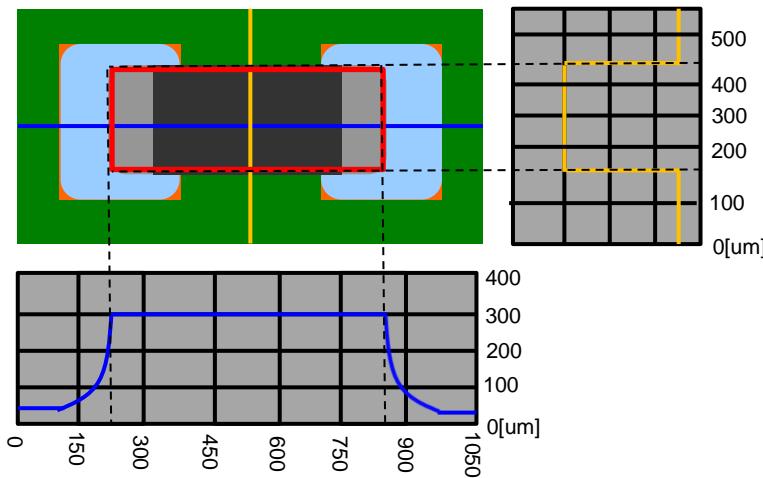
#### [Case: Extraction Method of Height]

For height, it is able to select maximum volume or cross-section shape as extraction method. For components such as diodes, which have inclined side faces, component extraction might be stabilized by using Cross-section Shape.



**[Case: Height: Extraction Method of Maximum Volume]**

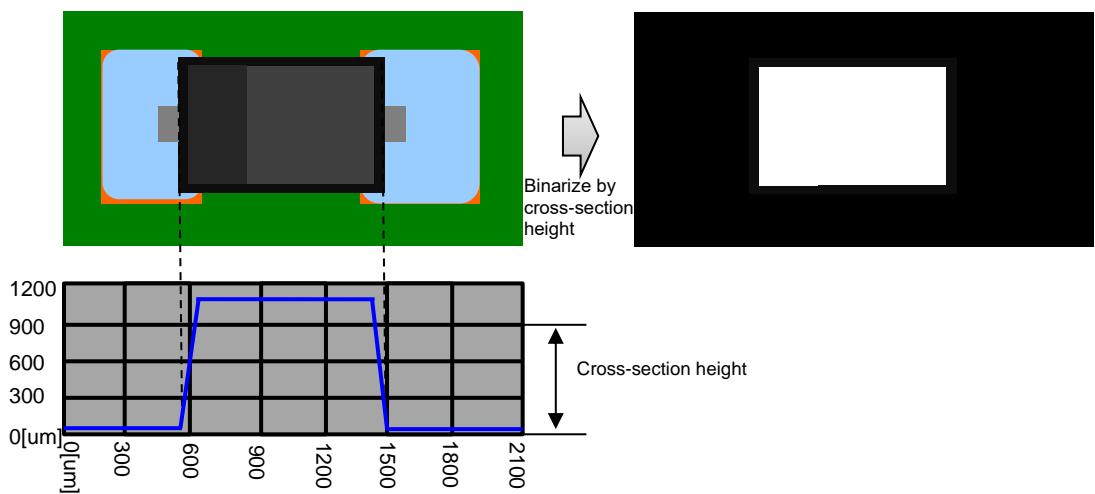
- In height data in the inspection range, measure volume inside the profile (model) of the teach-in component window and electrode window while excluding the exclusion window, and search a location where the volume is the largest.



- Move the Component Window and Electrode Window to the searched position.

**[Case: Height: Extraction Method of Cross-section Shape]**

- For the height data in the inspection area, create a binarized image of a height greater than or equal to the specified cross-section height (mm).

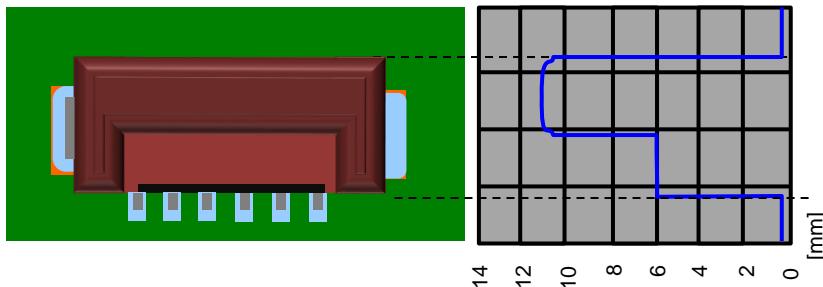


- Move the component body window and electrode window to the center of gravity position and angle of the connected largest pixel group (angle of the most linear side).

**Fault Output: None**  
**Fault Code: None**

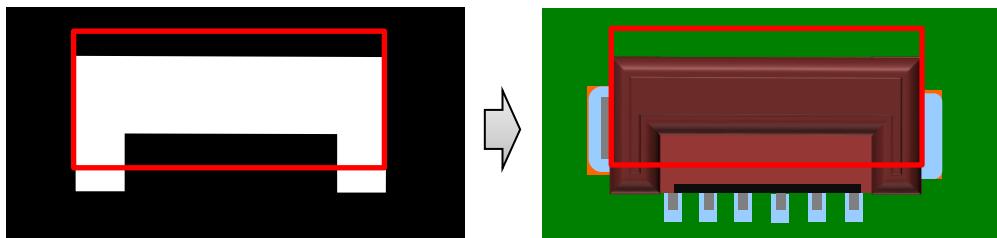
### Precautions to use cross-section shape

If the cross-section shape is not symmetric horizontally and vertically, the center of gravity position does not match the center position of the component body window, so that the extraction position does not match. In this case, set a cross-section height symmetric horizontally and vertically or use the maximum volume. An example is shown below.

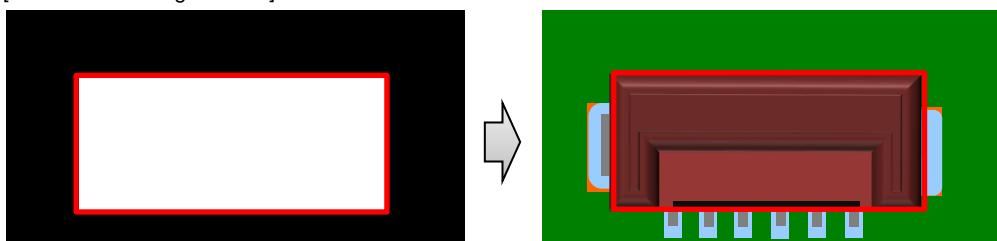


If the cross-section height is 10 mm, the cross-section shape is not symmetric horizontally and vertically, so that the center of gravity position does not match the center position of the component body window. In this case, set the cross-section height to 4 mm, or use the maximum volume.

[Cross-section height: 10 mm]



[Cross-section height: 4 mm]



## 2.6 Electrode Horizontal Extraction

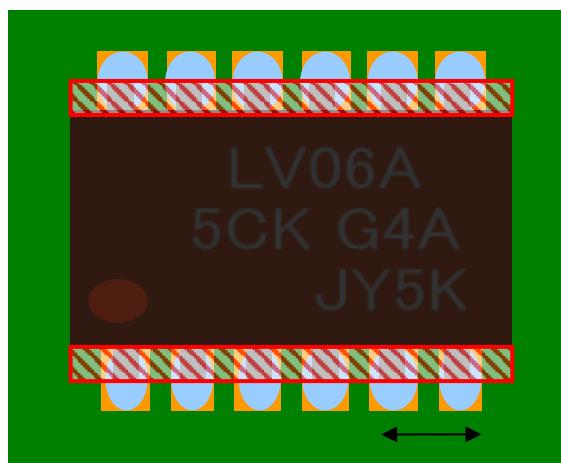
### ■ Outline

This system extracts the electrodes in the Inspection Range Window, based on which it corrects the position of the Electrode Windows to be referred to during electrode inspection.

### ■ Inspection Range

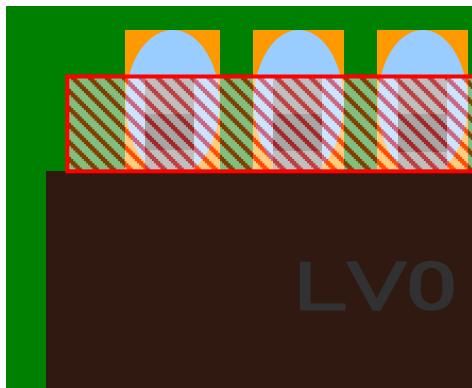
Shaded Areas Below

(a) Other than Gull-Wing Lead (Electrode Type)

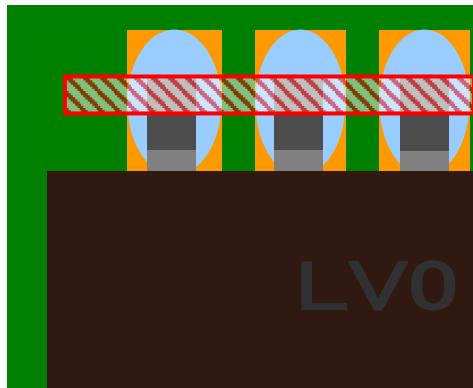


(b) Gull -Wing Lead (Electrode Type)

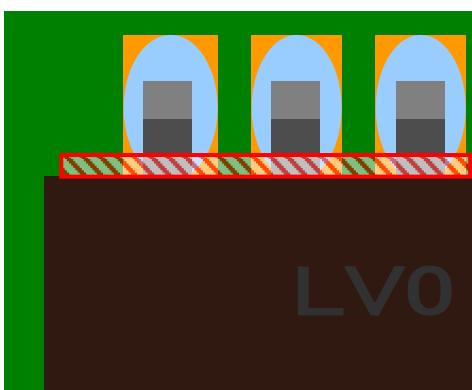
Extraction Method: Entire Lead



Extraction Method: Lead Toe



Extraction Method: Lead Shoulder



Extraction Method: Lead Toe + Shoulder



### ■ Characteristic Parameter

#### Electrode Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

Only electrode extraction (No measurement and inspection) is provided. Inspection criteria are not available for chip-type electrodes.

- (a) Other than Gull-Wing Lead (Electrode Type)

Inspection Item	Setting Value	Measurement Value	Judge
■ Electrode Horizontal Extraction			

- (b) Gull-Wing Lead (Electrode Type)

Inspection Item	Setting Value	Measurement Value	Judge
■ Electrode Horizontal Extraction			
Extraction Method		▼	
	Entire Lead		
	Lead Toe		
	Lead Shoulder		
	Lead Toe plus Shoulder		

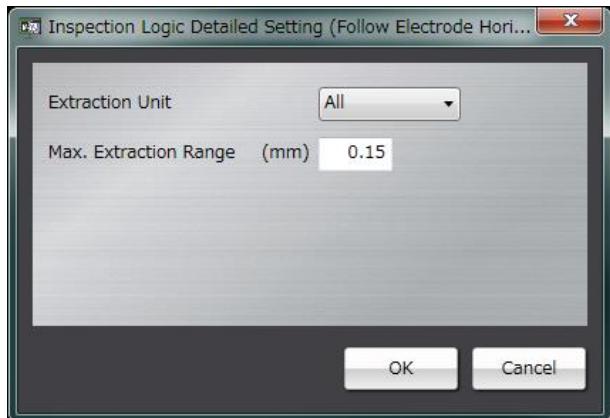
### ■ Processing Detail

- Characteristic parameters are used in the correction range to create a binarized image.
- In the image created in the step 1, the system horizontally searches a location that most matches the shape (model) of all the electrode windows in the same direction of the same electrode group provided by teaching.
  - The horizontal search is not done for a component with only one electrode in the same direction. The location extracted in the Component Extraction is used.
- The Electrode Window is moved to the location searched in the step 2 as the electrode position.

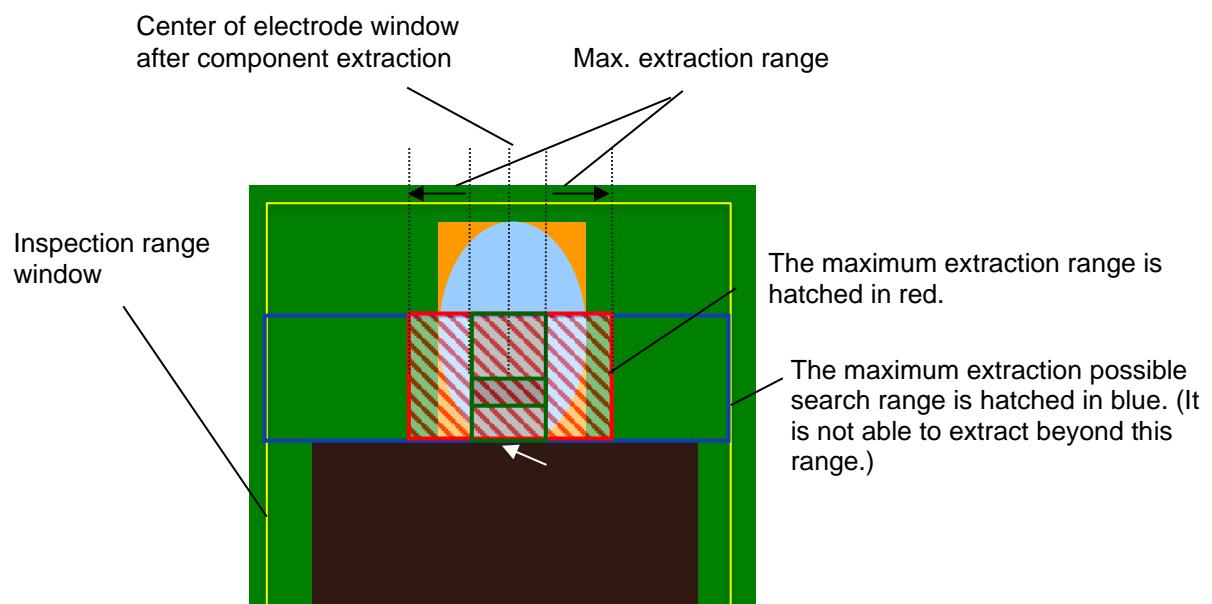
### Detailed setup

It is able to set the extraction unit and the maximum search range of electrode horizontal extraction.

For the extraction unit, 1, 4, 8, 16, or All can be selected.



The setup range of the maximum extraction range is as follows:



Fault Output: None  
Fault Code: None

## 2.7 Electrode Toe Extraction

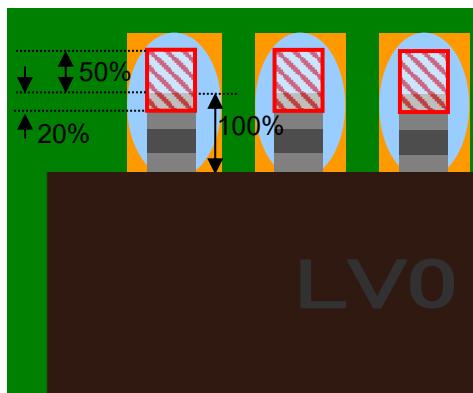
### ■ Outline

This system extracts the electrodes in the Inspection Range Window, based on which it corrects the position and size of the Electrode Windows to be referred to during electrode inspection.

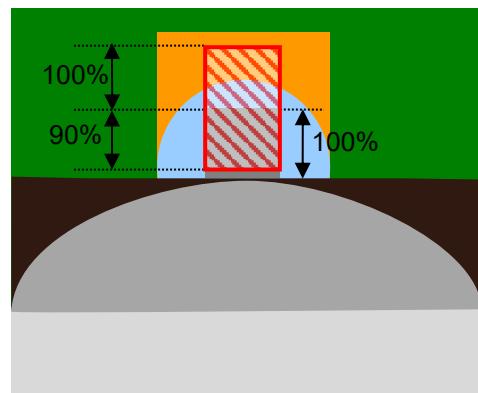
### ■ Inspection Range

Shaded Areas Below

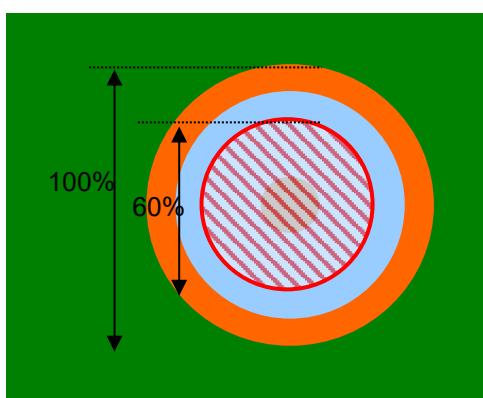
(a) Gull-Wing Lead (Electrode Type)\*



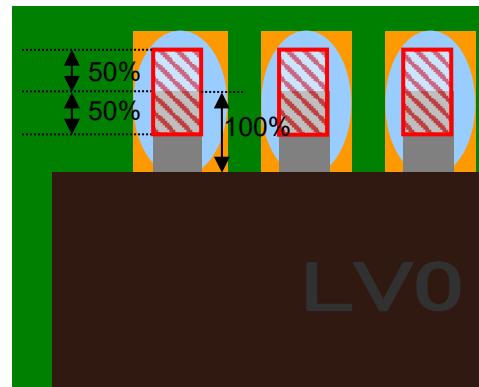
(b) Electrolytic Capacitor (Component Type)



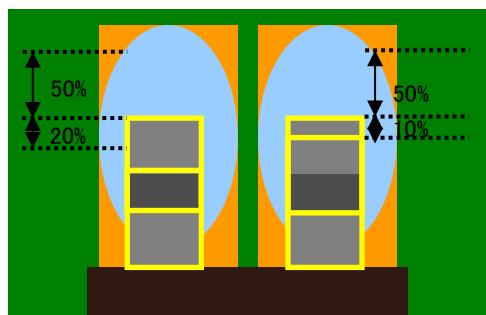
(c) Insertion Lead



(d) Electrode Type and Component Type other than (a), (b) and (c)



\* The electrode toe extraction range of the gull-wing lead is; 20% from the electrode toe to the front (component side), 50% to the rear (land side) when the electrode window size (long side) is 100%. However, when the range setting of the electrode toe is narrow as the electrode shown on the right side of the figure below, the search area of the front (component side) becomes narrow so that toe extraction may fail. In that case, set the toe area according to the actual electrode.



Electrode window setting of gull-wing lead (left: good example, right: bad example)

Reference → For details on the setting of the electrode toe length (inflection point length), see "2.4.5.4 Electrode Setting" on v-TS teaching manual.

### ■ Characteristic Parameter

[Extraction Method: Color] Electrode Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination  
S730 S530

[Extraction Method: Height] None

\* The 3D measurement result in the inspection range window is used.

[Extraction Method: Color and Height] Electrode Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination  
S730 S530

### ■ Inspection Criteria

Only electrode toe extraction (No measurement and inspection) is provided.

(a) Other than Insertion Terminal

	Inspection Item	Setting Value	Measurement Value	Judge
<b>■ Electrode Toe Extraction</b>				
Extraction Method	<input checked="" type="radio"/> Color <input type="radio"/> Height <input type="radio"/> Color and Height			
Extraction Unit	<div style="border: 1px solid black; padding: 2px; width: 150px;"> <span style="font-size: small;">▼</span> </div>			
	1			
	4			
	8			
	16			
	ALL			

(b) Insertion Terminal

	Inspection Item	Setting Value	Measurement Value	Judge
<b>■ Electrode Toe Extraction</b>				
Extraction Method	<input checked="" type="radio"/> Color <input type="radio"/> Height <input type="radio"/> Color and Height			

### ■ Processing Detail

[Extraction Method: Color, other than insertion terminal]

1. In the electrode of the same direction of the same electrode group, grouping is made by the number of the electrode set by extraction unit.
2. Find the location where the total width of pixels extracted within inspection range grouped by Step 1. continues by more than “50%” against the total width of electrode window grouped by Step 1. by searching it in the vertical direction toward the land end from component side.
3. If a position satisfying the condition of Step 2 is found, its end point is regarded as the electrode toe.  
If not found, the position extracted by component extraction is used. (It is not handled as a defect)  
By doing so, the electrode toe grouped by Step 1. comes in the same position.

[Extraction Method: Height, other than insertion terminal]

1. In the electrode of the same direction of the same electrode group, grouping is made by the number of the electrode set by extraction unit.
2. In the height data in the inspection range grouped in 1. the position where the electrode height change is the highest is extracted as the electrode toe position and used.

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#### **[Extraction Method: Color and height, other than insertion terminal]**

S730 S530

1. In the electrode of the same direction of the same group, grouping is made by the number of the electrode set by extraction unit.
2. Within the inspection range grouped by Step 1., create a binarized image by using characteristic parameter.
3. In the height data within inspection range grouped by Step 1., create a binarized image at the height more than “40%” of electrode height set.
4. Take an AND operation for each pixel of the image by Step 1. and the image of Step 2. (If both are white, the color is white and others are black.)
5. Find the location where the width of the pixels extracted within the inspection range grouped by Step 1. continues by more than “50%” for the width of the electrode window grouped by Step 1. by searching it in the vertical direction toward the land end from the component side.
6. If the portion of Step 5. is found, take the end point of the location which continues higher than the portion of Step 5. toward the land end from the component side by electrode as the electrode toe. By doing so, each electrode toe grouped by Step 1. comes in each different position.  
If the portion of Step 5. is not found, use the position extracted by component extraction. (It is not treated as NG.)

#### **[Extraction Method: Color Insertion Terminal]**

1. Create a binarized image by using characteristic parameter within the inspection range.
2. Within the image created by Step 1., the system searches a location which most matches the shape of the electrode window provide by teaching.
3. The electrode window is moved to the location searched in Step 2. as the electrode position.

S730 S530  
S730 S530

#### **[Extraction Method: Height Insertion Terminal]**

1. Create a binarized image by using characteristic parameter within the inspection range.
2. From the binarized image created in Step 1., extract a height information.
3. From the image created in Step 2, search a location in which the volume within the electrode window becomes maximum.
4. Search a location most matched within the range extended each 2 pixels to upper, lower, left and right from the image created in Step 3, and search a luminance centroid of maximum value within that range.
5. The electrode window is moved to the location searched in Step 4. as the electrode position.

S730 S530  
S730 S530

#### **[Extraction Method: Color and Height Insertion Terminal]**

1. Create a binarized image by using characteristic parameter within the inspection range.
2. From the binarized image created in Step 1., extract a height information.

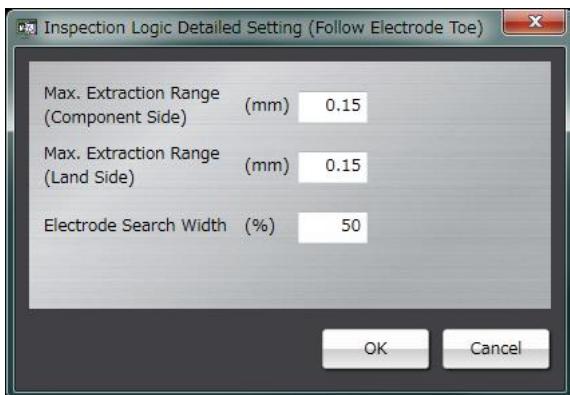
3. From the image created in Step 2, search a location in which the volume within the electrode window becomes maximum.
4. Search a location most matched within the range extended each 2 pixels to upper, lower, left and right from the image created in Step 3, and search a luminance centroid of maximum value within that range.
5. The electrode window is moved to the location searched in Step 4. as the electrode position.

**Fault Output: None**  
**Fault Code: None**

#### Detailed setup

##### (a) Other than insertion terminal

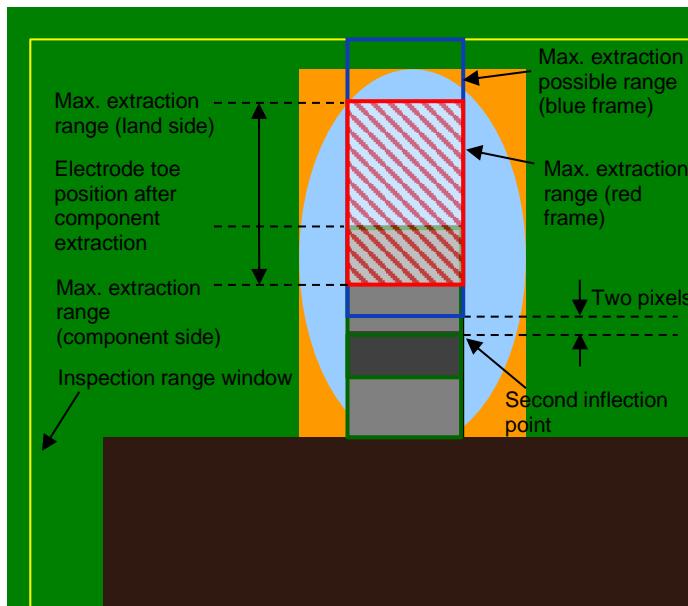
It is able to set the maximum extraction range and electrode search width for electrode toe extraction.



##### - Inspection area for gullwing lead

This section shows below an explanatory drawing of the maximum extraction range of gullwing lead.

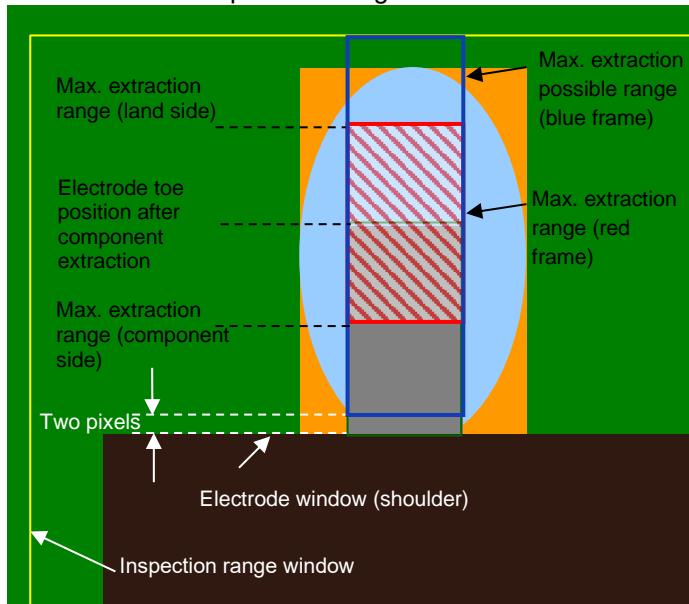
The maximum extraction range is the inspection area. However, it is unable to extract beyond the maximum extraction possible range.



- Inspection area for the shape other than gullwing lead

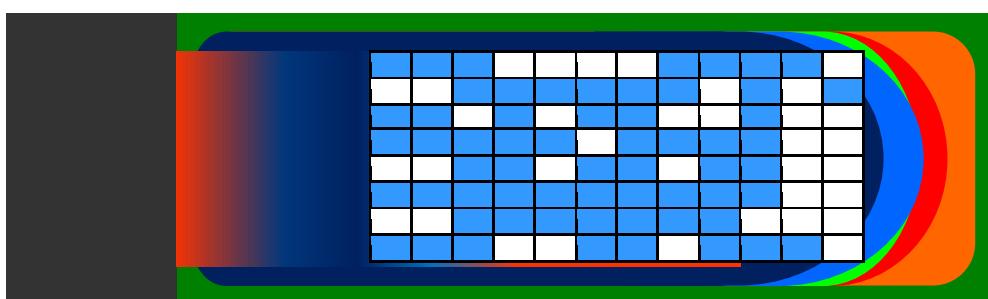
This section shows below an explanatory drawing of the maximum extraction range of the shape other than gullwing lead.

The maximum extraction range is the inspection area. However, it is unable to extract beyond the maximum extraction possible range.

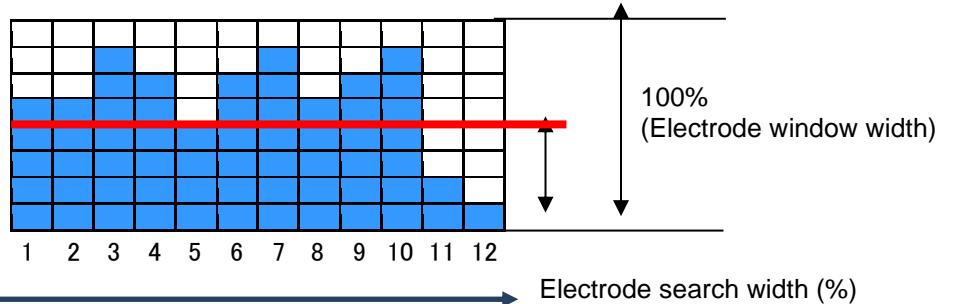


- Electrode search width

The software searches the position where the width of the pixel extracted by the electrode color in the inspection area continues at a rate of the electrode search width to the electrode window's width (%) or higher in a vertical direction from the component side to the land side.

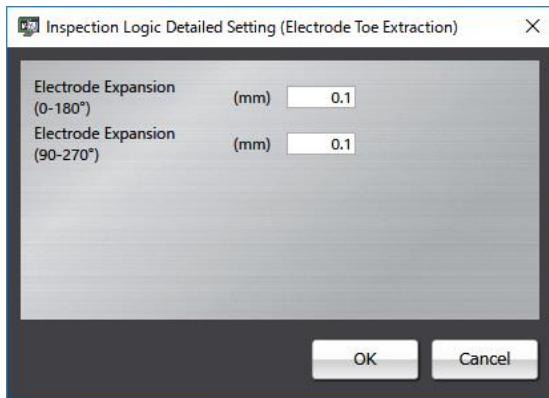


When setting width to 50%, the number of continuous pixels of 50% width or more is ten. The length is measured as ten pixels.



## (b) Terminal insertion

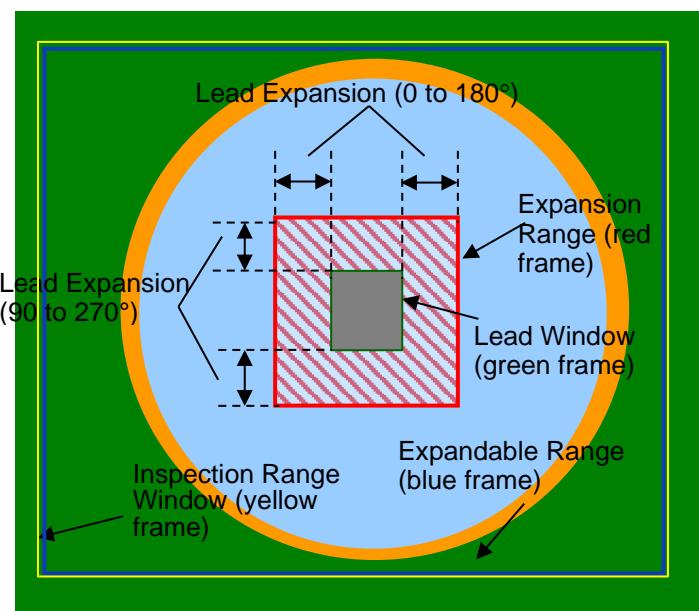
The size of the lead tip can be expanded after extraction of the lead tip.



## ▪ Extension range

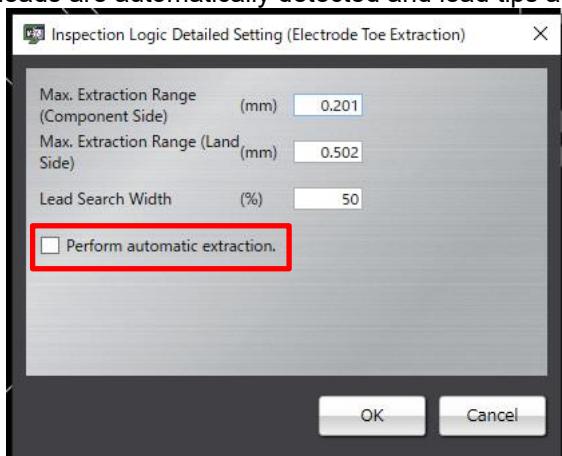
The following is an illustration of the extension range of the lead tip.

The lead window expands to the size set by "Lead Expansion (0 to 180°) (mm)" and "Lead Expansion (90 to 270°) (mm)". However, the range cannot be extended beyond the expandable range.



**S1080 S1040** (c) Gull wing lead, flat lead (except for aluminum electrolytic capacitor)

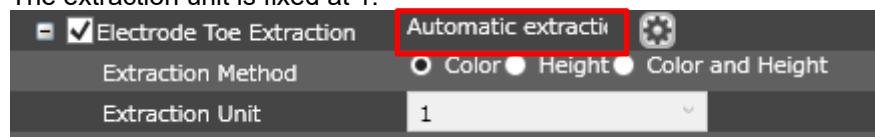
**Z600** When the [Perform automatic extraction] check box is selected, the color and shape features of leads are automatically detected and lead tips and sides are extracted.



When the [Perform automatic extraction] checkbox is selected, the message "Automatic Extraction Selected" appears on the inspection criteria tree.

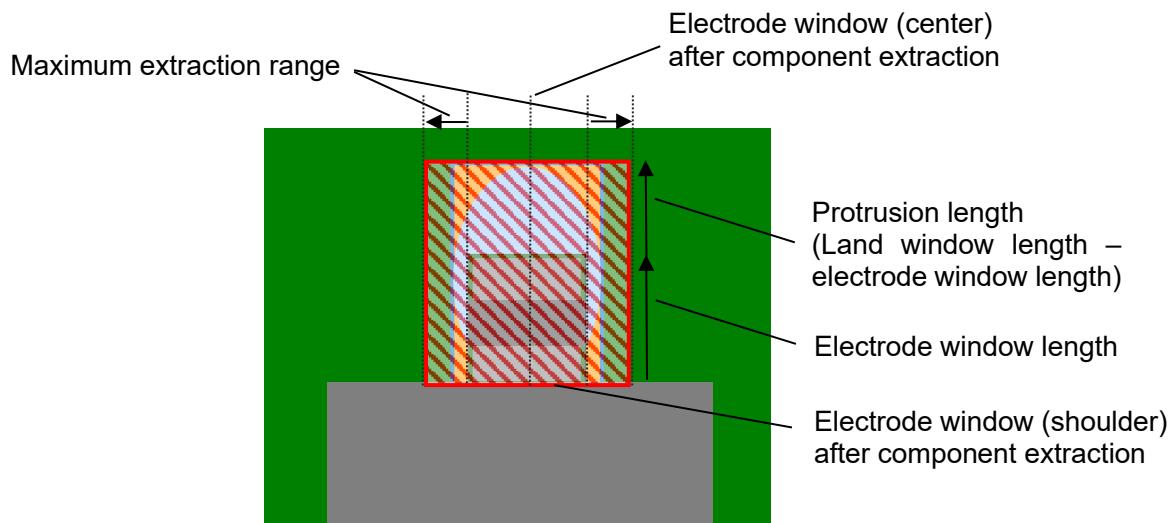
While the message is displayed, the extraction method being selected is ignored and parameter automation automatically performs extraction of lead tip and side. (Z600 has no display of extraction method line)

The extraction unit is fixed at 1.



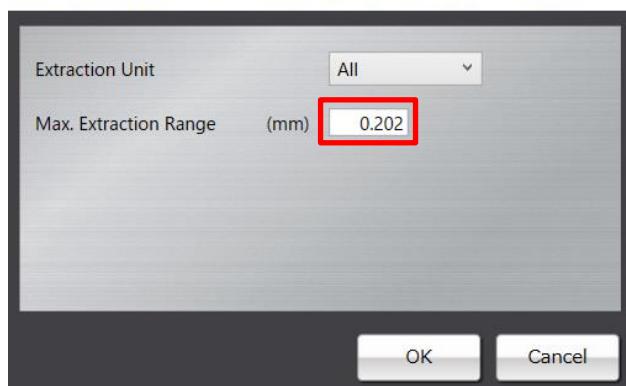
The starting points and search ranges for each extraction direction are as follows.

Extraction directions	Starting points	Search ranges
Electrode toe	Electrode window (shoulder) after component extraction	Electrode window length + protrusion length
Electrode horizontal	Electrode window (center) after component extraction	The larger of the following: • Electrode window width + maximum extraction range x2 • Land window width



The maximum extraction range refers to the settings for lateral electrode extraction.

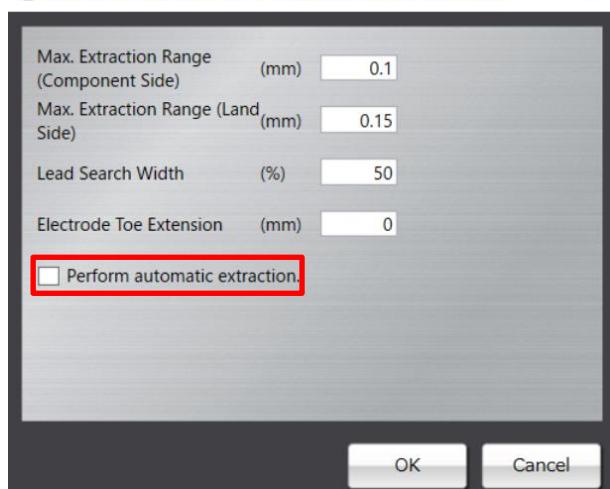
Inspection Logic Detailed Setting (Electrode Horizontal Extracti... X



(d) Chip Electrodes (excluding MELF)

When you check "Perform Auto Extraction," the system will automatically detect the color and shape characteristics of the electrodes and perform both tip and lateral extraction.

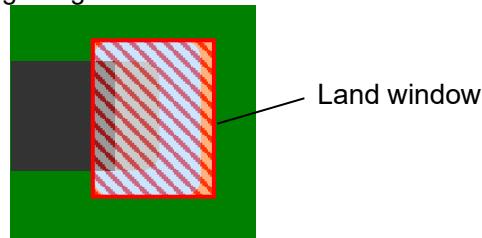
Inspection Logic Detailed Setting (Electrode Toe Extraction) X



When you check “Perform Auto Extraction,” a message saying “Auto Extraction Selected” will appear on the inspection criteria tree. While this message is displayed, the selection state of the extraction method will be ignored, and the system will automatically perform electrode tip extraction using parameter automation. (For Z600, the extraction method row is not displayed)



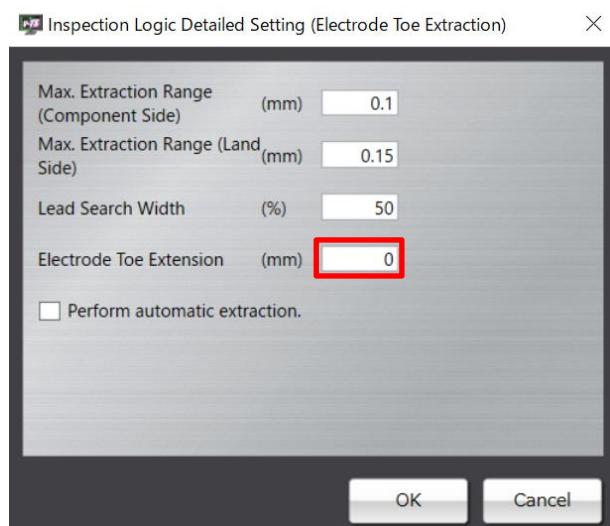
The search range targets the land window.



Note the followings when using the [Perform automatic extraction] option.

- ① Only after fully verifying inspection performance through component tests, component number tests, group tests, and PCB tests, and only if there are no problems, should the inspection be applied to mass production inspection.
- ② Inspection time may be longer depending on the number of leads and component placement in the component number for which automatic extraction is performed.

Additionally, by entering a value in “Electrode Tip Extension,” you can extend the electrode tip position by the specified length from the electrode tip extraction position. This is used to extract the correct position when the electrode end face is rounded, such as in capacitors.



## 2.8 Land Position Individual Extraction

### ■ Outline

This system sets whether the land position is individually extracted or not, after the position of the entire inspection screen is adjusted.

### ■ Inspection Range



### ■ Characteristic Parameter

Position Correction Colors

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

Not Specified

\*The extraction unit and maximum search range can be set with the Detailed setup.

### ■ Processing Detail

#### 【Case: Being Linked】

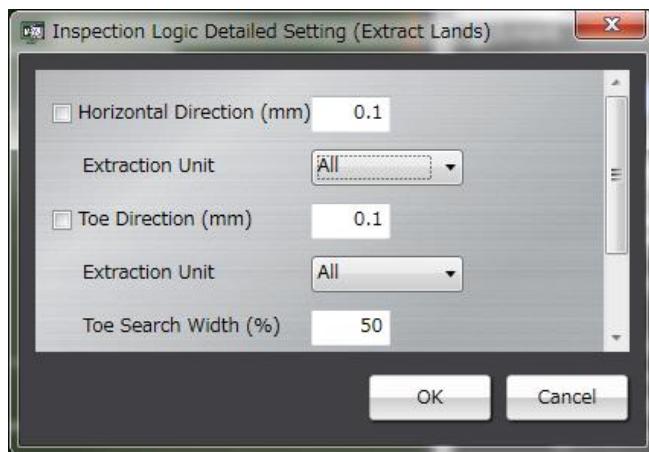
1. The system horizontally searches the search area to extract a pixel cluster, which was extracted using the characteristic parameter, with the same size as the land protrusion amount for each extraction unit.
2. The land window is moved to the position extracted in Step 1.
3. The system searches the search area in the component direction to detect the position whose pixel width extracted using characteristic parameter is larger than or equal to the specified percentage of the land width for each extraction unit.

**Fault Output: None  
Fault Code: None**

### Detailed setup

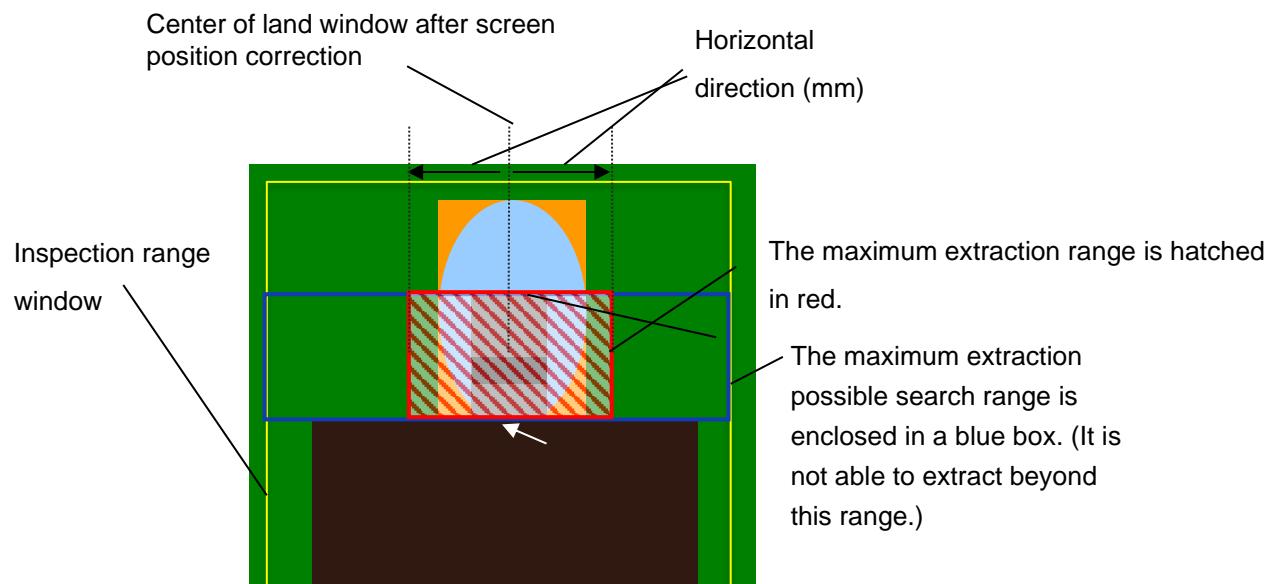
It is able to set the extraction unit and the maximum search range in the horizontal/toe direction.

For the extraction unit, 1, 4, 8, 16, or All can be selected.



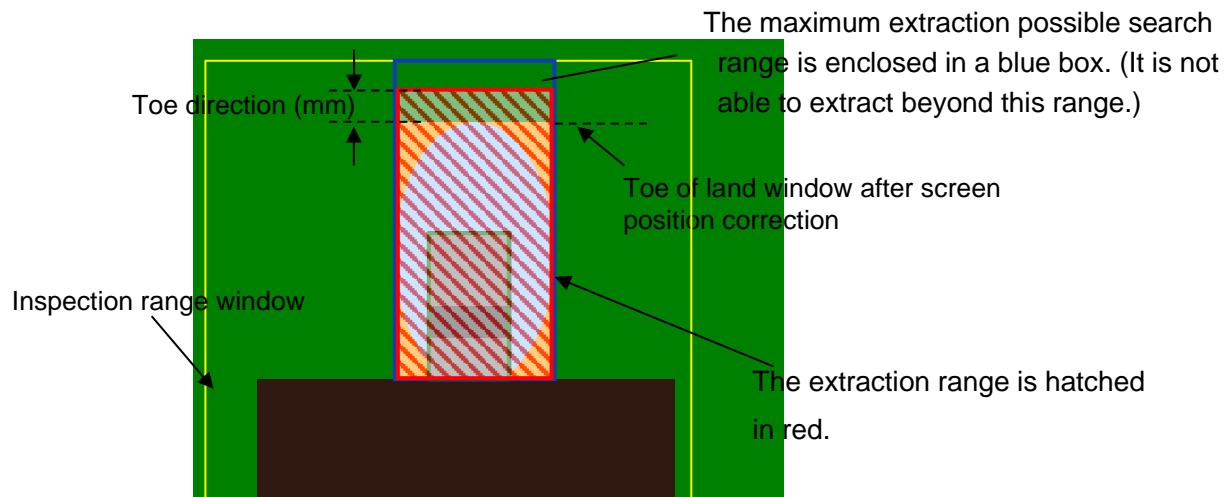
#### • Extraction range in land horizontal direction

This section shows below an explanatory drawing of the extraction range in the land horizontal direction.



• Extraction range in land toe direction

This section shows below an explanatory drawing of the extraction range in the land toe direction.



# 3 Component Unit Inspection

\* The description regarding the inspection logic is as follows.

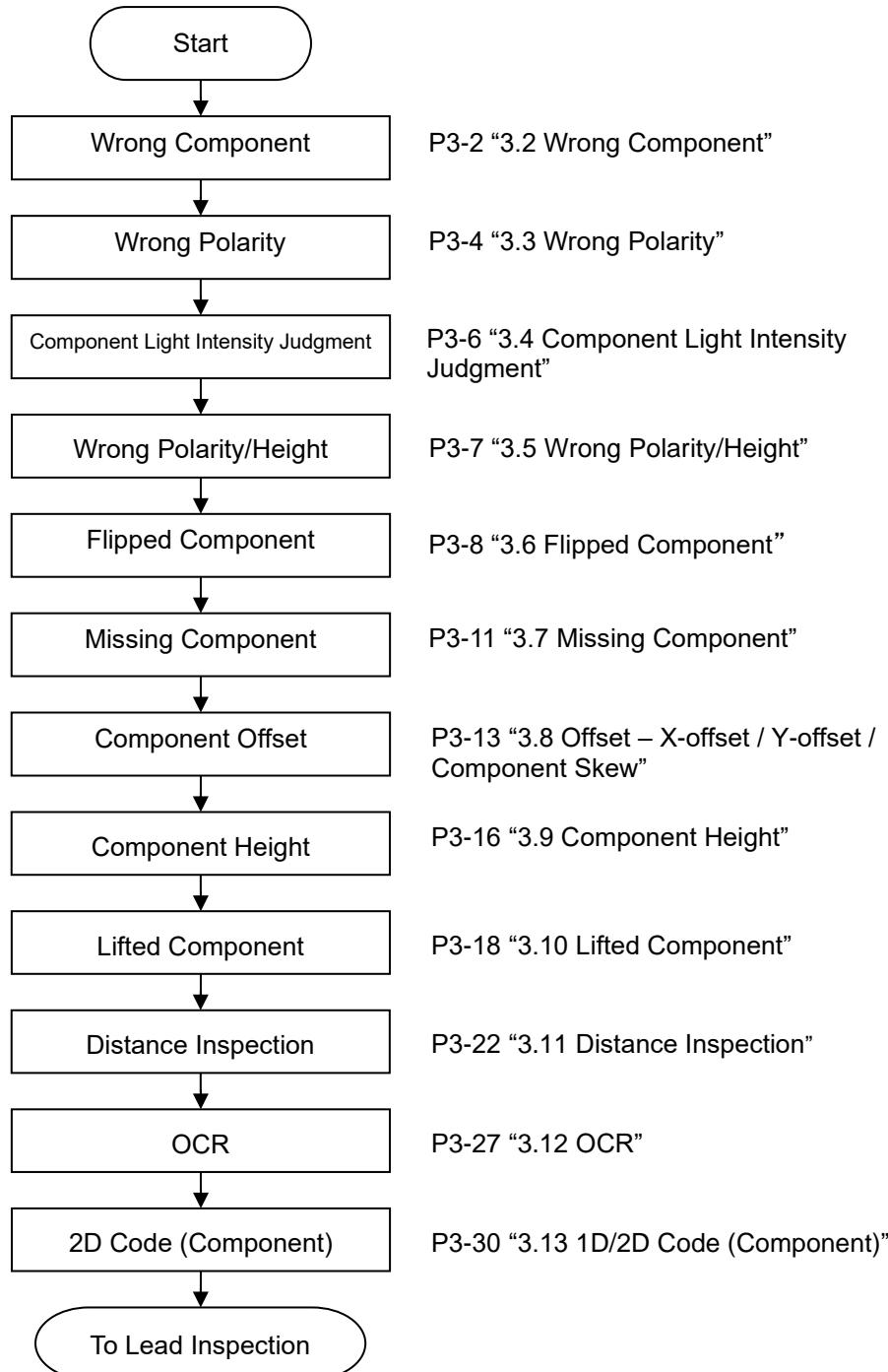
No symbol: Common for VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500,

**S1080** : S1080 **S1040** : S1040 **Z600** Z600 **S730** : S730-H/S730 **S720A** : S720A **S530** : S530 **S500** : S500

## 3.1 Flow of Component Unit Inspection

This section describes the inspection logics used for component unit inspection.

The following chart shows the flow of component unit inspection.



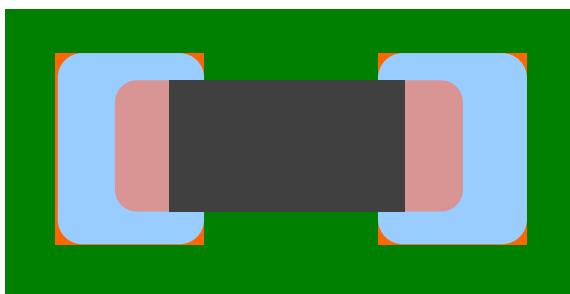
## 3.2 Wrong Component

### ■ Outline

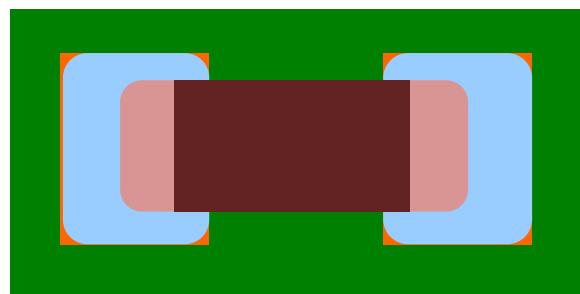
This system inspects the component colors and the shape of the marking shown in the window to judge if the wrong component is mounted.

### Component with No Marking Character/Symbol

OK Example: Right Component Colors

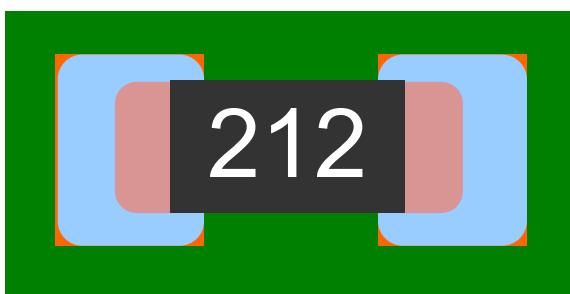


NG Example: Wrong Component Colors

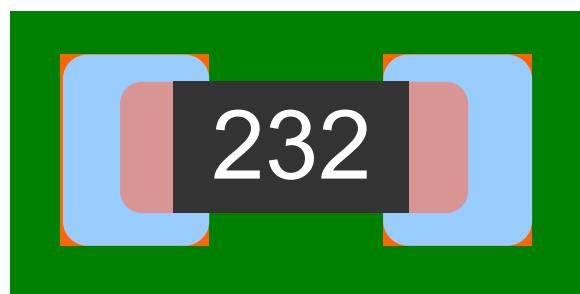


### Component with Marking Characters/Symbols

OK Example: Right Characters/Symbols



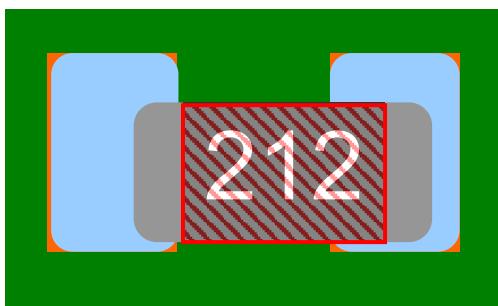
NG Example: Wrong Characters/Symbols



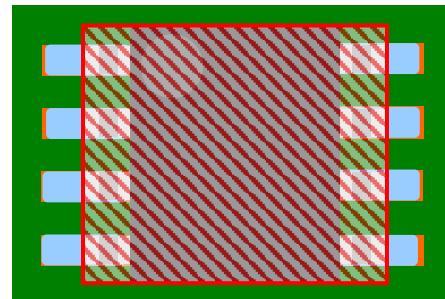
### ■ Inspection Range

Shaded Area Below (Inside Component Unit Window)

- a) Chip electrode (an area of Component Unit Component Window minus Electrode Window)



- (b) Other than chip electrode (Inside Unit Window)



### ■ Characteristic Parameter

Component with No Marking Character/Symbol: Component Unit Color

Component with Marking Character/Symbol: Marking Characters, Color and Shape of Marking Symbols

Illumination type (available only for S1080/S1040/Z600): Color highlight, white illumination, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

#### In case no character/mark found

Inspection Item	Setting Value	Measurement Value	Judge
■ Wrong Component			
Judgment Type	<input type="radio"/> Area (Color)	<input checked="" type="radio"/> Shape (Color)	
Matching Rate (%)		-	100

#### In case character/mark found

Inspection Item	Setting Value	Measurement Value	Judge
■ Wrong Component	<input type="radio"/> Character Unit Inspection		
Judgment Type	<input checked="" type="radio"/> Shape (Brightness)	<input type="radio"/> Shape (Color)	
Matching Rate (%)		-	100



### ■ Processing Detail

#### If Area (Color) is selected

The pixels are extracted from the inspection range based on the characteristic parameters. The result is judged as "Wrong Component" if the ratio of the extracted pixel area to the inspection range area is smaller than the "matching rate (%)".

#### If Shape (Brightness)/Shape (Color) is selected

1. The system binarizes the image in the inspection range using the characteristic parameters.
2. Then it searches for the most matching portion between the image created in Step 1 and the pre-registered model and measures the matching rate of the image with the model.
3. It rotates the model in 90, 180 and 270 degrees and conducts a search and matching rate measurement for the individual rotation degrees in the same way as Step 2.  
\* If the rotated images of the inspection range (except masked area) in 90 and 270 degrees fall outside the original inspection range, the system does not perform the matching rate measurement for 90- and 270-degree rotation.
4. If all the results obtained in Steps 2 and 3 are smaller than the "Matching Rate (%)", the "Wrong Component" judgment is output.

### Result Judgment

If multiple models are registered, the model with the highest "Matching Rate" is used for judgment.

#### [Character-Basis Inspection]

A matching rate is calculated for each mask area to perform wrong component inspection.

For how to configure the mask, see v-TS Teaching Manual, "2.14.3 Editing Model".

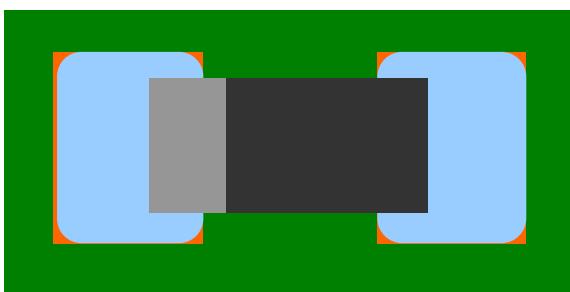
Fault Output: Wrong Component  
Fault Code: 131

## 3.3 Wrong Polarity

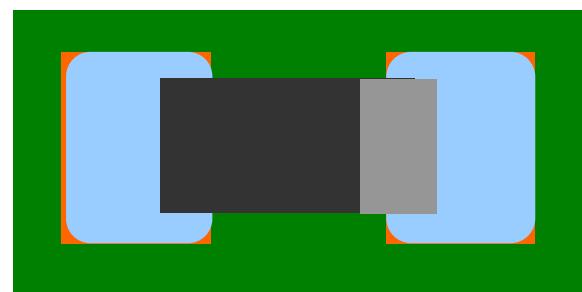
### ■ Outline

This system inspects the colors and the marking shape appearing in the Component Unit Window to judge if the component is mounted in the right direction.

OK Example: Polarity Mark on the Right Position



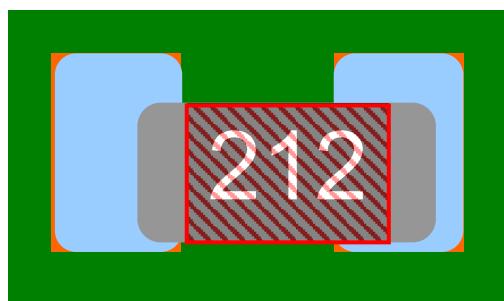
NG Example: Polarity Mark on the Wrong Position



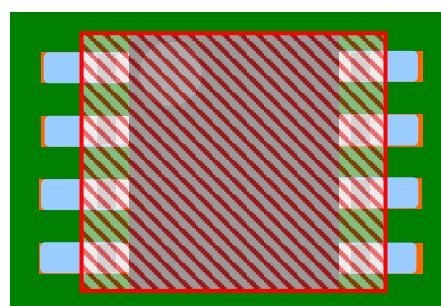
### ■ Inspection Range

#### Shaded Area Below

(a) Chip Electrode (Area excluding Electrode Window from Component Unit Window)



(b) Other than Chip Electrode (Inside the rectangular frame of the Component Window and Electrode Window)



### ■ Characteristic Parameter

Marking Characters, Color and Shape of Marking Symbols

Illumination type (available only for S1080/S1040/Z600): Color highlight, white illumination, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

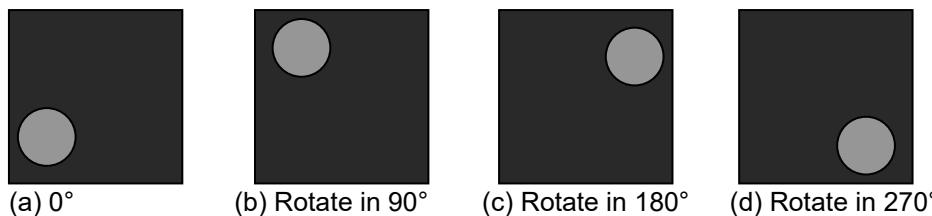
Inspection Item	Setting Value	Measurement Value	Judge
■ Wrong Polarity			
Judgment Type	<input checked="" type="radio"/> Shape(Brightness) <input type="radio"/> Shape (Color)		
Matching Rate (%)	<input type="text"/> - 100		



---

### ■ Processing Detail

1. The system binarizes the image in the inspection range using the characteristic parameters.
2. Then, it uses the OK model (a) registered beforehand and the image created in Step 1 to search in the inspection range for the most matching portion with the model and measure the matching rate with the model.
3. It rotates the model as in (b), (c), and (d), then searches the most matching portion and measures the matching rate in the same way as Step 2.



\* If the rotated images of the inspection range (except masked area) in 90 and 270 degrees fall outside the original inspection range, the system does not perform the matching rate measurement for 90- and 270-degree rotation.

4. It calculates the difference between "the Matching Rate obtained in Step 2" and "the greatest value among the Matching Rates for (b), (c), and (d)."
5. The system outputs the "No Polarity Mark" judgment if the value obtained in Step 4 is smaller than the "Matching Rate(%)" set for the inspection criteria.

### Result Judgment

If multiple models are registered, the model with the highest "Matching Rate obtained in Step 2 and 3" is used for judgment.

S1080  
S1040  
S730  
S530

## 3.4 Component Light Intensity Judgment

### ■ Outline

Measure projector luminance in the component unit window after the component is extracted to judge that projector light intensity is correct.

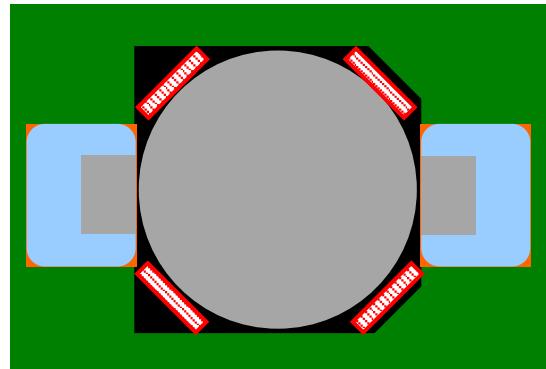
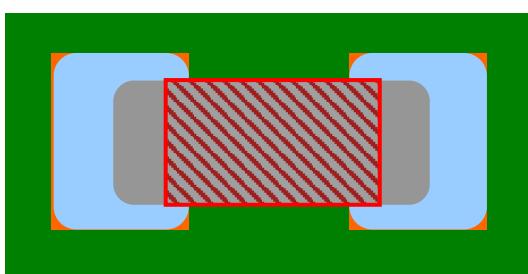
### ■ Inspection Range

Shaded area on the figures

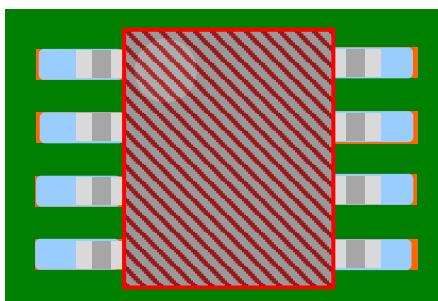
(a) Chip Electrode

Area excluding Electrode Window from Component Unit Window

(b) Electrolytic Capacitor/Connector  
In Component Lift Window



(c) Other Components  
In Component Unit Window



### ■ Characteristic Parameter

N/A

\*This is because projector luminance and 3D measurement information in the inspection window are used.

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value.

### ■ Processing Details

1. Obtain the projector luminance and 3D measurement information in the component window (in the component lifting window for electrode capacitors/connectors).
2. Judge that the projector light intensity of the component unit is within the normal range.

Fault Output	: Projector Light Intensity Low
Fault Code	: 351
Fault Output	: Projector Light Intensity High
Fault Code	: 352

S730 S1040  
S730 S530

## 3.5 Wrong Polarity/Height

### ■ Outline

The system measures the step of the polarity mark in the component unit window and inspects the direction of the implementation.

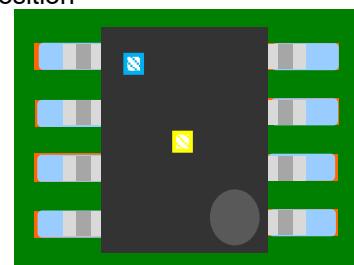
### ■ Inspection Range

Two shaded parts in the figure (comparison area/reference point: yellow, polarity mark area/measurement point: light blue)

OK Example: Polarity Mark on the Right Position



NG Example: Polarity Mark on the Wrong Position



### ■ Characteristic Parameter

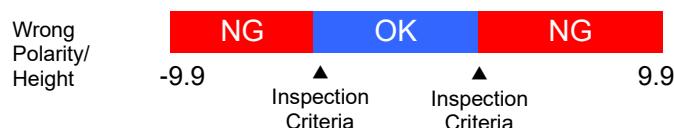
Not Specified

\* As 3D measurement result in the inspection range window is used.

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value.

	Inspection Item	Setting Value	Measurement Value	Judge
	■Wrong Polarity/Height(mm)			



### ■ Processing Detail

1. The median values of the height measured in two polarity height windows (reference point of the comparison area (yellow) and measurement point of the polarity mark area (light blue)) are calculated, respectively.
2. If the difference of the height values obtained on the respective polarity height windows is larger than the upper limit of "Polarity Difference - Height (mm)," it is judged as "Polarity Difference."



For setup, method, refer to section "2.15.3 Editing Model <Component Polarity/Height Inspection Edit Tool>." of v-TS Teaching Manual.

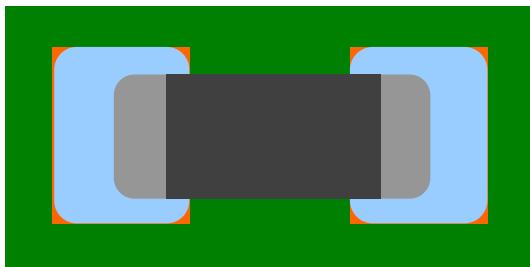
Fault Output: Wrong Polarity  
Fault Code: 132

## 3.6 Flipped Component

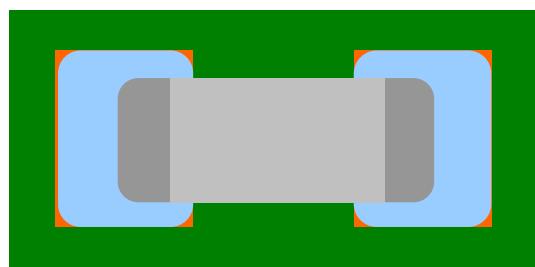
### ■ Outline

This system inspects the colors and the marking shapes appearing in the Component Unit Window to judge if the component is not mounted bottom-up on the PCB.

OK Example: Right Colors and Marking Characters/Symbols

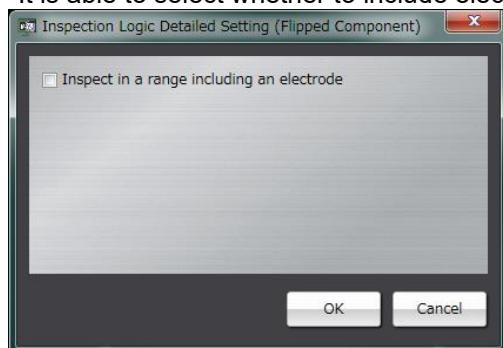


NG Example: Wrong Colors and Marking Characters/Symbols



### ■ Inspection Range

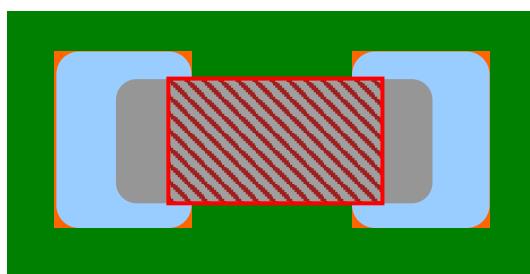
It is able to select whether to include electrodes in the inspection area.



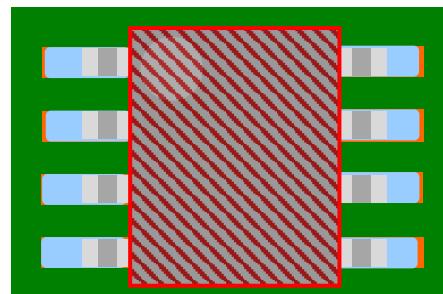
[Inspect in an area including electrodes: OFF]

Hatched area in the diagram

(a) Chip electrode (an area of Component Unit Window minus Electrode Window)



(b) Other than chip electrode (Inside Component Unit Window)

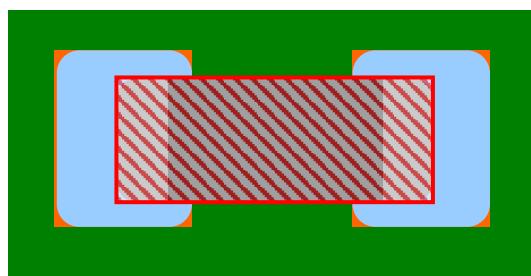


\*Content in the exclusion window is excluded from the inspection area.

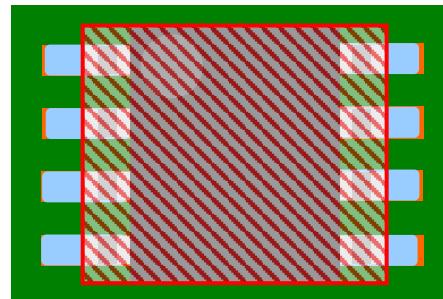
[Inspect in an area including electrodes: ON]

Hatched area in the diagram

(a) Chip electrode (an area of Component Unit Window minus Electrode Window)



(b) Other than chip electrode (Inside Component Unit Window)



\*Content in the exclusion window is excluded from the inspection area.

#### ■ Characteristic Parameter

Colors on the Component Flipped Side

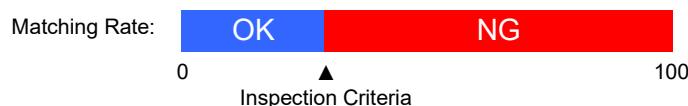
\* The characteristics on the component flipped side are used as the parameters for flipped component inspection.

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

#### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
Flipped Component			
Matching Rate (%)	0 -	<input type="text"/>	



---

■ Processing Detail

The pixels matching the characteristic parameters are extracted from the inspection range. The result is judged as "Flipped Component" if the ratio of the extracted pixel area to the inspection range area is larger than the "matching rate (%)".

\*The area set in the exclusion window is not used for measurement of matching rate.

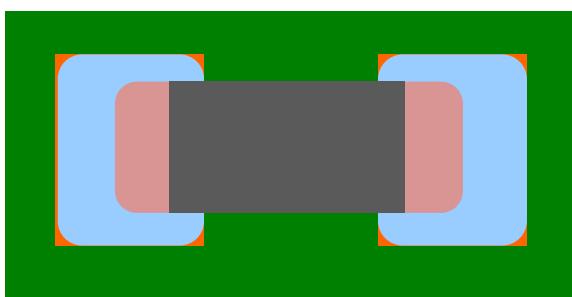
**Fault Output: Flipped Component**  
**Fault Code: 133**

## 3.7 Missing Component

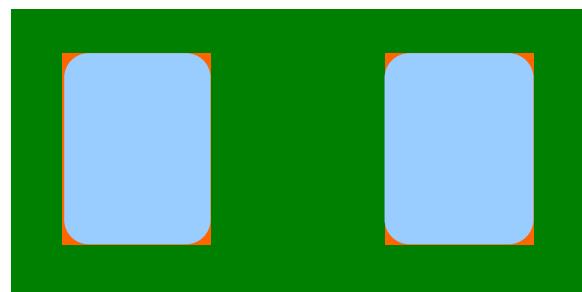
### ■ Outline

This system inspects the colors or volumes appearing in the location where the component is supposed to be mounted to judge if the component is properly mounted on the PCB.

OK Example: Component Colors

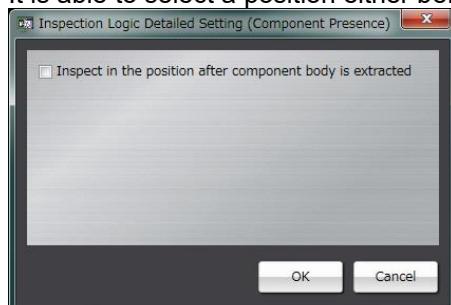


NG Example: Colors Other than Those of Component, e.g. PCB

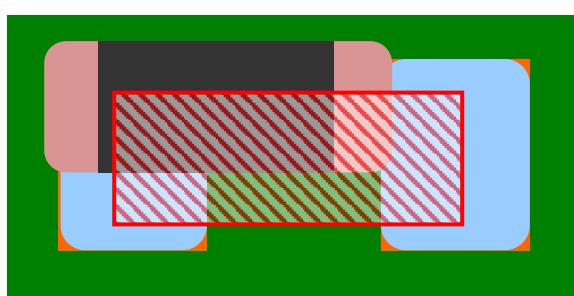


### ■ Inspection Range

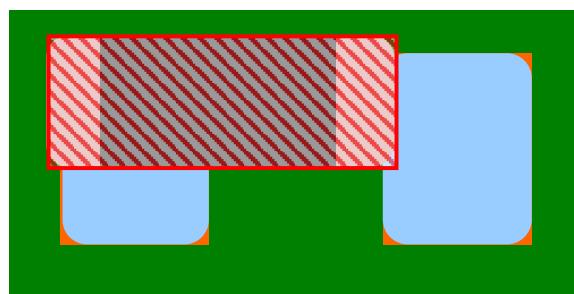
It is able to select a position either before or after component body extraction.



[Inspect in a position after component body extraction: OFF]  
Hatched area in the drawing



[Inspect in a position after component body extraction: OFF]  
Hatched area in the drawing



### ■ Characteristic Parameter

[Match ratio (%)] PCB color, land color and solder with component unit and electrode colors removed  
 [Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination]

S730     S1040  
 S730     S530

\* 3D measurement result in the inspection range window is used.

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
<b>■ Missing Component</b>				
	● Matching Rate (%)	<input type="text"/> — <input type="text"/>		
	● Volume Ratio (%)	<input type="text"/> — <input type="text"/>		

Matching Rate:  
 Volume Rate: 

0              ▲              Inspection Criteria              ▲              100  
 Inspection Criteria

### ■ Processing Detail

[Case: Matching Rate (%)]

If the area of the pixels extracted by the characteristic parameter in the inspection area is larger than the upper limit of the "matching rate (%)" for the inspection area, the component is judged as "missing". On the other hand, if it is smaller than the lower limit of the "matching rate (%)", it is judged as "implementation error".

S730     S1040    [Case: Volume Ratio (%)]

S730     S530    If the volume measured in the inspection area is smaller than the lower limit of the "volume ratio (%)" for the inspection area, the component is judged as "missing". On the other hand, if it is larger than the upper limit of the "volume ratio (%)", it is judged as "implementation error".

\* A range configured in the exclusion window is not used for measurement of matching rate and volume rate.

Fault Output: Missing Component  
 Fault Code: 130

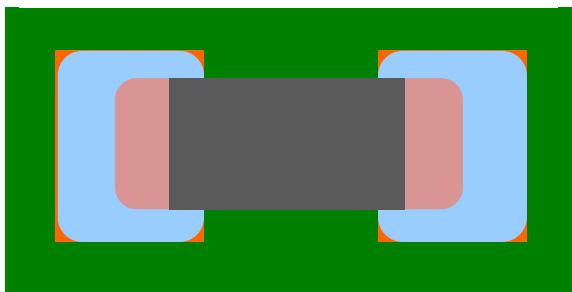
Fault Output: Implementation error  
 Fault Code: 109

## 3.8 Offset – X-offset / Y-offset / Component Skew

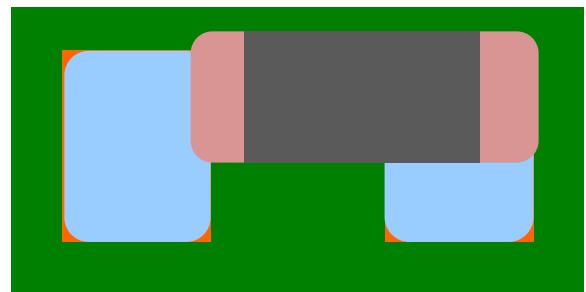
### ■ Outline

This system inspects the component position detected in the Inspection Range Window to judge if the component is mounted at the right position.

OK Example: Component Mounted at the Right Position



NG Example: Component Mounted at the Wrong Position



### ■ Inspection Range

Not Specified

\* The result obtained in component extraction is used.

### ■ Characteristic Parameter

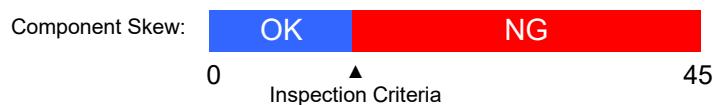
Not Specified

\* The result obtained in component extraction is used.

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting	Measured Value	Judgement
■ Component Offset				
■ X-offset (PCB) [Abs.] (mm)	0 –	<input type="text"/>		
[Signed] (mm)				
■ Y-offset(PCB) [Abs.] (mm)	0 –	<input type="text"/>		
[Signed] (mm)				
■ Component Skew[Abs.] (°)	0 –	<input type="text"/>		
[Signed] (°)				
■ X-offset (Component) [Abs.] (mm)	0 –	<input type="text"/>		
[Signed] (mm)				
■ Y-offset (Component) [Abs.] (mm)	0 –	<input type="text"/>		
[Signed] (mm)				



### ■ Processing Detail

#### X-Offset or Y-Offset

"X-offset" is output if the position gap in the X direction between the component position detected in component extraction and the Component Unit Window position before the extraction is larger than the "X-offset [Abs] (mm)"; and "Y-offset", if the gap in the Y direction is larger than the "Y-offset [Abs] (mm)".

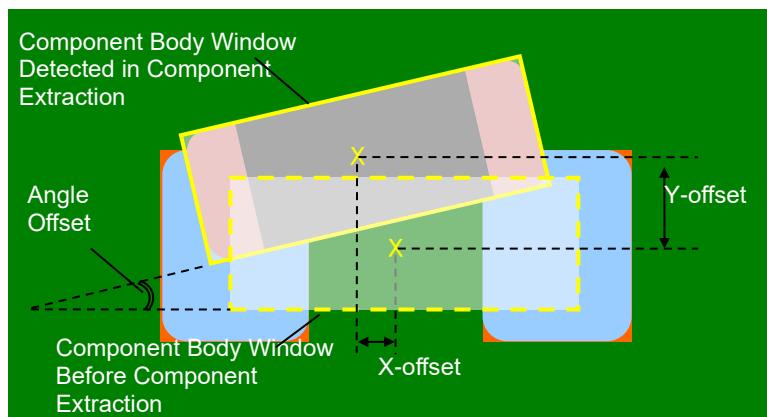
#### Component Skew

"Component Skew" is output if the angle offset between the component position detected in component extraction and the Component Unit Window position before the extraction is larger than the "Component Skew [Abs] (°)".

#### [Direction: X-offset (PCB) and Y-offset (PCB)]

The PCB horizontal direction is the X-axis and the vertical direction, Y-axis. The following shows the positive directions for the X and Y axes:

- X Axis: Left to Right
- Y Axis: Front to Rear
- Angle Axis: Counterclockwise

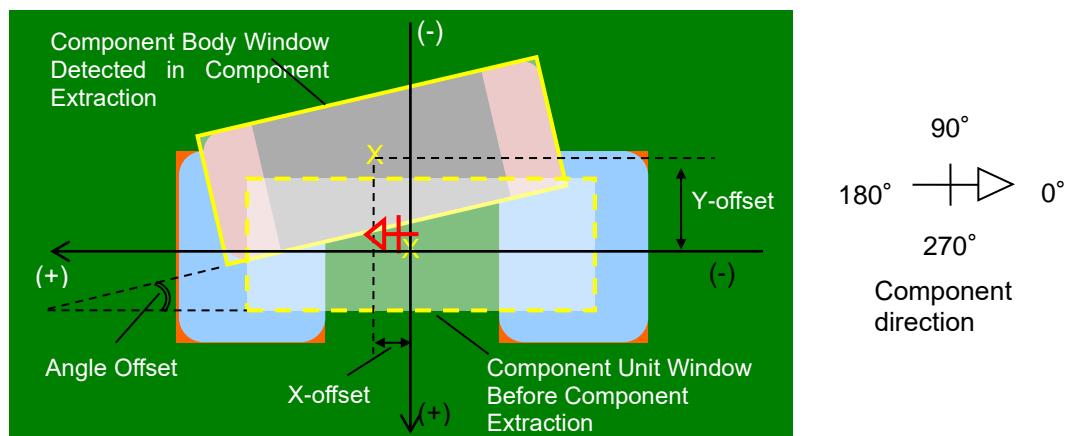


The Component Skew measurement range refers to the range specified in "Angle Measuring Range" in "2.4 Component Extraction".

**[Direction: X-offset (Component) and Y-offset (Component)]**

Direction of 0-180° is defined as the X axis, and direction of 90-270° is defined as the Y axis. The following shows the positive directions for the X and Y axes:

- X Axis: 180° to 0°
- Y Axis: 270° to 90°
- Angle Axis: Counterclockwise



**Fault Output: X-offset (PCB)**  
**Fault Code: 134**

**Fault Output: Y-offset (PCB)**  
**Fault Code: 135**

**Fault Output: Angle Offset**  
**Fault Code: 136**

**Fault Output: X-offset (Component)**  
**Fault Code: 174**

**Fault Output: Y-offset (Component)**  
**Fault Code: 175**

S730 S1040  
S730 S530

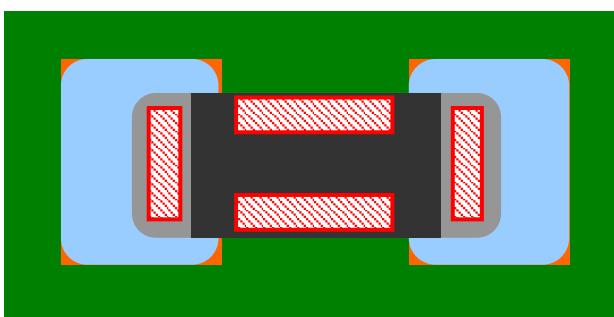
## 3.9 Component Height

### ■ Outline

In the inspection range window, a height inside the lifted component windows located at four locations on top of the component in the component window is used to check if the component is implemented in the proper height.

### ■ Inspection Range

Shaded Area Below (in Lifted Component Window)



### ■ Characteristic Parameter

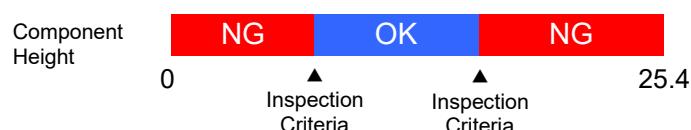
Not Specified

\* As 3D measurement result in the inspection range window is used.

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value.

Inspection Item	Setting Value	Measurement Value	Judge
Component Height (mm)	-		



### ■ Processing Detail

1. A median value of heights measured in four lifted component window is calculated respectively.
2. If the maximum height obtained by step 1 is larger than the upper limit of component height (mm), it is judged as "Component Height: High."
3. If the maximum height obtained by step 1 is smaller than the lower limit of component height (mm), it is judged as "Component Height: Low."

**Fault Output: Component Height: High**  
**Fault Code: 137**

**Fault Output: Component Height: Low**  
**Fault Code: 138**

**[Result Judgment]**

If either maximum or minimum height is out of the setting range, the out-of-the-range measured value is used for judgment.

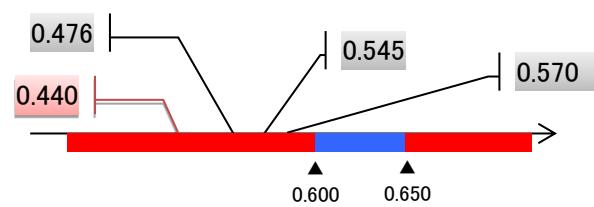
If both maximum and minimum height are in the setting range together or more than the setting range together, the measured value of maximum height is used for judgment.

If both maximum and minimum heights are smaller than or equal to the lower limit of the setting range, the measured value of the minimum height is used for judgment.

If the minimum height is smaller than or equal to the lower limit of the setting range and the maximum height is larger than or equal to the upper limit of the setting range, the measured value of the maximum height is used for judgment.

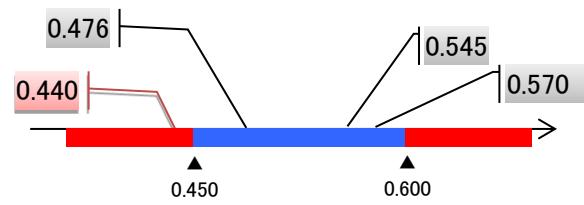
When all values are below the lower limit:

Lifting window	Median (mm)	Use
Lifting window①	0.545	
Lifting window②	0.440	○
Lifting window③	0.476	
Lifting window④	0.570	



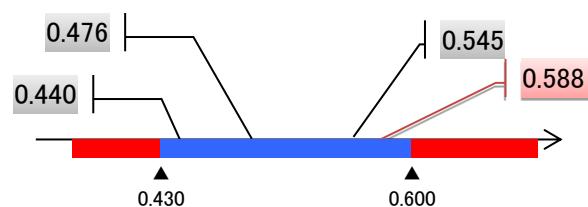
When one or more values are below the lower limit of the setting range:

Lifting window	Median (mm)	Use
Lifting window①	0.545	
Lifting window②	0.440	○
Lifting window③	0.476	
Lifting window④	0.570	



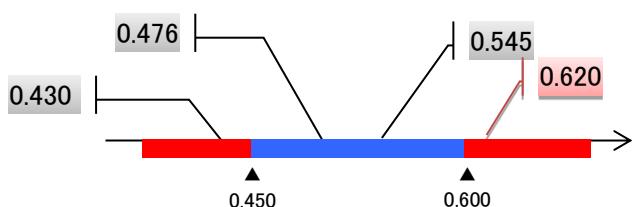
When all values are within the setting range:

Lifting window	Median (mm)	Use
Lifting window①	0.545	
Lifting window②	0.440	
Lifting window③	0.476	
Lifting window④	0.588	○



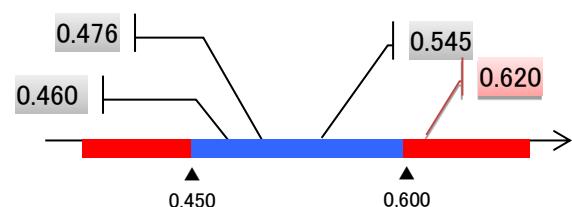
When value above the upper limit exists and value below the lower limit also exists:

Lifting window	Median (mm)	Use
Lifting window①	0.545	
Lifting window②	0.430	
Lifting window③	0.476	
Lifting window④	0.620	○



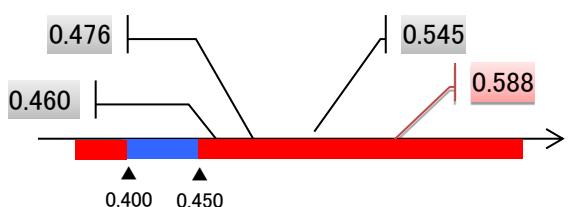
When one or more values are below the upper limit:

Lifting window	Median (mm)	Use
Lifting window①	0.545	
Lifting window②	0.460	
Lifting window③	0.476	
Lifting window④	0.620	○



When all values are above the upper limit:

Lifting window	Median (mm)	Use
Lifting window①	0.545	
Lifting window②	0.460	
Lifting window③	0.476	
Lifting window④	0.588	○



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S730 S530

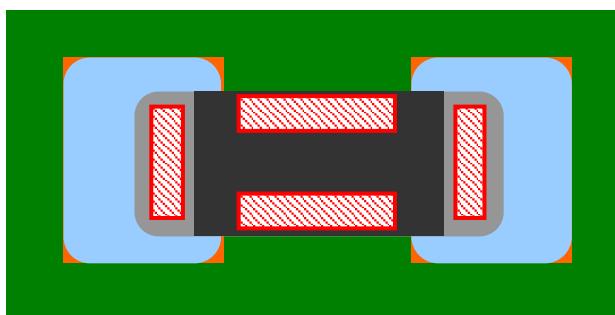
## 3.10 Lifted Component

### ■ Outline

In the inspection range window, a height inside the lifted component windows located at four locations on top of the component in the component window is used to check lifted component and tilt.

### ■ Inspection Range

Shaded Area Below (in Lifted Component Window)



### ■ Characteristic Parameter

Not Specified

\* As 3D measurement result in the inspection range window is used.

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value.

Inspection Item	Setting Value	Measurement Value	Judge
■ Lifted Component			
■ Tilt (0 to 180° )			
● Height [Abs](mm) [Signed](mm)	0 -	<input type="text"/>	
● Angle [Abs](° ) [Signed](° )	0 -	<input type="text"/>	
■ Tilt (90 to 270° )			
● Height [Abs](mm) [Signed](mm)	0 -	<input type="text"/>	
● Angle [Abs](° ) [Signed](° )	0 -	<input type="text"/>	
■ Lift (Average Height)(mm)	0 -	<input type="text"/>	

Tilt (0-180° ): Height (mm)

Tilt (90-270° ): Height (mm)

Tilt (Average Height)(mm)

Tilt (0-180° ): Angle (° )

Tilt (90-270° ): Angle (° )

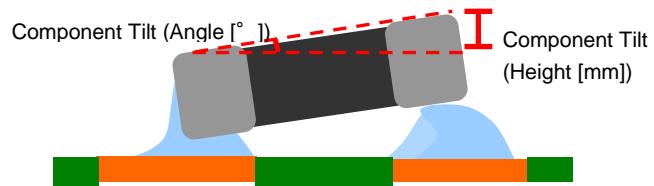
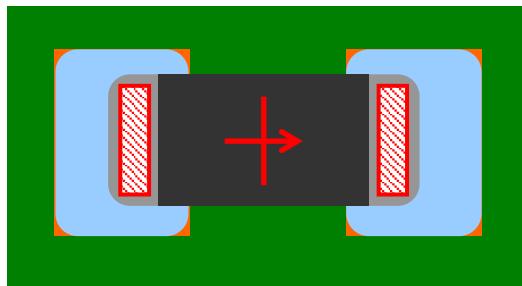


### ■ Processing Detail

#### [Case: Tilt (0°-180°)]

With difference in median values of height in the lifted component window in the 0-180-degree direction against component angle, component tilt is checked.

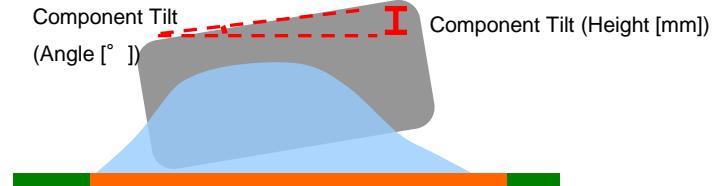
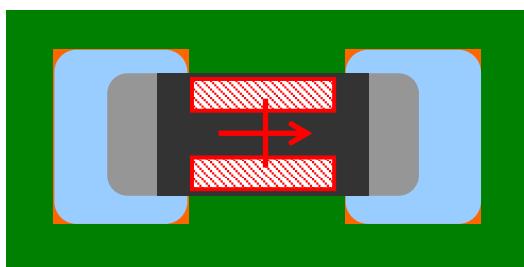
If the "Height [Abs.] (mm)" or "Angle [Abs.] (° )" of the component tilt is larger than the set value, it is evaluated as "Component Tilt (0-180° )".



#### [Case: Tilt (90°-270°)]

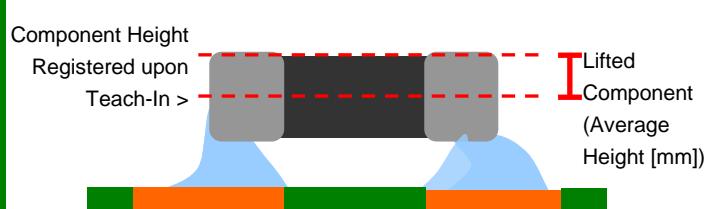
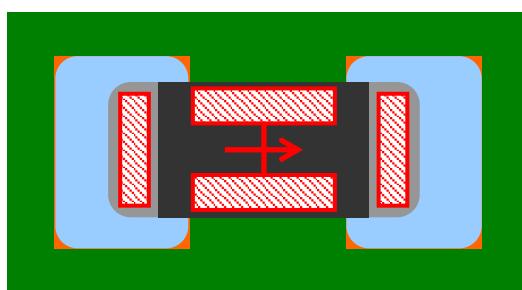
With difference in height in the lifted component window in the 90-270-degree direction against component angle, component tilt is checked.

If the component tilt is larger than "Height [Abs.] (mm)" or "Angle [Abs.] (° )", it is evaluated as "Component Tilt (90-270° )".



#### [Case: Lifted Component (Average Height)]

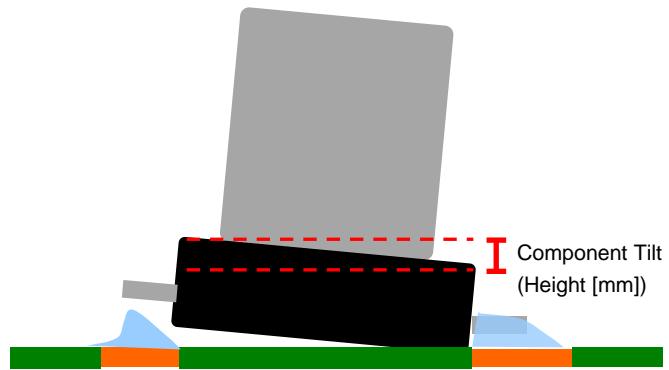
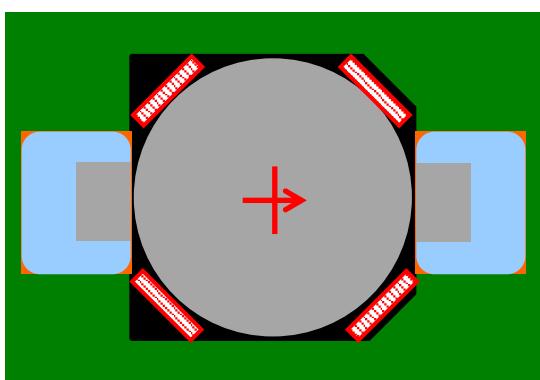
An average value is calculated based on median values of heights in four lifted component windows, and lifted component (average height) is checked from the height difference with the component registered upon teach-in. If the lift is larger than "Lift (Average Height) (mm)", it is evaluated as "Parallel Lifted Component".



### [Lifted Component Inspection for Electrolytic Capacitor]

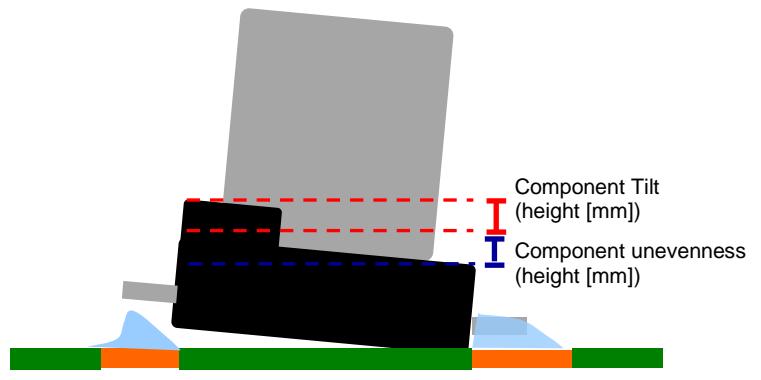
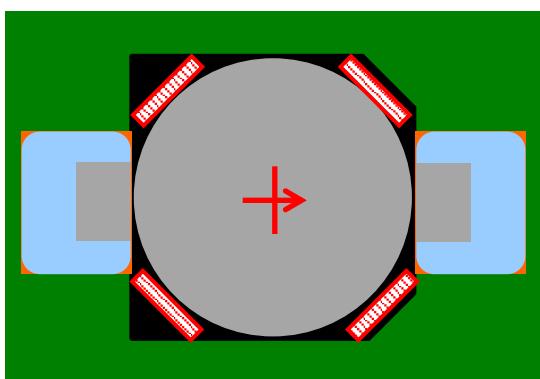
For an electrolytic capacitor, a lifted component window tilted to 45 degrees is configured as a base. To inspect a tilt (0 to 180 degrees), with an average height difference in the lifted component windows (two pairs of top and bottom) in the 0-180-degree direction against component angle, component tilt in the 0-180-degree direction is checked.

To inspect a tilt (90 to 270 degrees), with an average height difference in the lifted component windows (two pairs of right and left) in the 90-270-degree direction against component angle, component tilt in the 90-270-degree direction is checked.



If the area in which a lifted component window is set has an unevenness, the unevenness is measured as component incline by mistake, it is necessary to set up component unevenness.

For the setup method, refer to Section 2.6.1 "Criterion setup (component number)" of v-TS Teaching Manual.



For lifting (average height), in the same way as applied to other component types, the average of height median values is calculated in four lifting window, and component lifting (average height) is inspected based on the difference between the average value and the component height registered when teaching was performed.

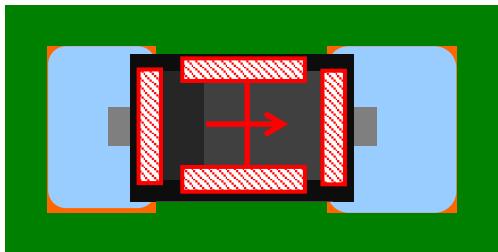
---

**[Component lifting inspection on components with tilt on their sides]**

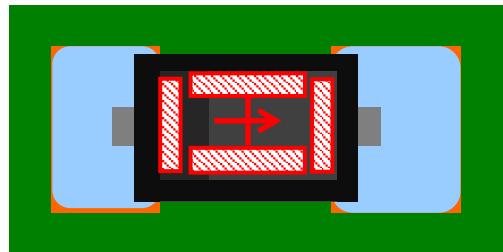
Components with tilt on their sides (such as transistors or melfs) might not be inspected correctly if the component lifting window is set on the tilt area. So, set the component lifting window on the flat area of the component top in the model edit screen to inspect them.



For the setup method, refer to section 2.14.3 "Editing models" of v-TS Teaching Manual.



NG: The component lifting window is set on the tilt area.



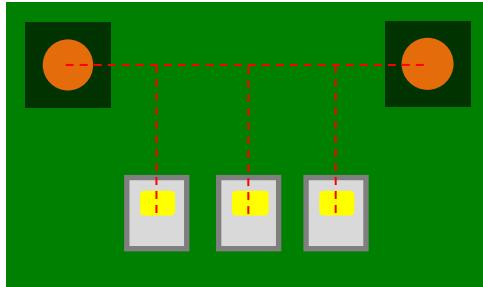
OK: The component lifting window is set on the flat area of the component top

## 3.11 Distance Inspection

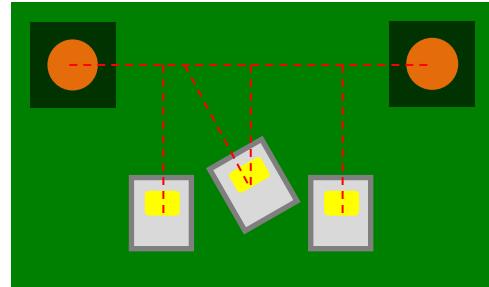
### ■ Outline

This system inspects component implementation position and/or angle based on the distance and/or angle between the criteria mark and the component.

OK Example: Correct Distance and Angle from the Reference Line



NG Example: Incorrect Distance and Angle from the Reference Line



### ■ Inspection Range

Not Specified

### ■ Characteristic Parameter

Not Specified

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

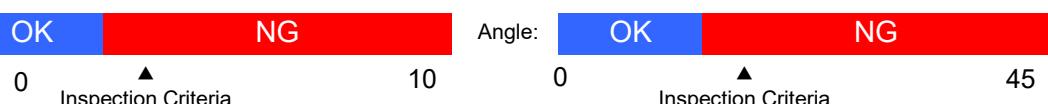
	Inspection Item	Setting value	Measurement value	Judge
■	Distance inspection			
	Distance 1 (mm)	0 -		
	Distance 2 (mm)	0 -		
	Distance A (mm)	0 -		
	Distance B (mm)	0 -		
	Angle (°)	0 -		

Distance 1:

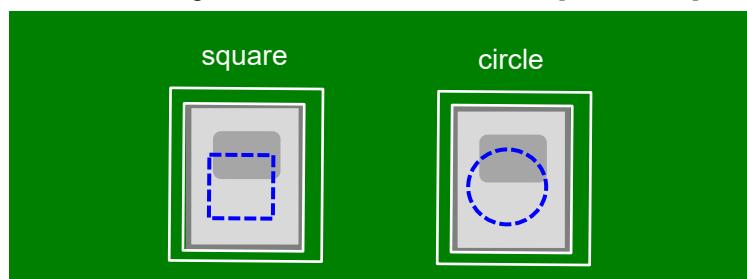
Distance 2:

Distance A:

Distance B:



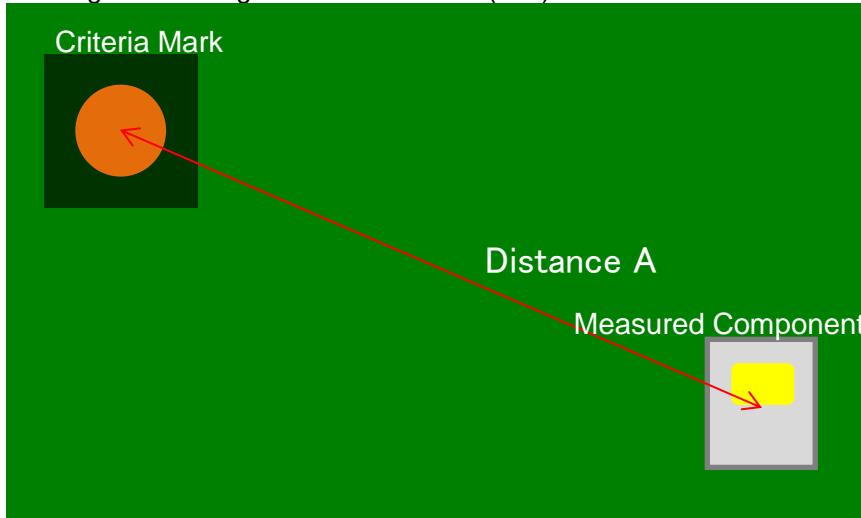
From "Advanced Settings," you can select whether to determine the range of set values by using a square or a circle. If you select circle, the values for [Distance A] and [Distance B] will be synchronized and always set to the same value. If a square is selected before pressing the Advanced button and then changed to a circle, the value set in [Distance A] will take precedence.



### ■ Processing Detail

#### 【Case: A Reference Point is Selected】

The system calculates the distance between the reference point (center of the criteria mark) and the measurement point (center of the measured component). "Distance Error" is output if the gap from the setting value is larger than "Distance X (mm)."



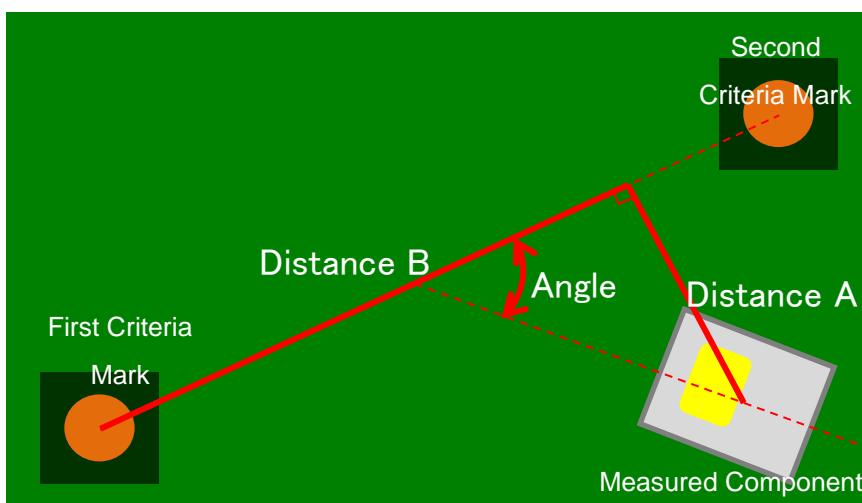
#### 【Case: A Reference Line is Selected】

##### For distance:

The shortest distance between the reference line (a straight line connecting two reference points) and the measurement point (center of the measured component) is named "Distance A." The distance between the intersection point of the reference line and the perpendicular, which is drawn from the measurement point to the reference line, and the first reference point is named "Distance B." "Distance Error" is output if the gap between each of the distances and the setting value is larger than "Distance X (mm)."

##### For angle:

The angle between the reference line and a line indicating the orientation of the measured component is calculated and "Angle Shift" is output if the gap from the setting value is larger than "Angle ( $^{\circ}$ )."



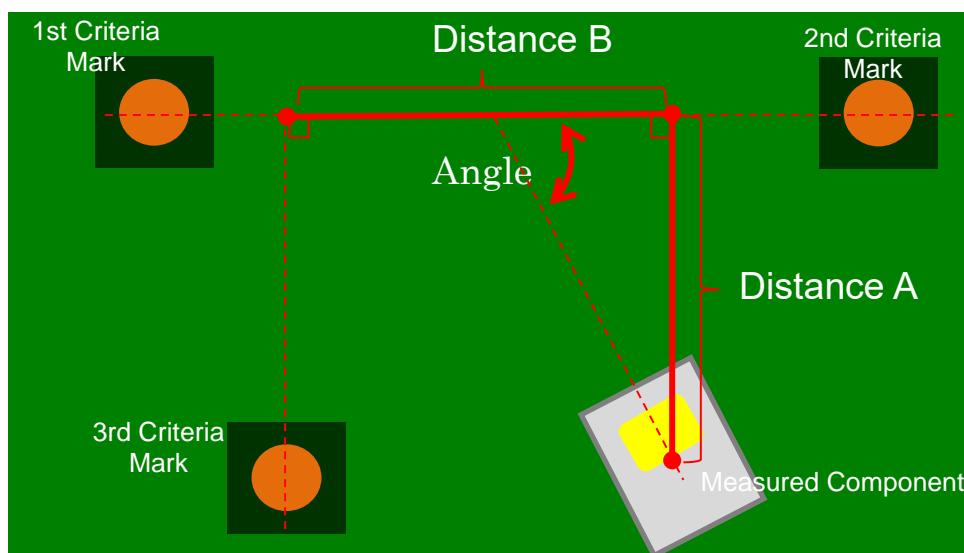
**[Case: Three Reference Points Selected]****For distance:**

Assuming the shortest distance between the reference line (a straight line connecting the first and second criteria marks) and the measurement point (center of the measured component) as distance A, and the distance between the intersection of the reference line and the perpendicular line of the third criteria mark and the intersection of the perpendicular line of the measurement point as distance B.

If the difference between each distance and its design value is outside the range of the inspection criteria for "Distance X (mm)", it is judged as "Distance Abnormal".

**For angle:**

The angle between the reference line and a line indicating the orientation of the measured component is calculated and "Angle Shift" is output if the gap from the setting value is larger than "Angle (° )."

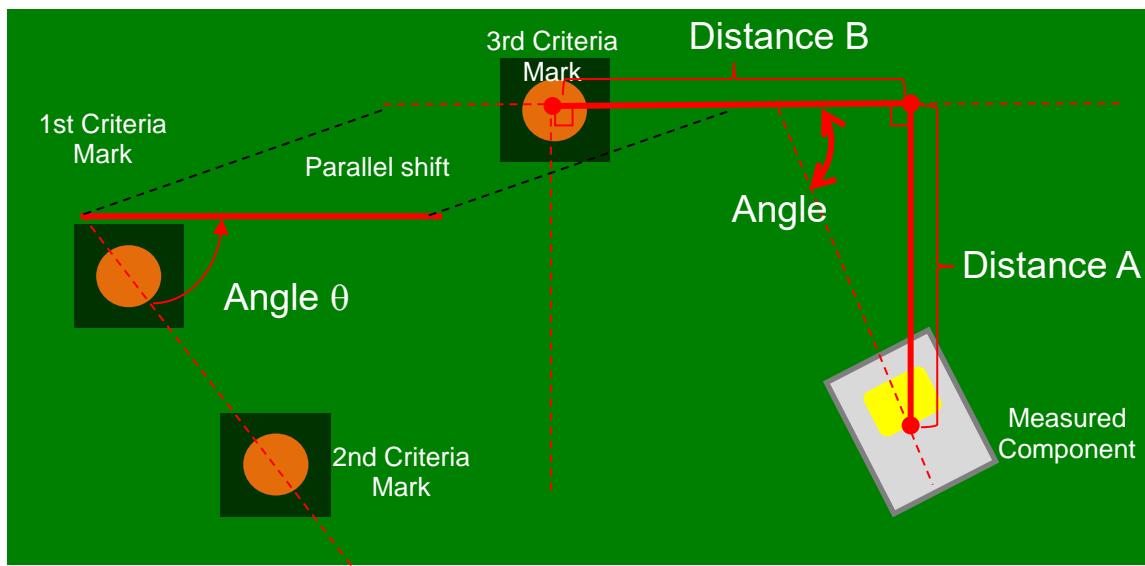
**[Case: Rotation of Two Reference Points Selected]****For distance:**

Assuming the shortest distance between the reference line (a straight line connecting the first and second criteria marks) rotated by the angle  $\theta$  and parallel-shifted on the 3rd criteria mark and the measurement point (center of the measured component) as distance A, and the distance between the intersection of the reference line and the perpendicular line of the measurement point and the perpendicular line of the third criteria mark as distance B.

If the difference between each distance and its design value is outside the range of the inspection criteria for "Distance X (mm)", it is judged as "Distance Abnormal".

**For angle:**

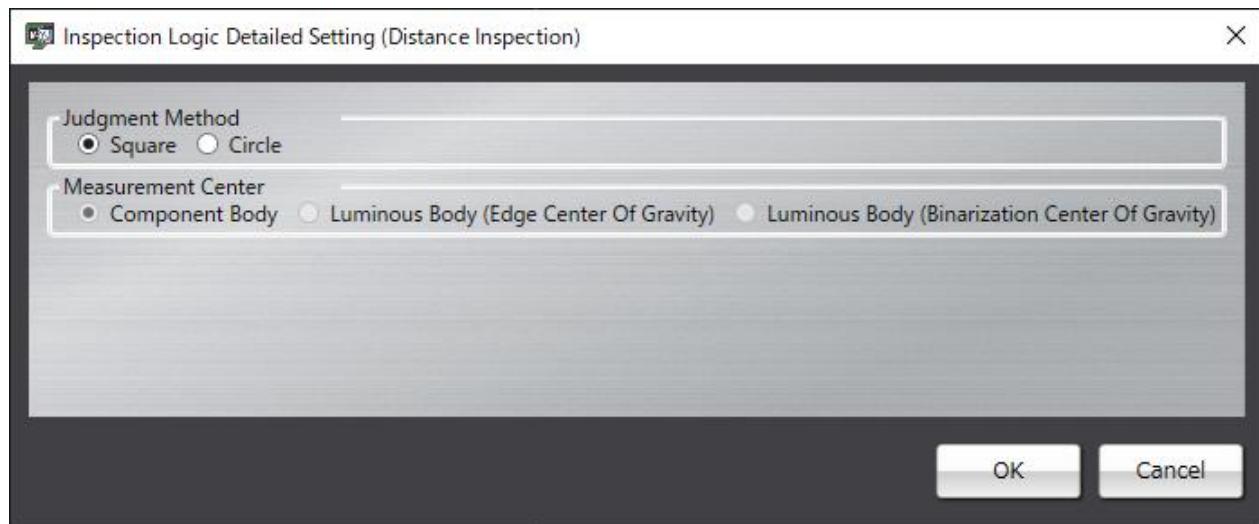
The angle between the reference line and a line indicating the orientation of the measured component is calculated and "Angle Shift" is output if the gap from the setting value is larger than "Angle (° )."



**Fault Output: Distance Error**  
**Fault Code: 139**

**Fault Output: Angle Shift**  
**Fault Code: 136**

## About the measurement center



The center position of the measurement target can be set to a light emitting object, etc., instead of the position of the part body extraction result.

### 【Case: Component body】

1. Refer to the part body extraction result.
2. The result of step1 is used as the center coordinate.

### 【Case: Luminous Body (Edge Center Of Gravity)】

1. Find the edges within the extension window.
2. Find the edges in the image created in step 1 that correspond to the 4 sides of the extension window (based on length and intensity).
3. Calculate the intersection point of the cross connecting the midpoints of the 4 edges obtained in step 2, and make it the center coordinate.

### 【Case: Luminous Body (Binarization Center Of Gravity)】

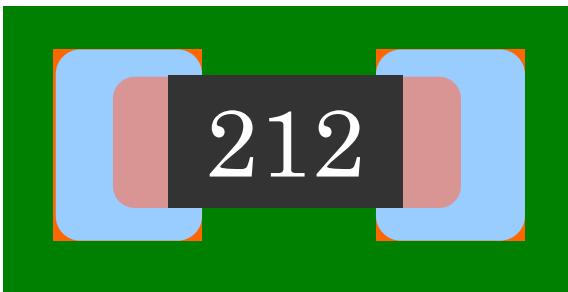
1. In the extension window, create a binarized image using the feature parameters.
2. In the image created in step 1, take the center of gravity of the largest binarized mass as the center coordinates.

## 3.12 OCR

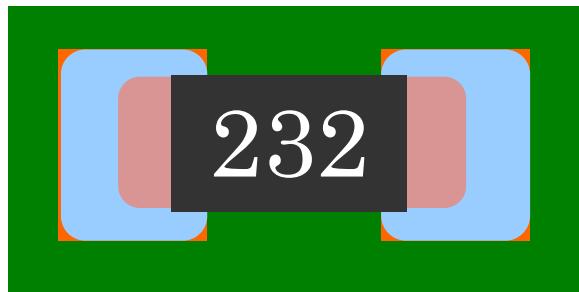
### ■ Outline

The system inspects if a different component is implemented based on the difference of the printed letters when such a component is implemented.

OK Example: Normal letters appear.



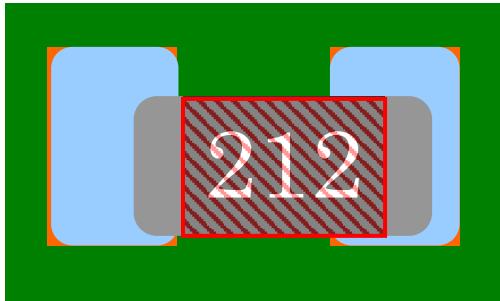
NG Example: Normal letters do not appear.



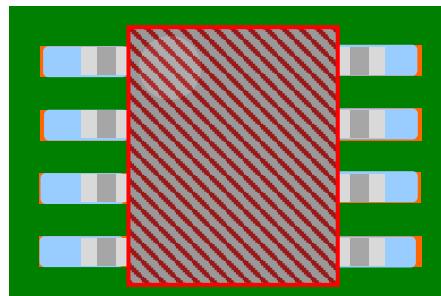
### ■ Inspection Range

Slashed areas in the figures

(a) Chip electrode (the area other than the electrode window in the component body window)



(b) The area other than the chip electrode (in the component body window)



### ■ Characteristic Parameters

■ Illumination type (available only for S1080/S1040/Z600): Color highlight illumination, white illumination, enhanced white illumination

\* Characteristic parameters are generated automatically from the colors specified as usable colors.

### ■ Inspection Criteria

It is judged as OK if the character string matches the one entered in the setting value.

	Inspection Item	Setting Value	Measurement Value	Judge
■	OCR			
	String 1			
	String 2			
	String 3			

The letters which are allowed to enter in the setting value area are as follows:

0-9

A-Z

Regular expression is also usable.

### ■ Processing Details

It is judged as OK if the string matches the one entered in the setting value area. Otherwise, it is judged as "Wrong Component (OCR)."

\*If any of strings 1-3 is OK, the PCB is judged as OK.

**Fault Output: Wrong Component (OCR)**  
**Fault Code: 176**

The inspection settings can be changed by the detailed settings.

Setup item	Selectable parameter	Description
OCR engine	Option1 *, Option2 *, standard	Select the type of OCR engine to use. Option cannot be selected unless Option is enabled. Option is supported only for S1080/S1040/Z600. Option 1 is a third-party model, and Option 2 is an Omron model. * If the standard method does not yield accurate results, please select an option. Be aware that applying an option may affect the inspection time.
Usable color	Red, green, blue, or saturation	Set colors used to extract letters. More than one color can be selected.
Letter orientation	0°, 90°, 180°, or 270°	Set the letter's orientation to the component's orientation. Parameters can be selected from 90°, 180°, and 270° in order CCW.
Number only	ON, OFF	If only numbers are read in, set this parameter ON. Then, the read-in rate is improved.
Component rotation	N/A, 180°, or 90°	Set the orientation to implement an OK component. If allowing 180° rotation of the component, set 180° ON. If allowing all kinds of rotation, set 90° ON.

### Regular Expression

Normal expressions are usable for the setting value.

Contents	Symbol	Descriptions	Normal expression examples	Examples of searchable character strings
Any single character	.	Matches to any single character by using half size of character's mark.	AB. CD	ABHCD, AB4CD
Repeated same character	*	Repetition of more than 0 time of a single character immediately before * mark is expressed.	AB*CD	ACD, ABCD
Repeated same character	+	The + mark expresses more than one time of the previous single character. Whereas * mark of half size of character was repetition of more than 0 time, this becomes repetition of more than one time.	AB+CD	ABCD, ABCD
Repeated same character	?	In the case of ? mark, it means that there is no previous character at all, or there is only one character.	AB?CD	ACD, ABCD
Any continuous character	. *	The . * mark means that there is no any single character at all, or there is any continuous character.	AB. *CD	ABFGDCD, AB45CD
Any single character in the specified characters	[]	It means whether it matches to any one character of a character bracketed by [] mark.	AB[3B]CD	AB3CD, ABCD

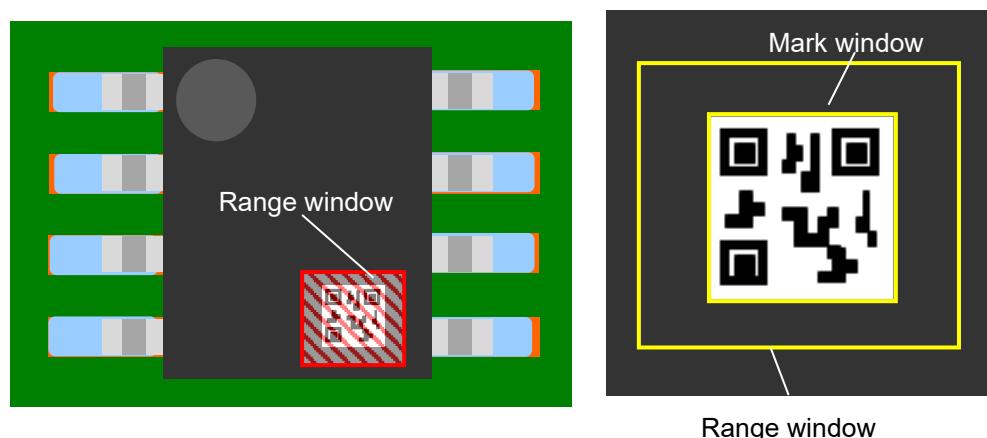
## 3.13 1D/2D Code (Component)

### ■ Outline

The system reads the 1D/2D code printed on the component and output it as a component ID.

### ■ Inspection Area

The hatched portion on the figure (in the range window)



### ■ Characteristic Parameters

Colors of the 1D/2D cell (no need to set them)

Illumination type (available only for S1080/S1040/Z600): Color highlight illumination, white illumination, enhanced white illumination

### ■ Inspection Criteria

N/A

	Inspection Item	Setting	Measured Value	Judgment
■ 1D/2D code (component)				
Format			EAN-8 EAN-13 UPC-A .....	

### ■ Processing

The 1D/2D code detected in the inspection range is read and output as a component ID. If the 1D/2D code cannot be read, "1D/2D read error" is output.

Fault Output: 1D/2D read error  
(component)  
Fault Code : 380

---

**Corresponding 2D Code**

PDF417/Micro PDF417, Data Matrix (ECC200), QR Code, GS1 Synthesized Symbol, Micro QR Code

**Corresponding 1D Code**

EAN-8/13, UPC-A/E, CODE39/93, CODE128/GS1-128, Codabar (NW-7),  
GS1 Data Bar Standard/Limited/Expansion Model, Pharmacode

**Option**

When the barcode standard extension option is enabled, the following standards can be further selected.

**Supported 2D code (Option, S1080/S1040/Z600 only)**

Aztec Code, DotCode, GS1 QR code/Data Matrix/Aztec Code/DotCode

**Supported 1D code (Option, S1080/S1040/Z600 only)**

2 of 5 industrial, EAN-8 Add-On 2/ EAN-8 Add-On 5, MSI, GS1 databar truncated/stacked/stacked  
omni-directional/expanded stacked, ITF

# 4 Lead Inspection

\* The description regarding the inspection logic is as follows.

No symbol: Common for VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500,

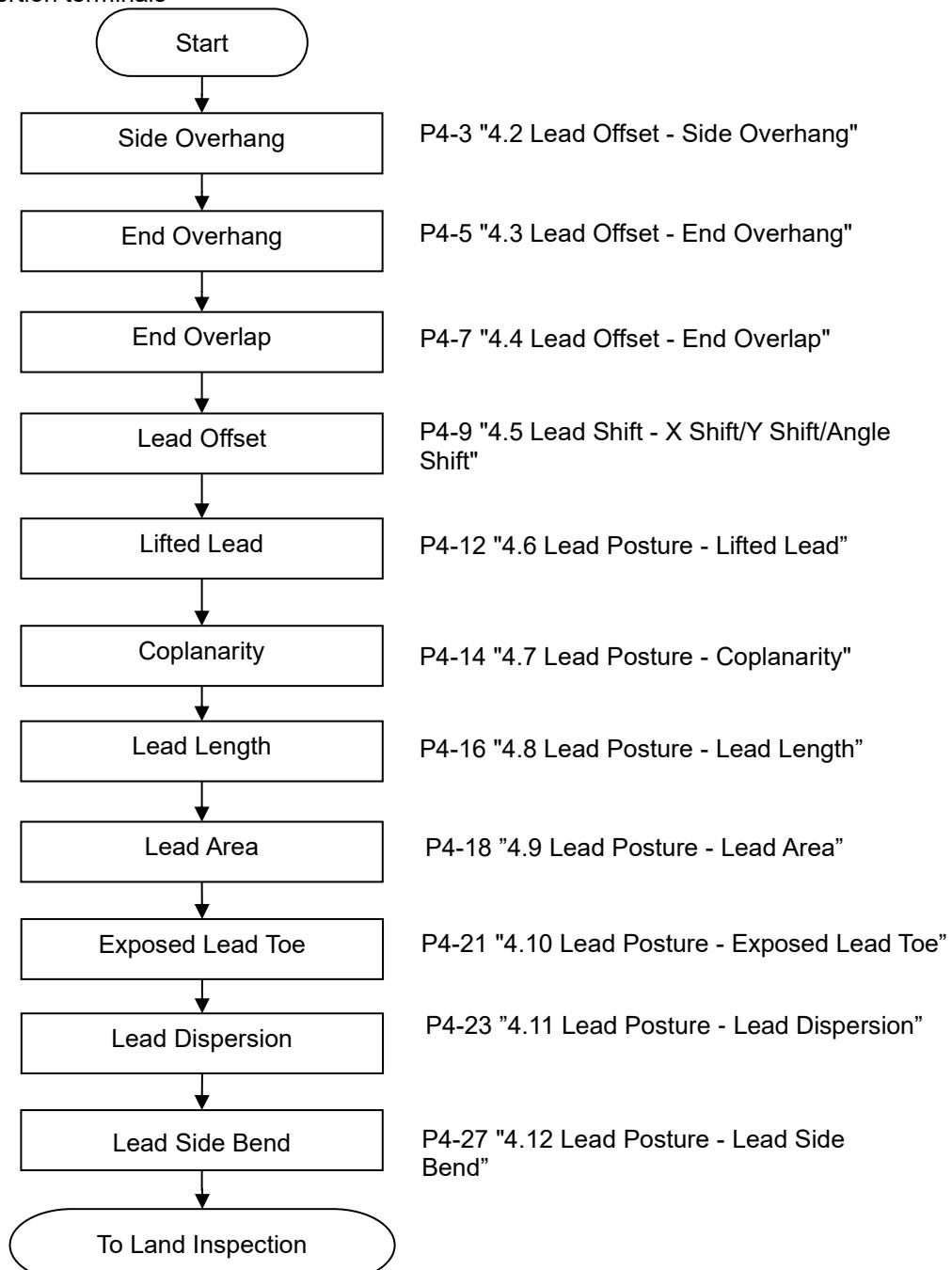
**S1080** : S1080 **S1040** : S1040 **Z600** : Z600 **S730** : S730-H/S730 **S720A** : S720A **S530** : S530 **S500** : S500

## 4.1 Flow of Lead Inspection

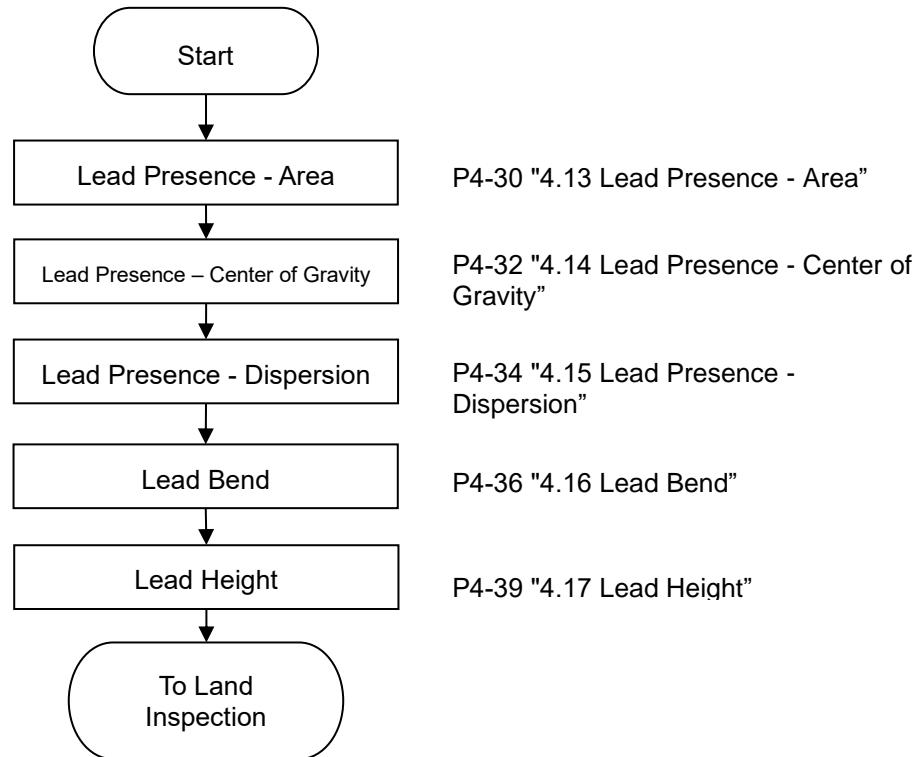
This section explains the inspection logics used for lead inspection.

The following chart shows the flow of lead inspection.

- Other than insertion terminals



- Insertion terminals



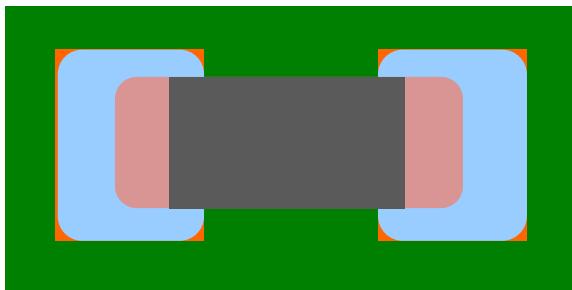
## 4.2 Lead Offset - Side Overhang

### ■ Outline

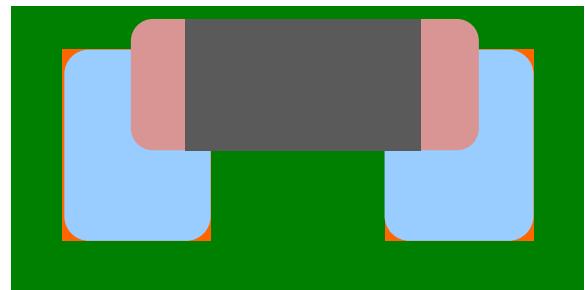
This system inspects the lead and land positions in the Inspection Range Window to judge if the lead are mounted on the right positions.

\*This cannot be applied to an insertion terminal.

OK Example: Electrodes Mounted on the Right Positions



NG Example: Electrodes Mounted on the Wrong Positions



### ■ Inspection Range

Not Specified

\* The results obtained in component extraction, lead horizontal extraction and lead end extraction are used.

### ■ Characteristic Parameter

Not Specified

\* The results obtained in component extraction, lead horizontal extraction and lead end extraction are used.

### ■ Inspection Criteria

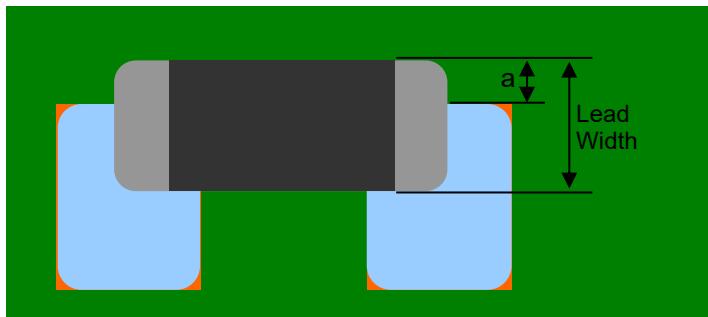
The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Offset			
■ Side Overhang (%)	0 - <input type="text"/>		

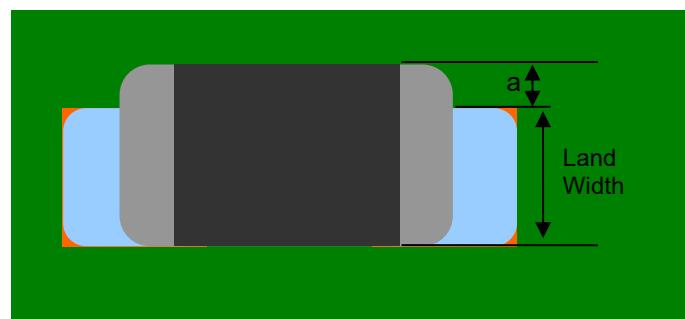


**■ Processing Detail****Lead Width is Smaller than Land Width**

The leads and lands in the Inspection Range Window are inspected. "Side Overhang" is output if the ratio of a) to the lead width (100%) is larger than the "Side Overhang (%)" where a) is the distance from the land end to the side end of the offset lead.

**Lead Width is Larger than Land Width**

The lead and lands in the Inspection Range Window are inspected. "Side Overhang" is output if the ratio of a) to the land width (100%) is larger than the "Side Overhang (%)" where a) is the distance from the land end to the side end of the offset lead.



**Fault Output: Side Overhang  
Fault Code: 140**

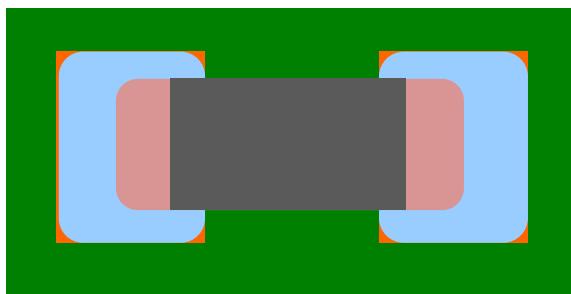
## 4.3 Lead Offset - End Overhang

### ■ Outline

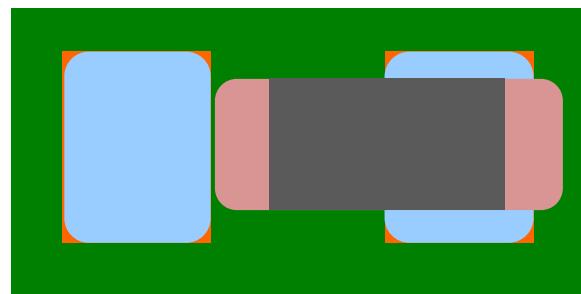
This system inspects the lead and land positions in the Inspection Range Window to judge if the lead are mounted on the right positions.

\*This cannot be applied to an insertion terminal.

OK Example: Electrodes Mounted on the Right Positions



NG Example: Electrodes Mounted on the Wrong Positions



### ■ Inspection Range

Not Specified

\* The results obtained in component extraction, lead horizontal extraction and lead end extraction are used.

### ■ Characteristic Parameter

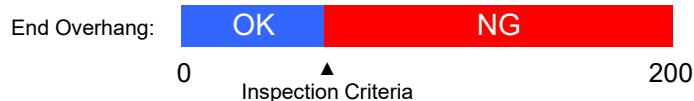
Not Specified

\* The results obtained in component extraction, lead horizontal extraction and lead end extraction are used.

### ■ Inspection Criteria

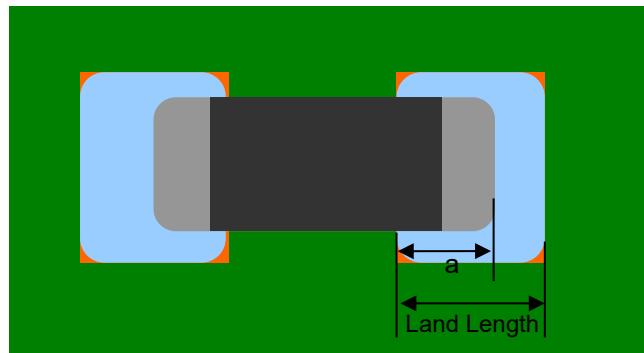
The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Offset			
■ End Overhang (%)	0 - <input type="text"/>		



■ Processing Detail

The lead and lands in the Inspection Range Window are inspected. "End Overhang" is output if the ratio of a) to the land length (100%) is larger than the "End Overhang (%)" where a) is the distance from the land inside edge to the offset lead end.



Fault Output: End Overhang  
Fault Code: 141

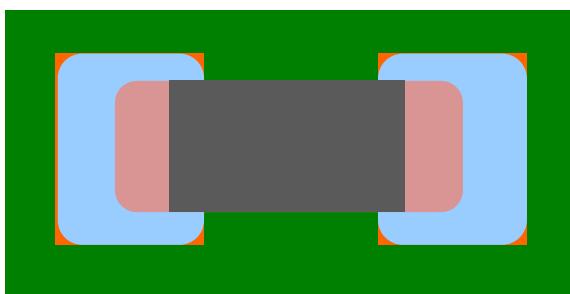
## 4.4 Lead Offset - End Overlap

### ■ Outline

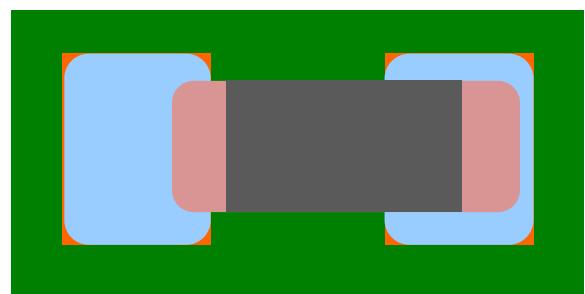
This system inspects the lead and land positions in the Inspection Range Window to judge if the lead are mounted on the right positions.

\*This cannot be applied to an insertion terminal.

OK Example: Electrodes Mounted on the Right Positions



NG Example: Electrodes Mounted on the Wrong Positions



### ■ Inspection Range

Not Specified

\* The results obtained in component extraction, lead horizontal extraction and lead end extraction are used.

### ■ Characteristic Parameter

Not Specified

\* The results obtained in component extraction, lead horizontal extraction and lead end extraction are used.

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

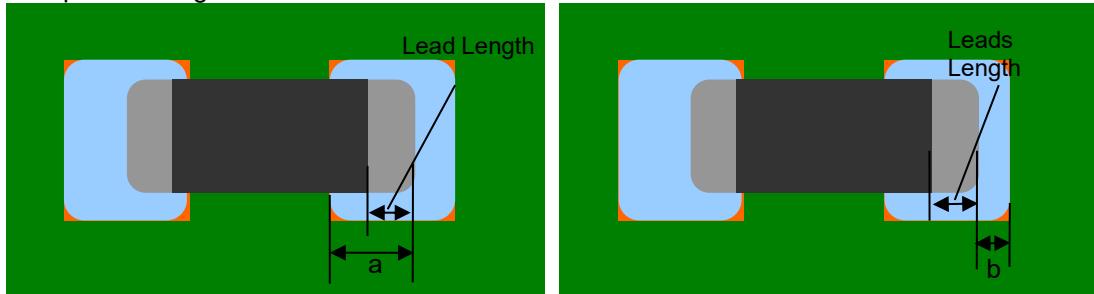
Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Offset			
■ End Overlap (%)	0 - 100		



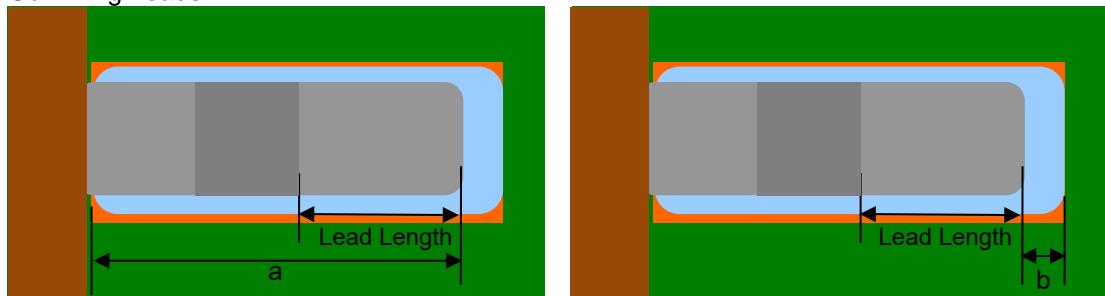
**■ Processing Detail**

The lead and lands in the Inspection Range Window are inspected. "End Overlap" is output if the smaller of the ratio of a) and b) to the lead length (100%) is smaller than the "End Overlap (%)" where a) is the distance from the land inside edge to the offset lead end and b) is the distance from the land outside edge to the offset lead end.

Except Gull Wing Leads



Gull Wing Leads



**Fault Output: End Overlap**  
**Fault Code: 142**

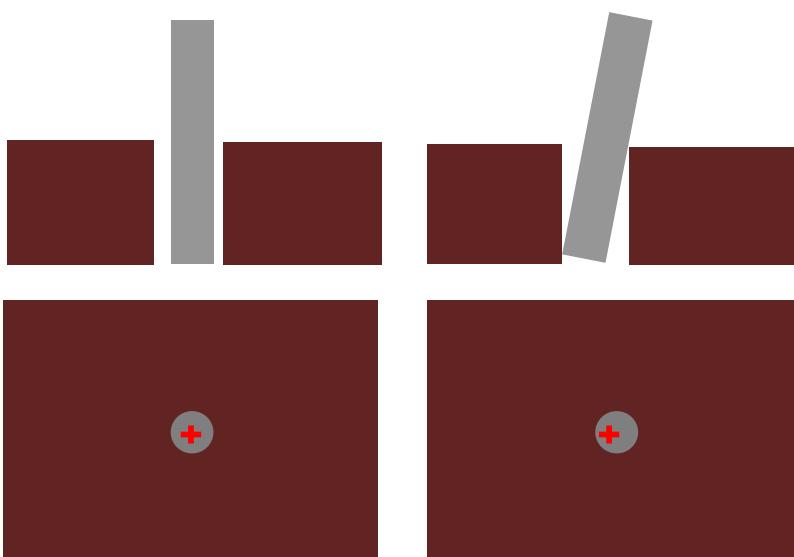
## 4.5 Lead Shift - X Shift/Y Shift/Angle Shift

### ■ Outline

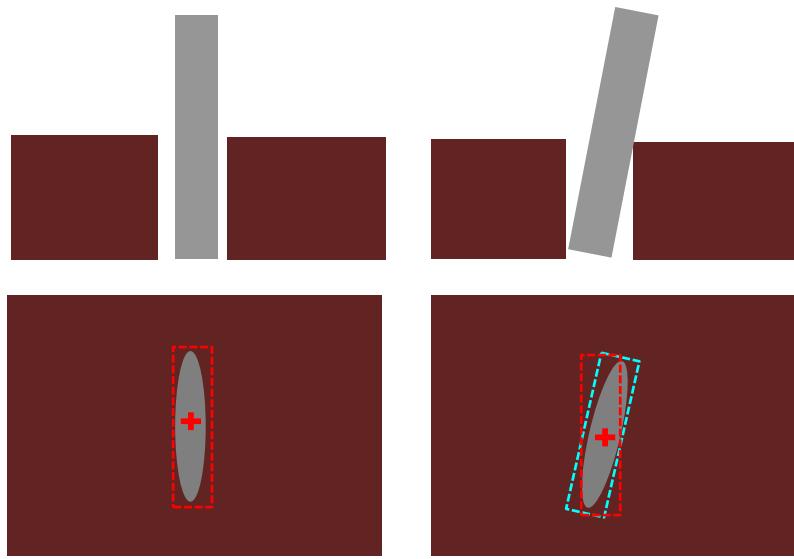
This system inspects the lead position in the Inspection Range Window to judge if the lead is mounted on the right position.

\*This can be applied only to connectors and other lead components.

OK Example: Lead at a Right Position    NG Example: Lead Shifted

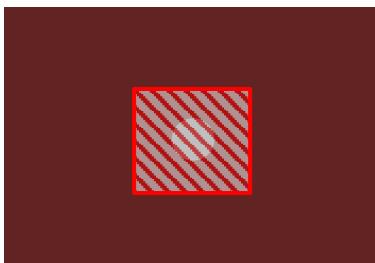


OK Example: Lead at a Right Position    NG Example: Lead Shifted (Angle)



### ■ Inspection Range

Shaded Area Below. In the Land Window



### ■ Characteristic Parameter

Not Specified

\*As the lead extraction result is used.

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Offset				
■ X Shift [Absolute Value] (mm)	0	—		
[Signed] (mm)				
■ Y Shift [Absolute Value] (mm)	0	—		
[Signed] (mm)				
■ Angele Shift [Absolute Value] (° )	0	—		
[Signed] (° )				



### ■ Processing Detail

#### Case: X or Y Shift:

"Lead X Shift" is output if the position shift between the lead extracted in the lead toe extraction and the lead window before lead toe extraction is larger than "X Shift (Absolute Value: mm)" in the X direction. "Lead Y Shift" is output if the position shift is larger than "Y Shift (Absolute Value: mm)" in the Y direction.

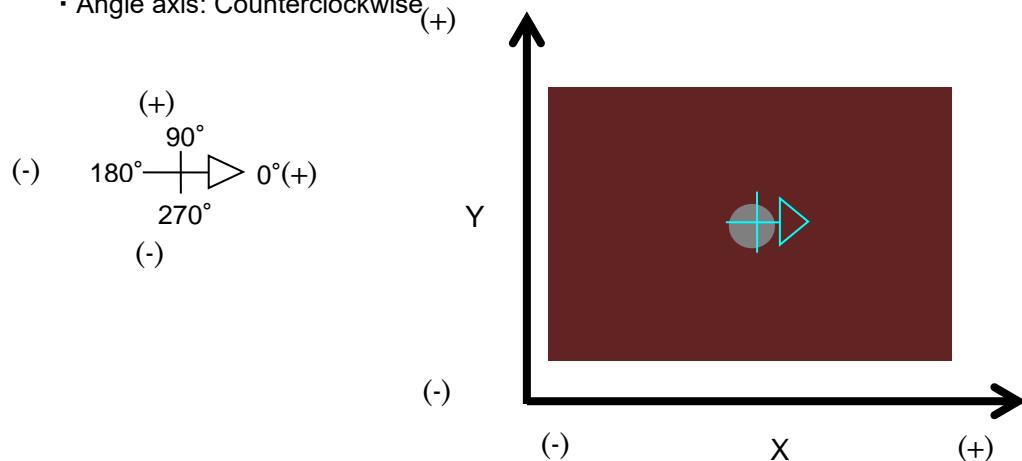
#### Case: Angle Shift:

"Lead Angle Shift" is output if the angle shift between the lead extracted in the lead toe extraction and the lead window before lead toe extraction is larger than "Angle Shift (Absolute Value: mm)".

**【Direction - X Shift, Y Shift】**

The line from  $0^\circ$  to  $-180^\circ$  is X axis and the line from  $90^\circ$  to  $-270^\circ$  is Y axis. In the figure below, the arrows indicate the plus (+) direction for each axis.

- X axis:  $180^\circ \rightarrow 0^\circ$
- Y axis:  $270^\circ \rightarrow 90^\circ$
- Angle axis: Counterclockwise (+)



**Fault Output: Lead X Shift  
Fault Code: 177**

**Fault Output: Lead Y Shift  
Fault Code: 178**

**Fault Output: Lead Angle Shift  
Fault Code: 179**

S1080 S1040  
S730 S530

## 4.6 Lead Posture - Lifted Lead

### ■ Outline

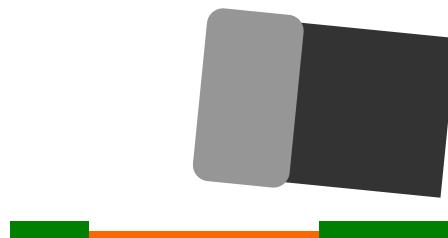
The bottom of an lead is checked if it is lifted based on a difference between the configured lead height and the lead top height measured by 3D measurement.

\* This cannot be applied to an insertion terminal.

OK: Lead bottom height is low



NG Example: Lead bottom height is high

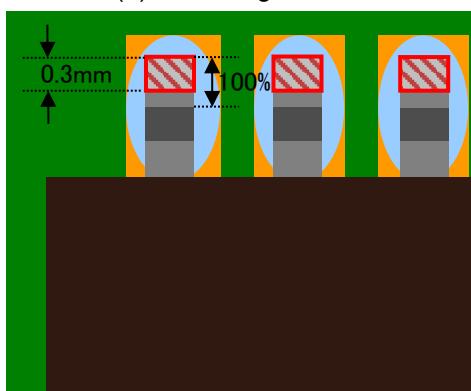


### ■ Inspection Range

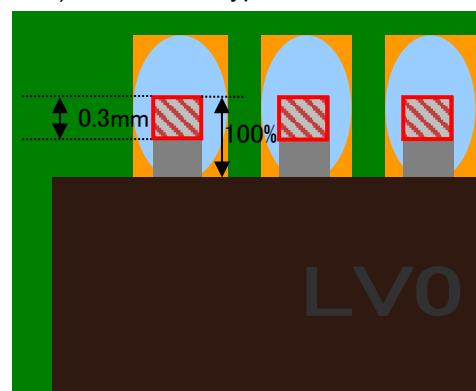
Shaded Area Below

Assuming an lead length as 100%, an inspection range is set as smallest one of 0.3mm or 100%.

(a) Gull-Wing Lead



b) Other Lead Types



### ■ Characteristic Parameter

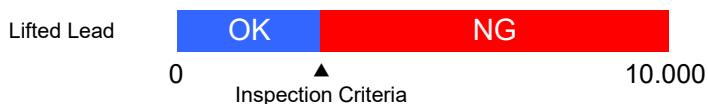
Not Specified

\* As 3D measurement result in the inspection range window is used.

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

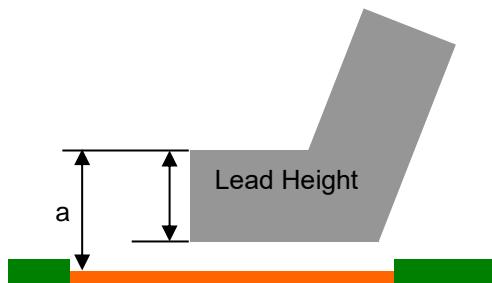
Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Posture			
■ Lifted Lead (mm)	0 -		



■ Processing Detail

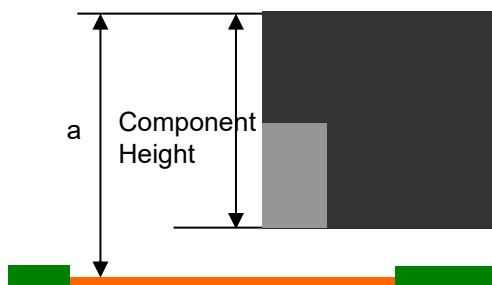
[Case: Flat leads or Gull-wing leads except electrolytic capacitors]

1. Calculate the median value  $a$  of heights measured in the inspection range.
2. Acquire "Lead Height" configured in teach-in.
3. Calculate the difference between the measured height  $a$  in Step 1 and "Lead Height".
4. If the value acquired in Step 3 is larger than "Lifted Lead (mm)", it is evaluated as "Lifted Lead". If lifted lead is found in multiple locations, one with the largest "Lifted Lead (mm)" is displayed as a measured value. Note that all measured values are outputted as an inspection result.



[Case: Lead types other than flat/gull-wing leads except electrolytic capacitors]

1. Calculate the component top height  $a$ .
2. Acquire "Component Height" configured in teach-in.
3. Calculate the difference between the measured height  $a$  in Step 1 and "Component Height".
4. If the value acquired in Step 3 is larger than "Lifted Lead (mm)", it is evaluated as "Lifted Lead". If lifted lead is found in multiple locations, one with the largest "Lifted Lead (mm)" is displayed as a measured value. Note that all measured values are outputted as an inspection result.



Fault Output: Lifted Lead  
Fault Code: 154

S1080  
S730

S1040  
S530

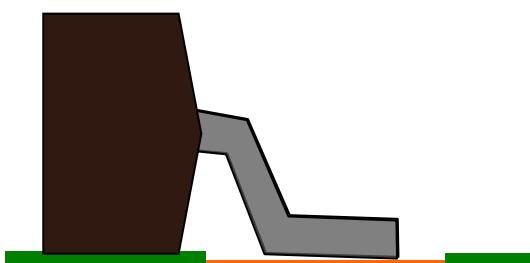
## 4.7 Lead Posture - Coplanarity

### ■ Outline

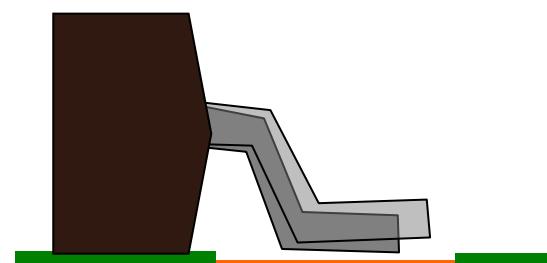
The lead Coplanarity (flatness) is checked based on the dispersion on the lead top surface measured by 3D measurement.

\*"Coplanarity" inspection cannot be used for others than flat lead and gull-wing lead.

OK Example: No dispersion in lead heights



NG Ex.: Dispersion exists in lead heights



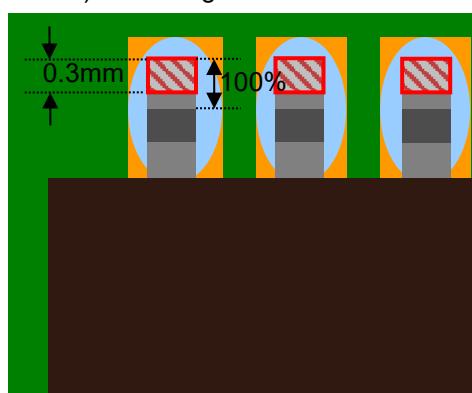
### ■ Inspection Range

Shaded Area Below

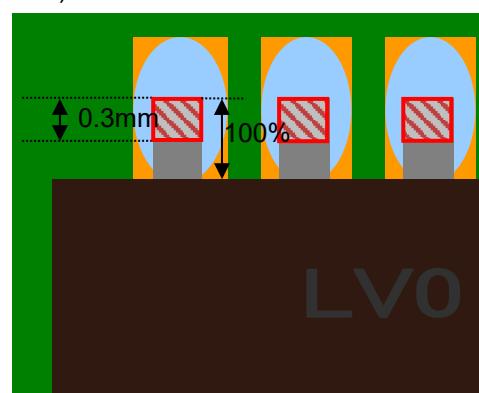
Assuming an lead length as 100%, an inspection range is set as smallest one of 0.3mm or 100%.

Coplanarity

a) Gull-Wing Lead



b) Flat Lead



### ■ Characteristic Parameter

Not Specified

\* As 3D measurement result in the inspection range window is used.

### ■ Inspection Range

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Posture			
■ Coplanarity (mm)	0 -	<input type="text"/>	

Coplanarity

OK

NG

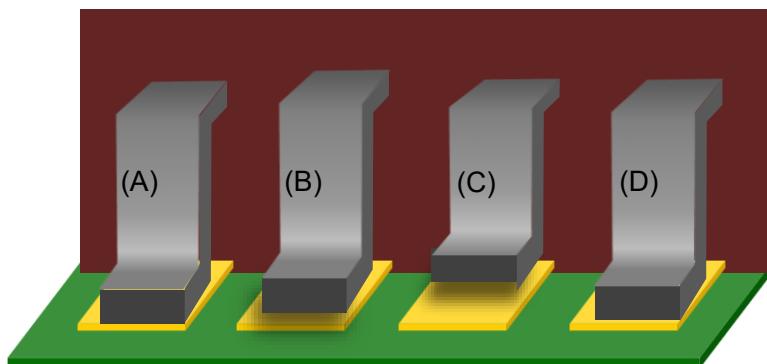
0

▲  
Inspection Criteria

10.000

### ■ Processing Detail

1. For the same lead group and lead in the same direction, calculate the median value  $a$  of lead top surface heights measured in the inspection range.
2. Calculate the absolute value of the difference between the maximum values in Step 1 and its lead top surface height.
3. Calculate the absolute value of the difference between the minimum values in Step 1 and its lead values.
4. If any value of Steps 2 or 3 is larger than "Coplanarity (mm)", it is evaluated as "Lead Posture (Coplanarity)".  
If lifted lead is found in multiple locations, one with the largest "Coplanarity (mm)" is displayed as a measured value. Note that all measured values are outputted as an inspection result.



Target Lead	(A)	(B)	(C)	(D)
Lead Top Surface Height (mm)	0.155	0.2	0.29	0.16
Measured Value (mm)	0.135	0.09	0.135	0.13

**Fault Output: Lead Posture (Coplanarity)  
Fault Code: 155**

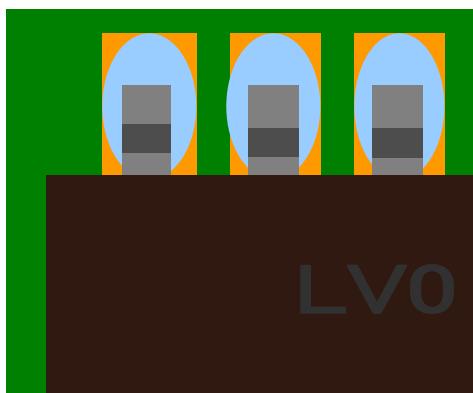
## 4.8 Lead Posture - Lead Length

### ■ Outline

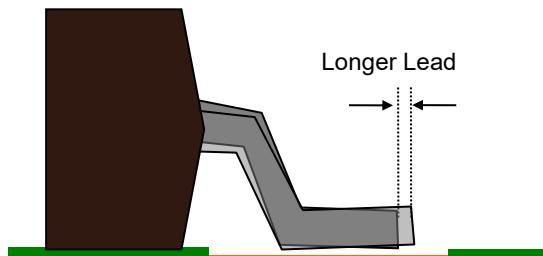
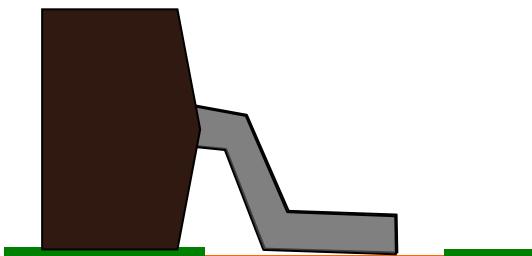
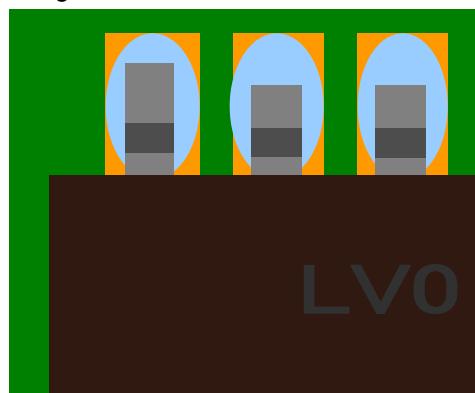
Lifted lead are rendered longer than normal ones in captured image. This system inspects the lengths of lead detected in the Inspection Range Window to judge if they are lifted.

\* This cannot be applied to chip electrode, castellation electrode and non-lead.

OK Example: Lead Uniform in Length

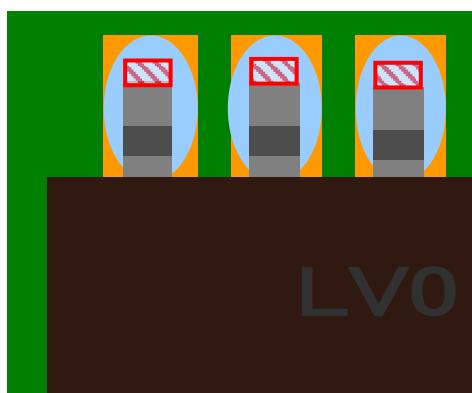


NG Example: Lead Not Uniform in Length



### ■ Inspection Range

Shaded Areas Below



### ■ Characteristic Parameter

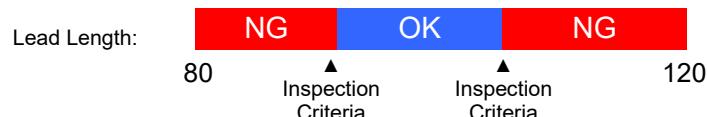
Lead Color

\* Same as the lead extraction parameter.

### ■ Inspection Criteria

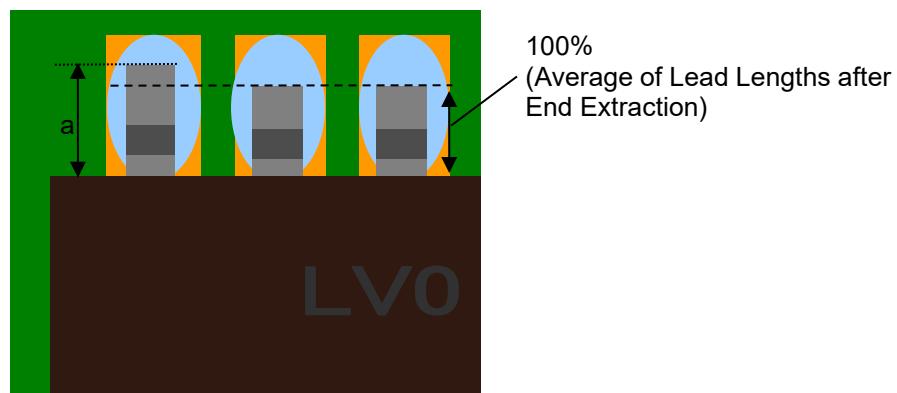
The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Posture			
■ Lead Length (%)	[ ] - [ ]		



### ■ Processing Detail

1. The system obtains the average value of the lengths of the lead in the same group in the same direction after the lead end extraction.
  2. It obtains the length  $a$  of the individual lead in the same group in the same direction using the "Offset Individually" mode of "Electrode End Extraction".
  3. "Lifted Lead (Lead Length)" is output if the ratio of the length  $a$  of any of lead obtained in Step 2 to the average length obtained in Step 1 (100%) is larger than the "Lead Length (%)".
- If a multiple number of lifted lead are detected, the one with the highest "Lead Length (%)" is displayed as the measure value. However, all the measured values are output as the inspection result.



Fault Output: Lifted Lead (Lead Length)  
Fault Code: 143

## 4.9 Lead Posture - Lead Area

### ■ Outline

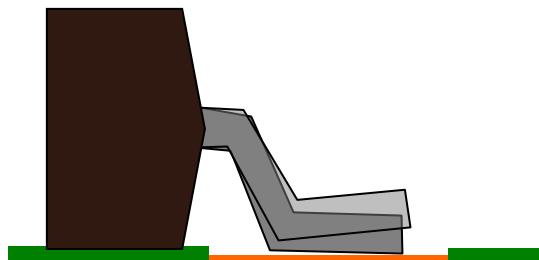
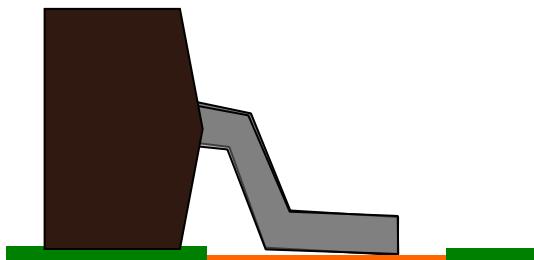
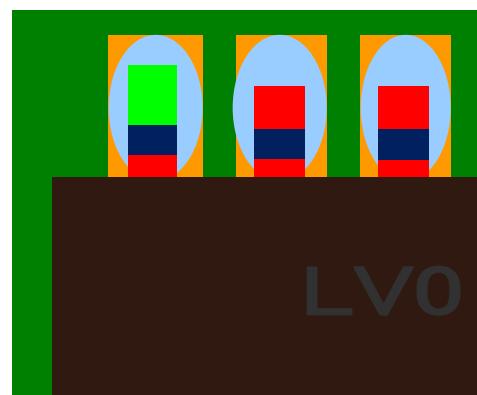
Lifted lead are shown, in image, with their ends in green or blue color instead of red (normal lead). This system inspects the lead color to judge if they are lifted.

\* This cannot be applied to chip electrode, castellation electrode and non-lead.

OK Example: Lead Ends in Red



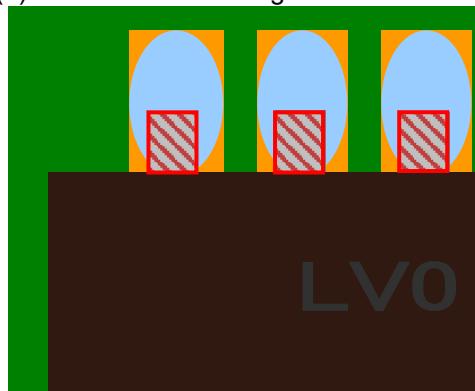
NG Example: Lead Ends in Color Other than Red



### ■ Inspection Range

Shaded Areas Below

(a) Other than Gull-Wing Lead



(b) Gull-Wing Lead



### ■ Characteristic Parameter

Color of a Faulty Lead

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

**■ Inspection Criteria**

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
■ Lifted Lead			
■ Lead Area (%)	0 -	<input type="text"/>	

**■ Processing Detail**

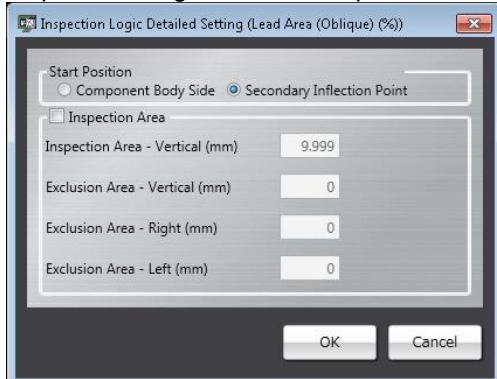
The pixels matching the characteristic parameters are extracted from the inspection range. "Lifted Lead (Lead Area)" is output if the area ratio of the extracted pixels to the inspection range is larger than the "Lead Area (%)".

If a multiple number of lifted lead are detected, the one with the highest "Lead Area (%)" is displayed as the measured value. However, all the measured values are output as the inspection result.

**Fault Output: Lead Posture (Area)**  
**Fault Code: 144**

### Detailed Setting

The inspection range can be set up in detail.



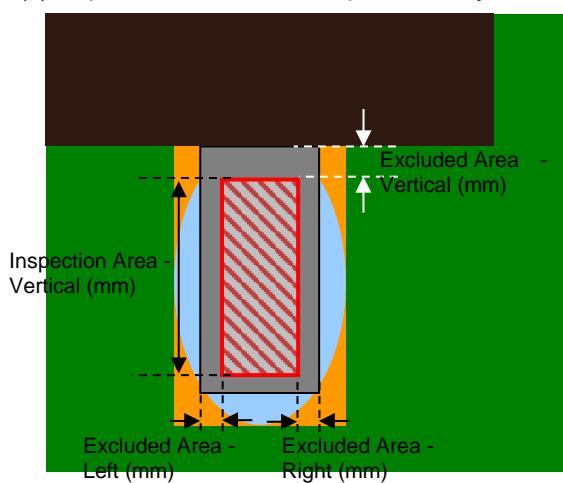
Remove "Excluded Area - Right (mm)" and "Excluded Area - Left (mm)" from the lead area.

Remove "Excluded Area - Vertical (mm)" from the origin position. The origin position becomes as follows:

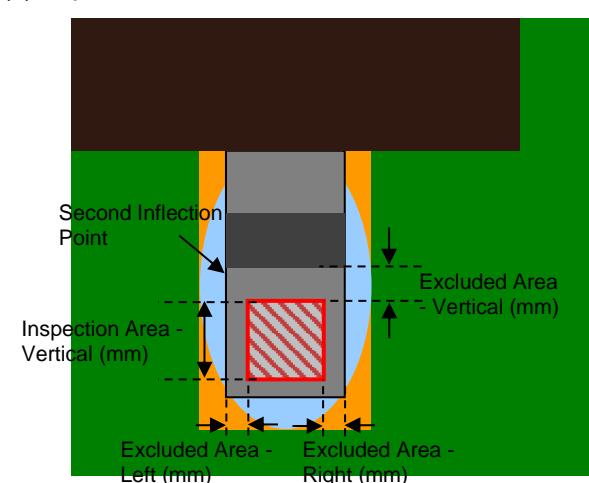
- Component Side of Start Position: The origin is on the component body.
- Second Inflection Point of Start Position: The origin is on the second inflection point of the lead.

The illustration of the inspection area setting is shown below.

(a) Inspection Area ON - Component Body Side



(b) Inspection Area ON - Second Inflection Point

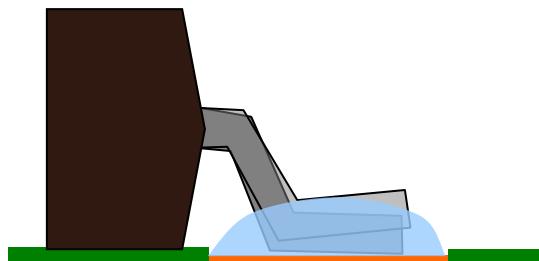
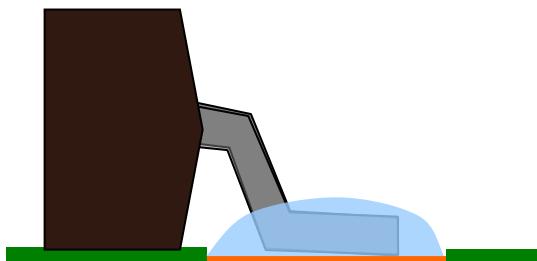
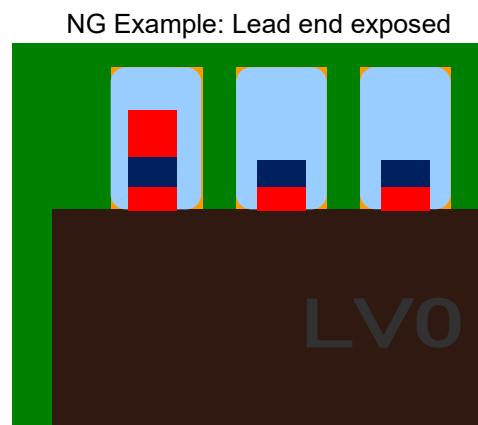
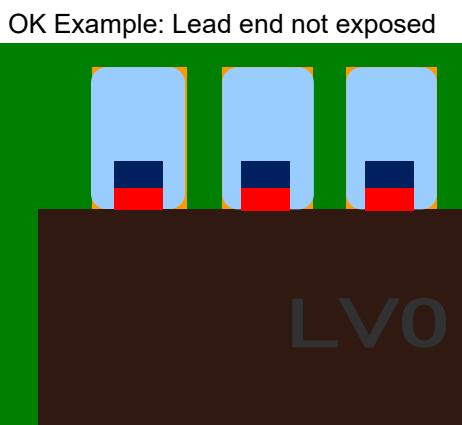


## 4.10 Lead Posture - Exposed Lead Toe

### ■ Outline

When a lead is lifted, its end will be exposed. Whether a lead is lifted or not is determined by difference of brightness on the border between the lead end appearing when lifted and the solder.

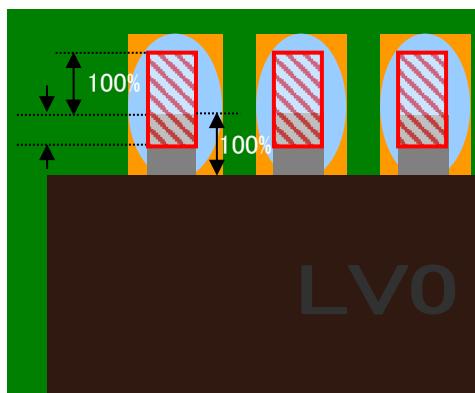
\* This cannot be used for chip electrode, castellated electrode, and non-lead.



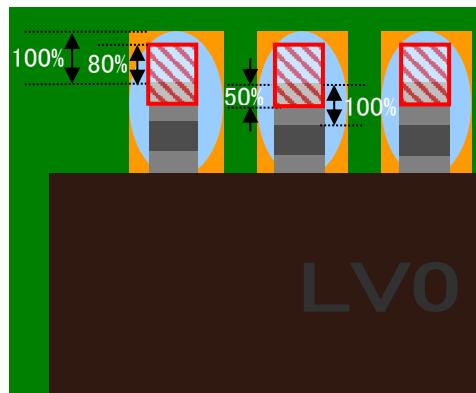
### ■ Inspection Range

Shaded area in the illustration

(a) Other than Gull-Wing Lead



(b) Gull-Wing Lead



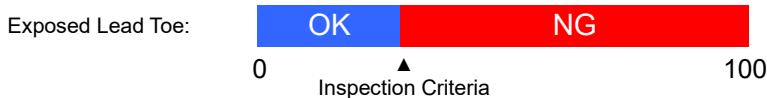
### ■ Characteristic Parameters

Color of lead end and solder (settings not required). All models use color highlight illumination.

### ■ Inspection Criteria

The item will be evaluated as good if the value is within the configured range. The available range for configuration is shown below.

Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Posture			
■ Exposed Lead Toe (%)	0 - <input type="text"/>		



### ■ Process Details

If a degree of brightness change extracted for the characteristic parameter in the inspection range is larger than [Exposed Lead Toe (%)], it is judged as "Lifted Lead (Exposed)".

If there is more than one lifted lead, the largest of the "Exposed Lead Toe (%)" will be displayed as the measured value. Note that all the measured values are provided as the inspection result.

Fault Output : Lead Posture (Lead Toe)
Fault Code : 145

## 4.11 Lead Posture - Lead Dispersion

### ■ Outline

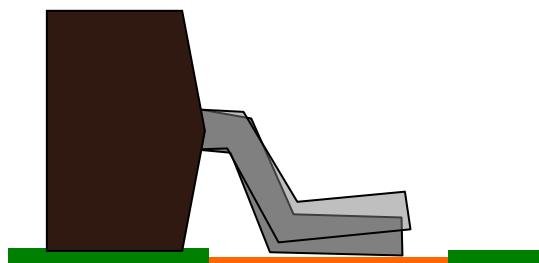
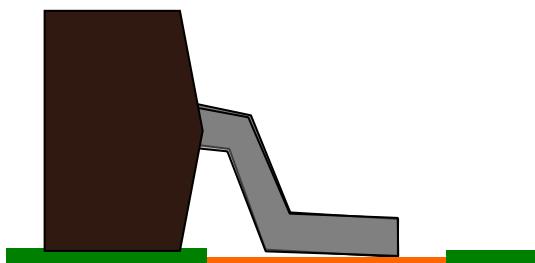
If a lead is lifted, the lead color changes from flat color (red) to green or blue. Based on the difference of lead color appearing when the lead is lifted, compare the lead color with the ones to the right and left of the lead to inspect if the lead is lifted.

\*This method is not usable for chip electrodes, castellation electrodes, non-lead, or inserted terminals.

OK Example: Lead toe red



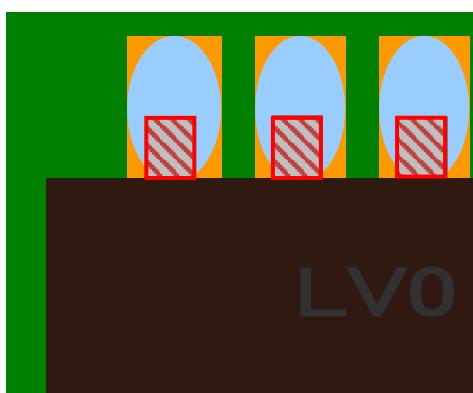
NG Example: Lead toe other than red



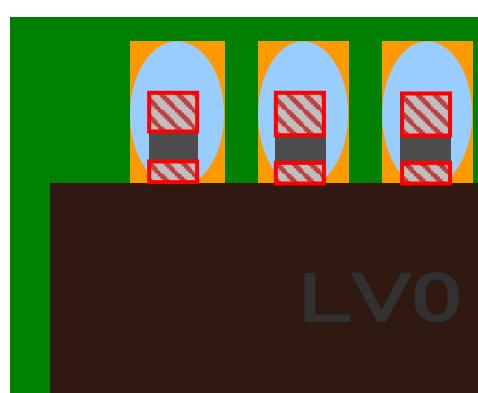
### ■ Inspection Range

Shaded area in the illustration

(a) Other than Gull-Wing Lead



(b) Gull-Wing Lead



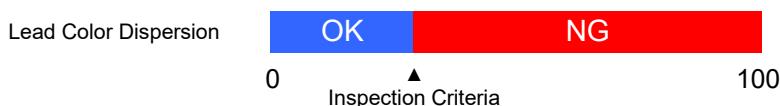
### ■ Characteristic Parameters

Color of lead (settings not required). All models use color highlight illumination.

### ■ Inspection Criteria

The item will be evaluated as good if the value is within the configured range. The available range for configuration is shown below.

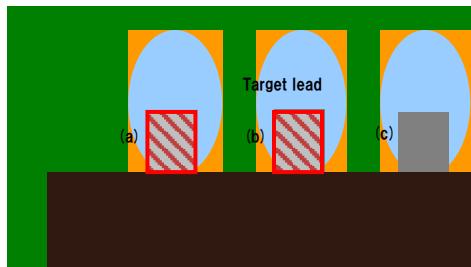
Inspection Item	Setting Value	Measurement Value	Judge
■ Lifted Lead			
■ Lead Dispersion (%)	0 - <input type="text"/>		



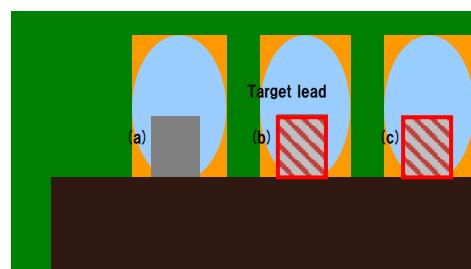
### ■ Processing Details

#### Other than gull-wing lead

1. Use the characteristic parameters inside the inspection range to measure the extent of dispersion of lead color between the (b) area of the target lead and the (a) area of the left-hand lead. If no lead exists to the left of the target lead, the extent of dispersion is measured as zero (0).



2. Measure the extent of dispersion of lead color between the (b) area of the target lead and the (c) area of the right-hand lead in the same way. If no lead exists to the right of the target lead, the extent of dispersion is measured as zero (0).

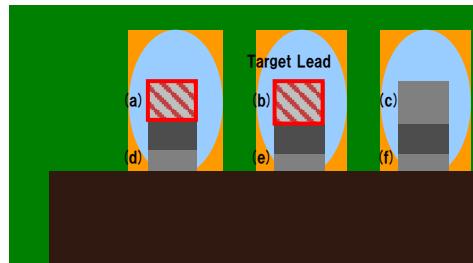


3. If either one of the measured values obtained by steps 1 and 2 is greater than the value of "Lead Dispersion (%)," this symptom is judged as "lead posture (dispersion)." In addition, if there are more than one lifted lead, the software displays the measured value of the lead of the largest "lead dispersion (%)" as measured value. However, with regard to inspection results, all measured values are output.

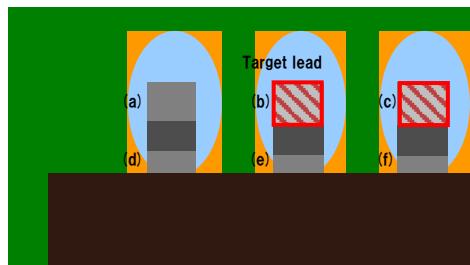
\*Measured values become closer to 100% as color difference becomes greater.

**Gull-wing lead**

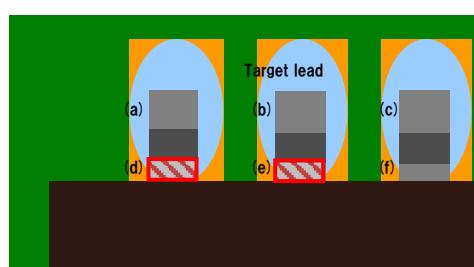
1. Use the characteristic parameters inside the inspection area to measure the extent of dispersion of lead color between the (b) area of the target lead and the (a) area of the left-hand lead. If no lead exists to the left of the target lead, the extent of dispersion is measured as zero (0).



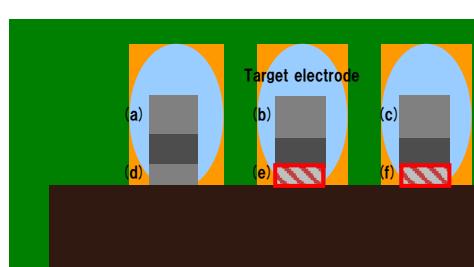
2. Measure the extent of dispersion of lead color between the (b) area of the target lead and the (c) area of the right-hand lead in the same way. If no lead exists to the right of the target lead, the extent of dispersion is measured as zero (0).



3. Measure the extent of dispersion of lead color between the (e) area of the target lead and the (d) area of the left-hand lead in the same way. If no lead exists to the left of the target lead, the extent of dispersion is measured as zero (0).



4. Measure the extent of dispersion of lead color between the (e) area of the target lead and the (f) area of the right-hand lead in the same way. If no lead exists to the right of the target lead, the extent of dispersion is measured as zero (0).



5. If one of the measured values obtained by steps 1, 2, 3, or 4 is greater than the value of "Lead Dispersion (%)," this symptom is judged as "lead posture (dispersion)." If there are more than one lifted lead, the software displays the measured value of the lead of the largest "lead dispersion

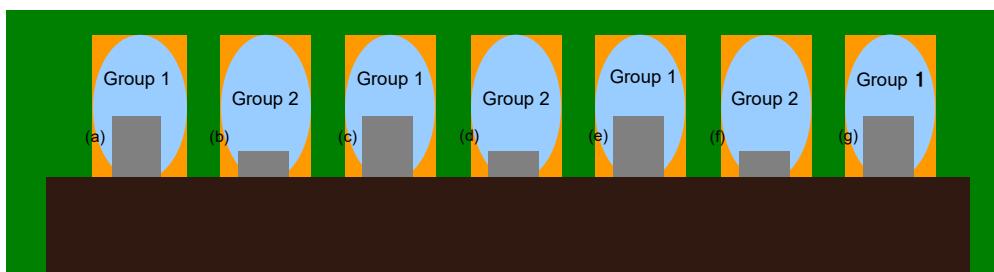
(%)<sup>\*</sup> as measured value. However, with regard to inspection results, all measured values are output.

<sup>\*</sup>Measured values become closer to 100% as color difference becomes greater.

<b>Fault Output</b>	<b>: Lead Posture (Dispersion)</b>
<b>Fault Code</b>	<b>: 147</b>

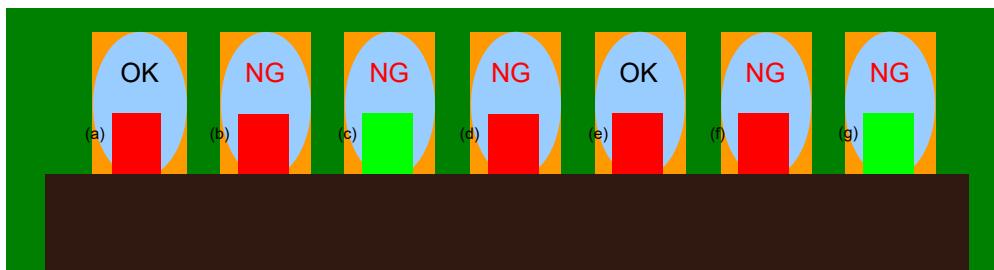
#### Lead used for measurement

Measurement is performed among the lead of the same direction in the same lead group. In the group configuration like below, for example, if the target lead is (c), lead (a) and (e) are used for measurement as the left-hand and right-hand ones, respectively.



#### Inspection results

This inspection judges two or more lead adjacent each other as NG simultaneously.



If the target lead is:

- (a), it is judged as OK because dispersion between it and the right-hand lead (b) is small.
- (b), it is judged as NG because dispersion between it and the right-hand lead (c) is large.
- (c), it is judged as NG because dispersion between it and the left-hand lead (b) is large.
- (d), it is judged as NG because dispersion between it and the left-hand lead (c) is large.
- (e), it is judged as OK because dispersion between it and the left-hand lead (d) is small and that between it and the right-hand lead (f) is small.
- (f), it is judged as NG because dispersion between it and the right-hand lead (g) is large.
- (g), it is judged as NG because dispersion between it and the left-hand lead (f) is large.

## 4.12 Lead Posture - Lead Side Bend

### ■ Overview

If a lead is bent horizontally against the PCB, the lead extrudes out of the land. Whether a lead is bent or not is inspected by difference of colors on the PCB due to lead bend.

\* This cannot be used for chip electrode, castellated electrode, non-lead, and insertion terminal.

OK Example: Lead not bent horizontally

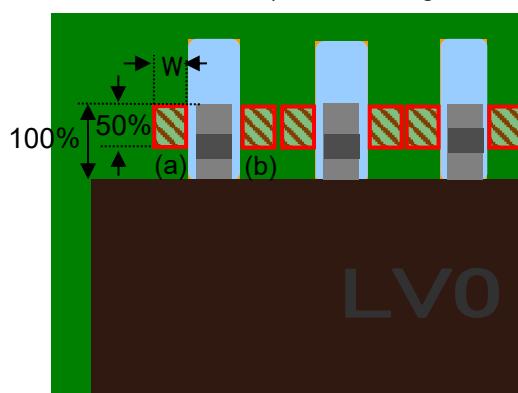


NG Example: Lead toe bent horizontally



### ■ Inspection Range

Shaded Areas Below (can be changed freely by detailed settings)



### ■ Characteristic Parameters

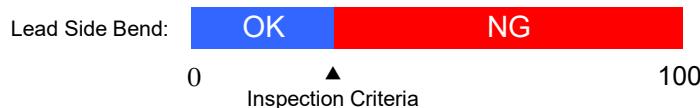
Lead Bend Color (lead color at fault)

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

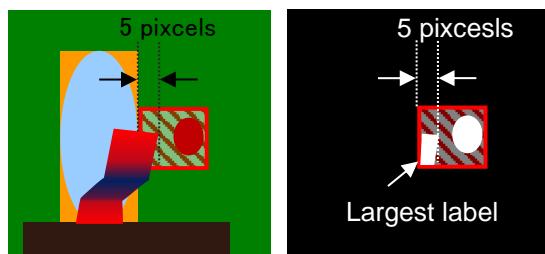
The item will be evaluated as good if the value is within the configured range. The available range for configuration is shown below.

Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Posture			
■ Lead Side Bend (%)	0 - <input type="text"/>		



**■ Processing Details**

1. The system extracts a pixel cluster (Label), which was extracted using the target color, in the Inspection Range.
2. Find the largest label within 5 pixels of the land window in the label extracted in "1."



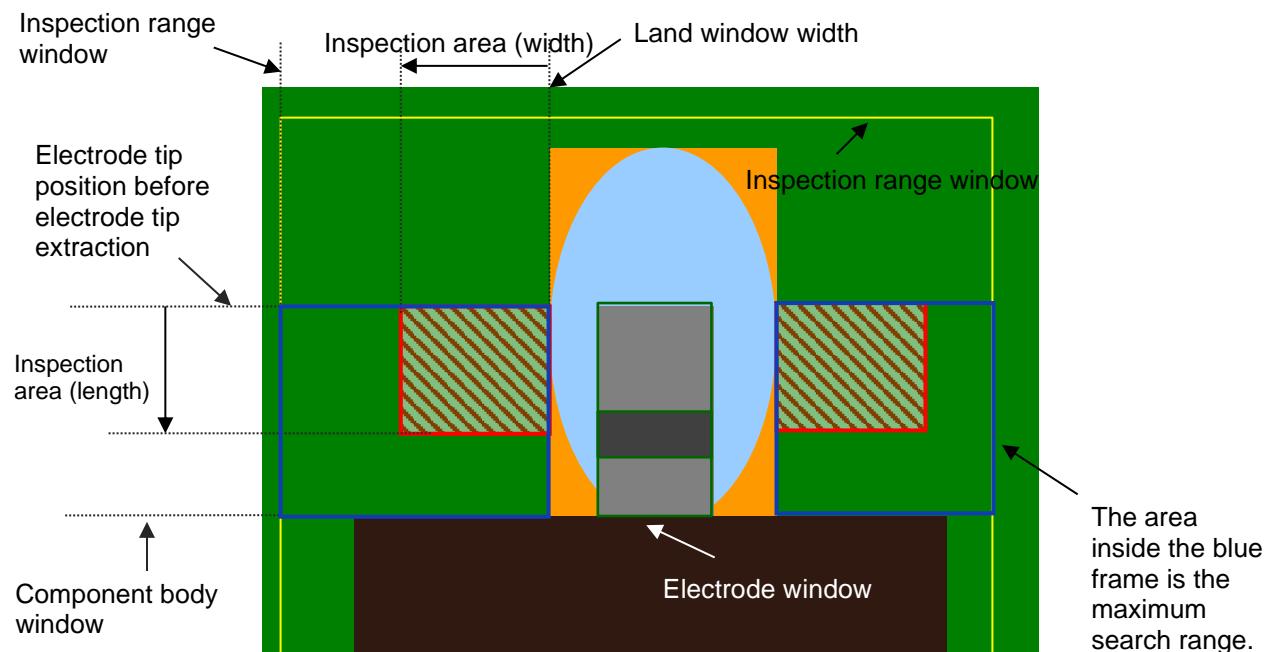
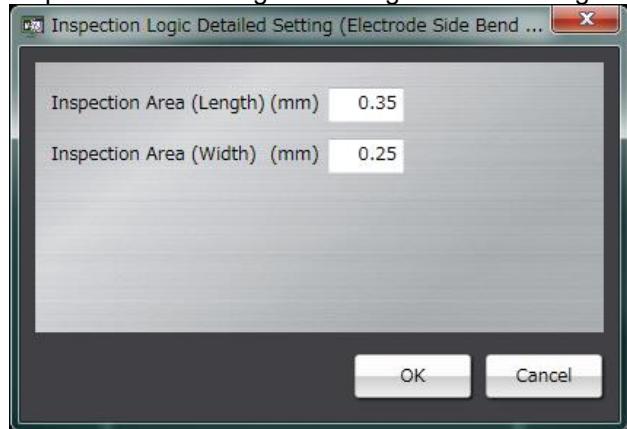
3. If the area of the maximum label obtained in "2." is larger than "Lead Side Bend (%)" in either of the inspection areas (a) and (b), it is judged as "Lead Posture (Lead Side Bend)".

If there is more than one lifted lead, the largest of the "Lead Side Bend (%)" will be displayed as the measured value. Note that all the measured values are provided as the inspection result.

<b>Fault Output</b>	: Lead Posture (Side Bend)
<b>Fault Code</b>	: 148

**Detailed settings for inspection area**

Inspection area's length and height can be changed freely by detailed settings.

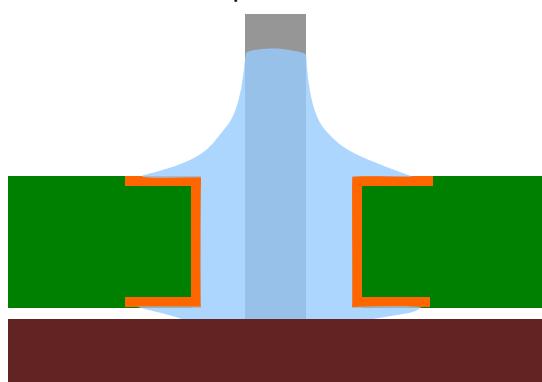


## 4.13 Lead Presence - Area

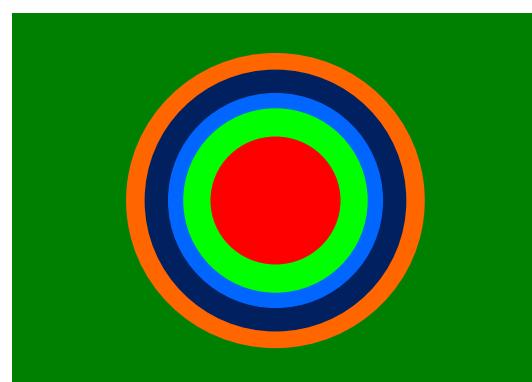
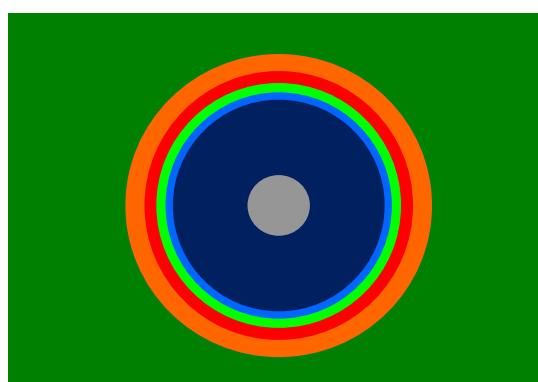
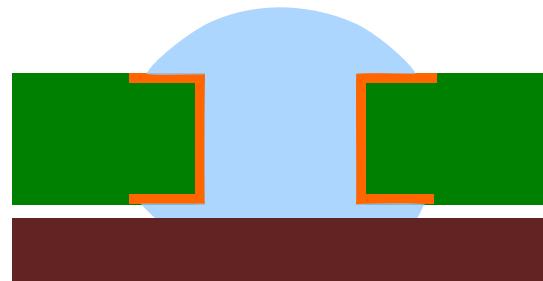
### ■ Outline

The system inspects colors appearing on the location where a lead is inserted to check for lead absence.  
\* Only used for insertion-type terminals and terminal leads.

OK Example: Lead Inserted

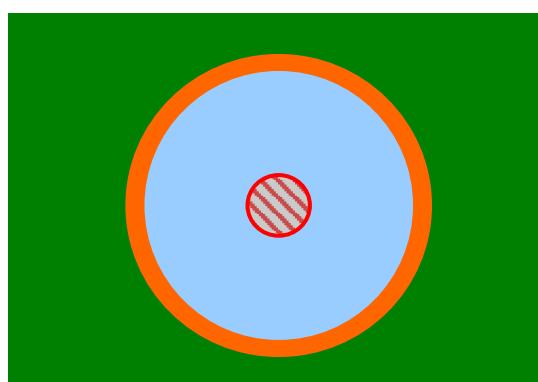


NG Example: Lead Not Inserted



### ■ Inspection Range

Shaded area in the illustration (Inscribed circle in an lead window)



### ■ Characteristic Parameter

Remaining colors of PCB, land and solder with lead colors removed

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

**■ Inspection Criteria**

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Presence			
Matching Rate (%)	■ - 100		

**■ Processing Detail**

The pixels matching the characteristic parameters are extracted from the inspection range. "Lead Absence" is output if the area ratio of the extracted pixels to the inspection range is smaller than the "Matching Rate (%)".

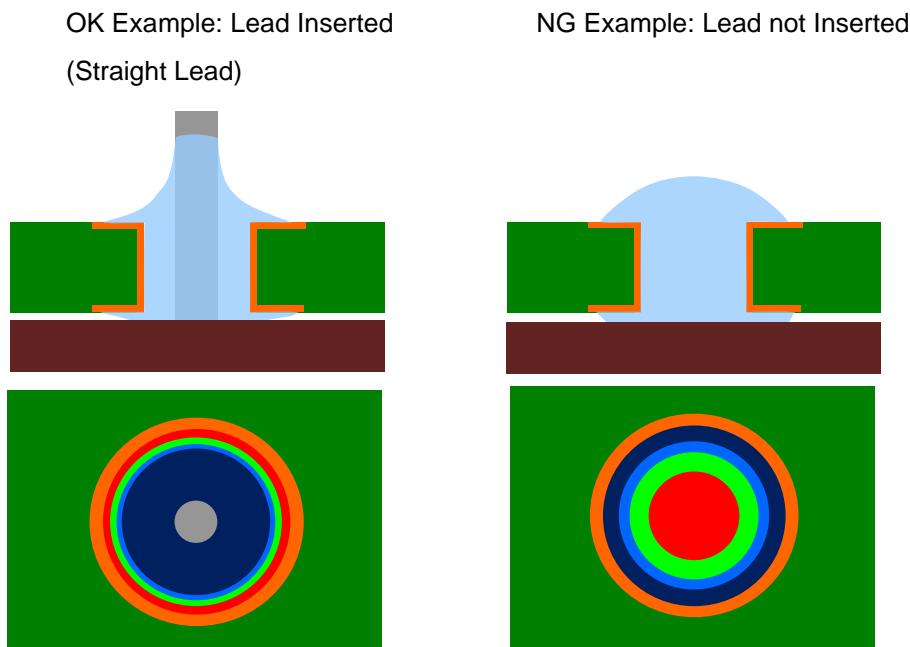
Fault Output : No Lead  
Fault Code : 146

## 4.14 Lead Presence - Center of Gravity

### ■ Outline

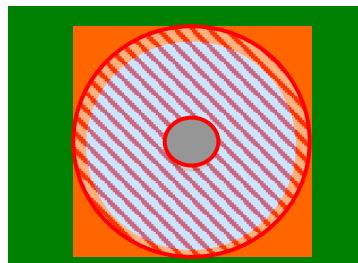
This system inspects the difference of solder shape to judge whether the lead is inserted or not. This is mainly used for straight leads.

\*This can be applied only to an insertion terminal.



### ■ Inspection Range

Shaded Areas Below Area Excluding Lead Window from Inscribed Circle of the Land Window



### ■ Characteristic Parameter

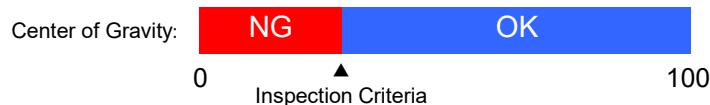
Solder Flat Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

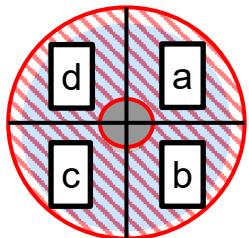
"OK" is output if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Presence				
■ Center of Gravity (%)			- 100	

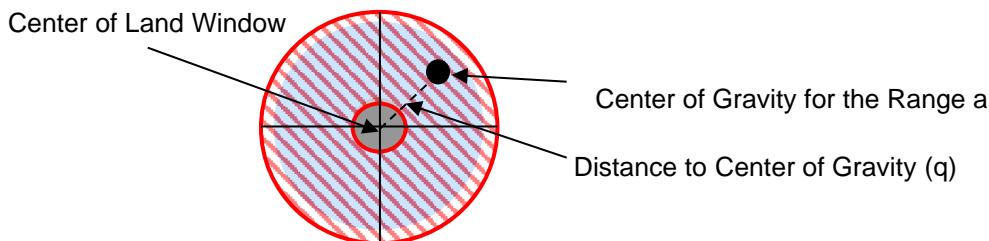


■ Processing Detail

1. The system obtains the center of gravity of pixels extracted using the target color in each Inspection Range (a, b, c, and d).



2. "Distance from the Center of Land Window to Center of Gravity (q) / Long radius of Ellipse of the Inspection Range (L) x 100" (%) is calculated in each Inspection Range (a, b, c, and d).



3. "No Lead (Center of Gravity)" is output if the maximum value of four values obtained in Step 2 is out of the set range of "Center of Gravity (%)." However the measurement value is set to "100" if no binarization is carried out.

**Fault Output: No Lead (Center of Gravity)**  
**Fault Code: 185**

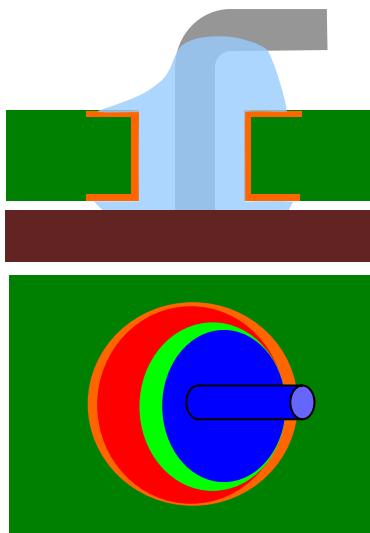
## 4.15 Lead Presence - Dispersion

### ■ Outline

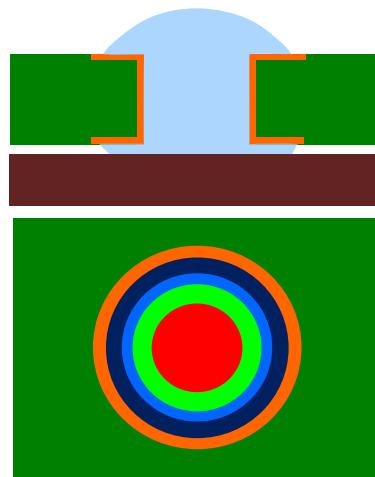
This system inspects the difference of solder shape to judge whether the lead is inserted or not. This is mainly used for clinch leads.

\*This can be applied only to an insertion terminal.

OK Example: Lead Inserted  
(Clinch Lead)

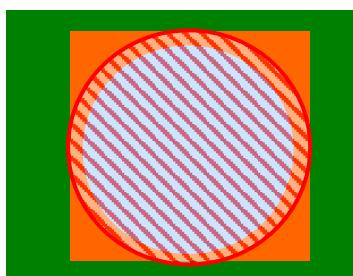


NG Example: Lead not Inserted



### ■ Inspection Range

Shaded Areas Below Area of Inscribed Circle of Land Window.



### ■ Characteristic Parameter

Solder Flat Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

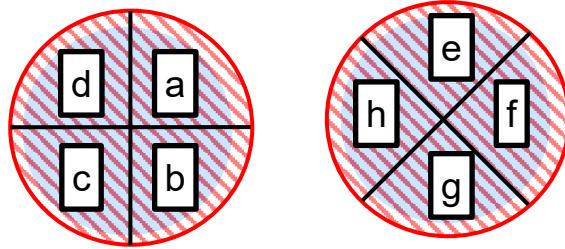
The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Presence			
■ Dispersion (%)			



### ■ Processing Detail

1. The system obtains the area rate of pixels extracted using the target color in each Inspection Range (a, b, c, d, e, f, g, and h).



2. "No Lead (Dispersion)" is output if the difference between the maximum and minimum values of the area rates obtained in b, c, d, e, f, g, and h is out of the set range of "Dispersion (%)."

**Fault Output: No Lead (Dispersion)**  
**Fault Code: 186**

## 4.16 Lead Bend

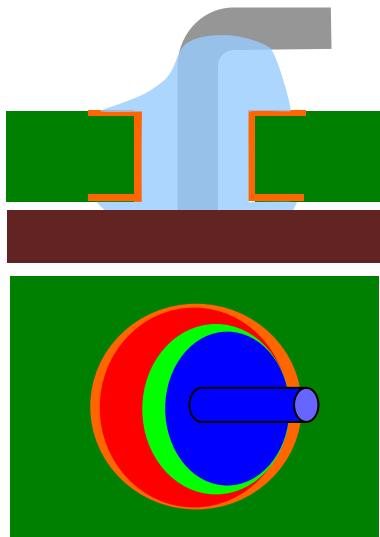
### ■ Outline

This system inspects the difference of colors appearing in a place where the lead should be inserted to judge whether the lead is inserted or not.

\*This can be applied only to an insertion terminal.

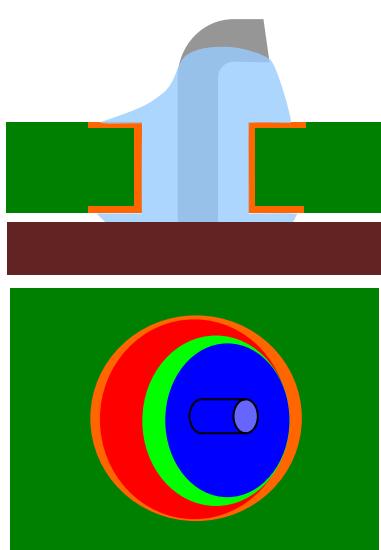
OK Example: Correct Lead Bend

Direction and Length



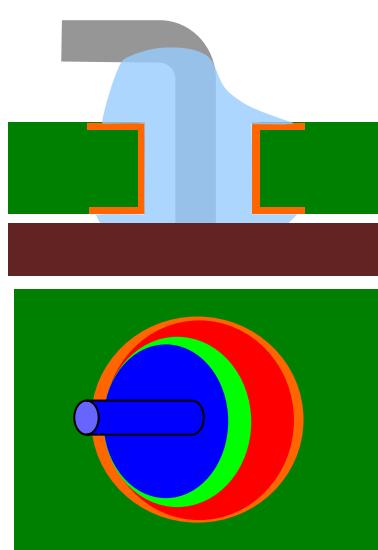
NG Example: Insufficient Lead

Bend Length



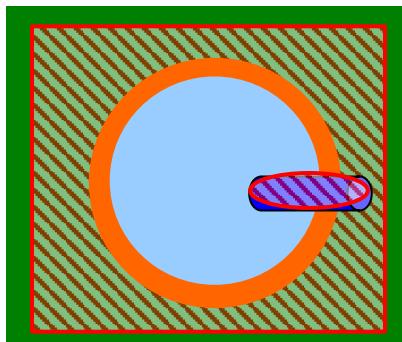
NG Example: Improper Lead Bend

Direction



### ■ Inspection Range

Shaded Areas Below. The area excluding the inscribed circle of the land window from the inspection area and the inscribed circle of the lead window



### ■ Characteristic Parameter

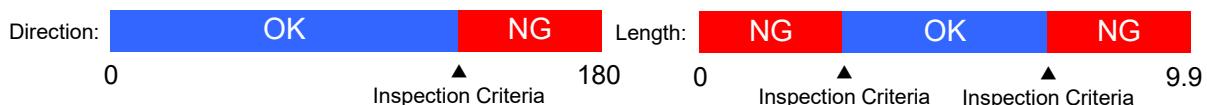
Lead Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

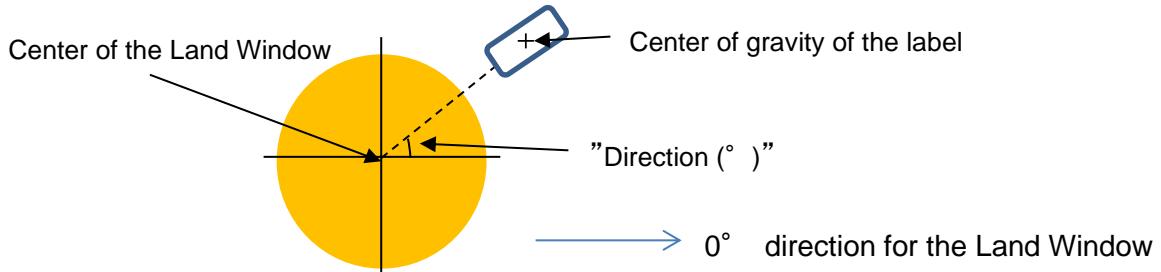
The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Bend				
Direction [Absolute Value] (°)	0	—	<input type="text"/>	
Direction [Signed] (°)				
Length (mm)	<input type="text"/>	—	<input type="text"/>	

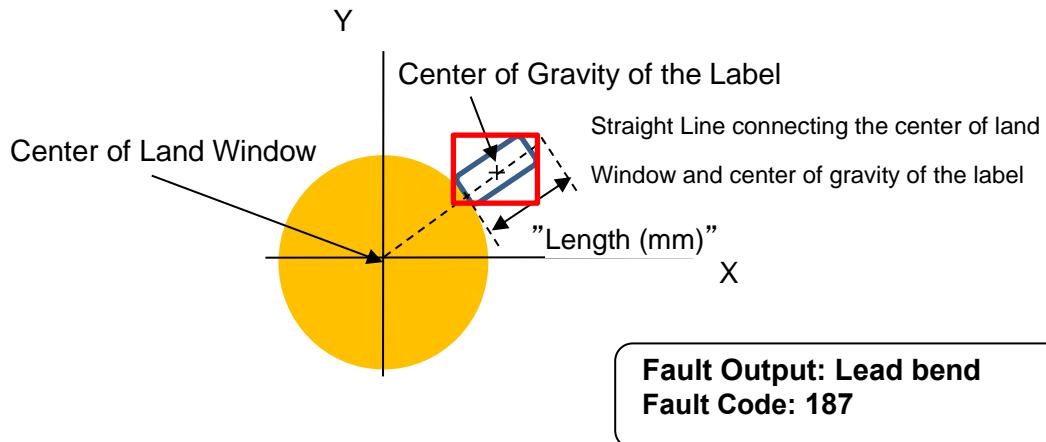


### ■ Processing Detail

1. The system extracts a pixel cluster (Label), which was extracted using the target color, in the Inspection Range.
2. The maximum label, which comes in contact with the inscribed circle of the Land window, is obtained for the label extracted in Step 1.
3. This becomes a candidate for the Lead Bend, if the angle between the straight line, which connects the center of the Land Window with the center of gravity of the maximum label obtained in Step 2, and 0° direction line of the Land Window is out of the set range of "Direction (Absolute Value: ° )."



- 
- 4. The system *depicts* a straight line, which connects the center of the Land Window with the center of gravity of the maximum label obtained in Step **2**.
  - 5. "Lead Bend" is output if the distance between the farthest (from the land) corner of the label circumscribed rectangle and the inscribed circle of the Land Window on the straight line obtained in Step **4** is out of set range of "Length (mm)."



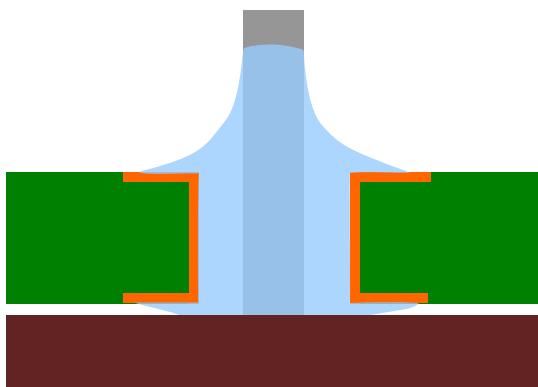
S1080 S1040  
S730 S530

## 4.17 Lead Height

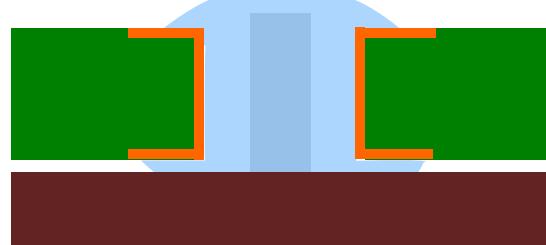
### ■ Outline

The system inspects colors appearing on the location where an lead is inserted to the sufficient height.  
\* Only used for insertion-type terminals and terminal leads.

OK Example:  
Lead Inserted to a sufficient height

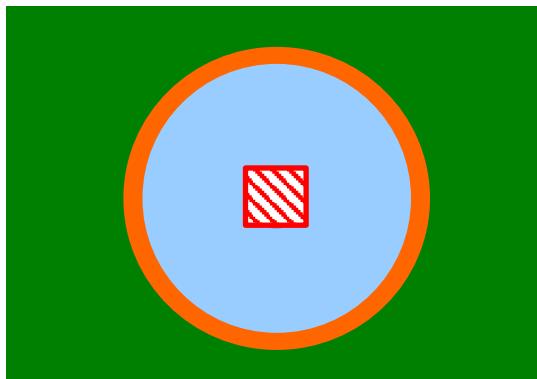


NG Example:  
Lead Not Inserted to a sufficient height



### ■ Inspection Range

Shaded area in the illustration (Inscribed circle in an lead window)



### ■ Characteristic Parameter

None

\*The result of 3D measurement inside the inspection range window is used.

### ■ Inspection Criteria

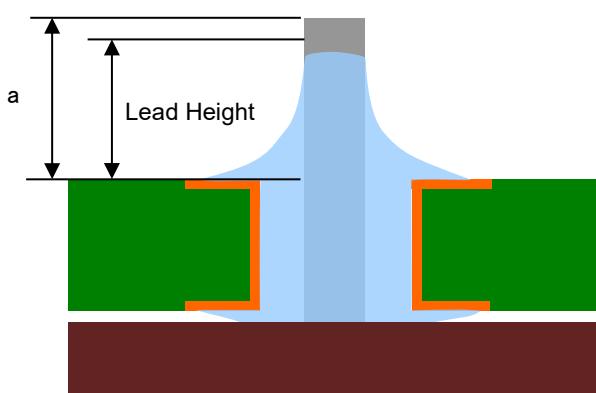
The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:



### ■ Processing Detail

1. Calculate the median value “a” in the height measured within the inspection range.
2. Obtain the “Lead Height” set by the teaching.
3. When the measurement height “a” obtained by 1. is within the set range of “Lead Height” set by the teaching, it is judged as OK product.
4. When the measurement height “a” obtained by 1. is larger than the set range of “Lead Height” set by the teaching, it is judged as “Lead Height: High,” and if it is smaller than the set range, it is judged as “Lead Height: Low.”

\*If the " Lead Height " set in teaching is not correct, the electrode may not be generated correctly. Therefore, if the electrode is not generated correctly, check if the set " Lead Height " is correct.



Fault Output	: Lead Height: High
Fault Code	: 158

Fault Output	: Lead Height: Low
Fault Code	: 159

# 5 Land Inspection

\* The description regarding the inspection logic is as follows.

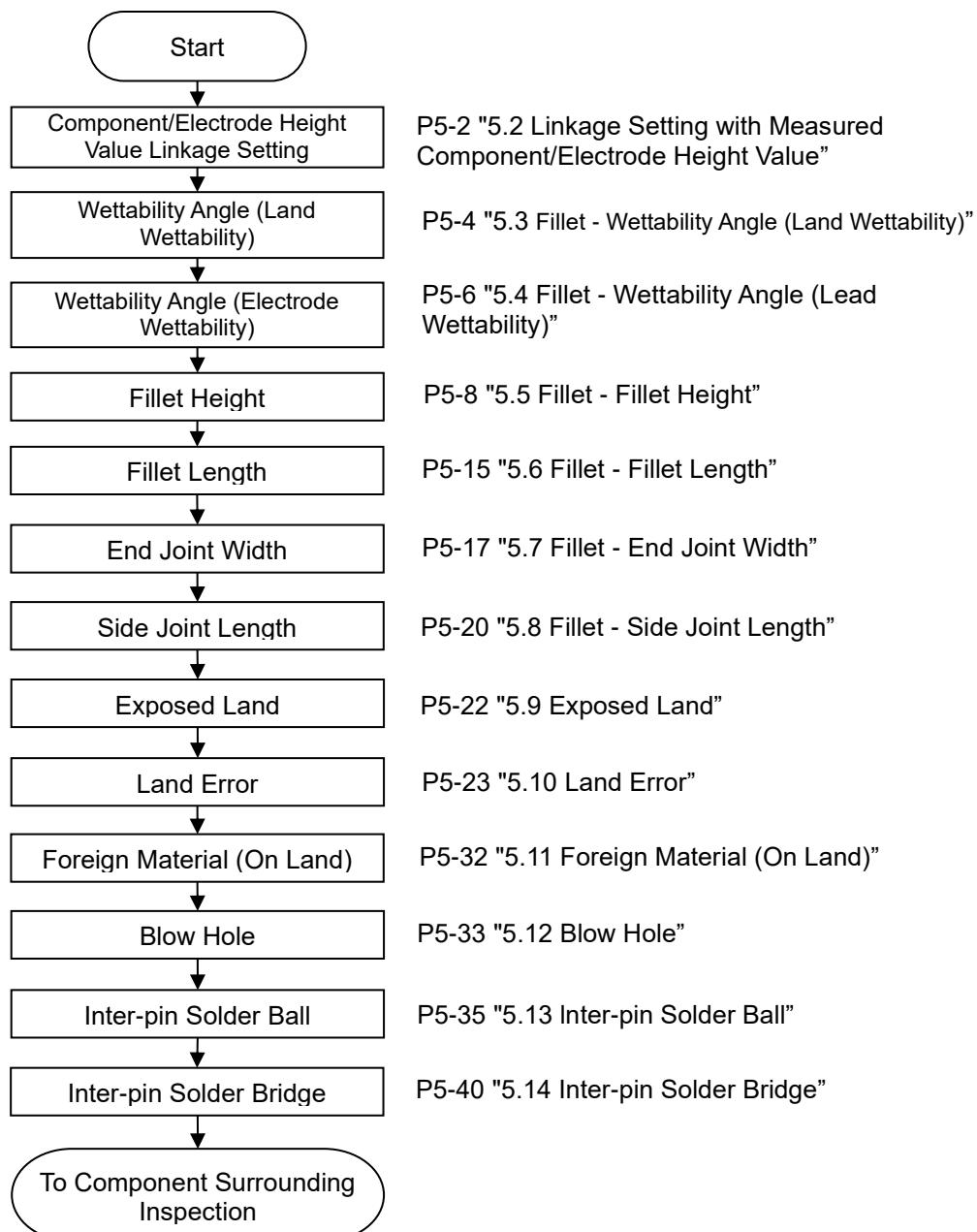
No symbol: Common for VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500,

**S1080** : S1080 **S1040** : S1040 **Z600** Z600 **S730** : S730-H/S730 **S720A** : S720A **S530** : S530 **S500** : S500

## 5.1 Flow of Land Inspection

This section describes the inspection logics used for Land inspection.

The following chart shows the flow of Land inspection. If there are shadows, secondary reflections from opposing parts, etc., or if foreign matter adheres to the surface, it may not be possible to make correct measurements.



S1080  
S1040  
S730  
S530

## 5.2 Linkage Setting with Measured Component/Electrode Height Value

### ■ Outline

You can configure the basis of fillet inspection; the 3-dimensional result of component/electrode height or the component/electrode information configured upon teach-in.

### ■ Inspection Range

Not Specified

### ■ Characteristic Parameter

Not Specified

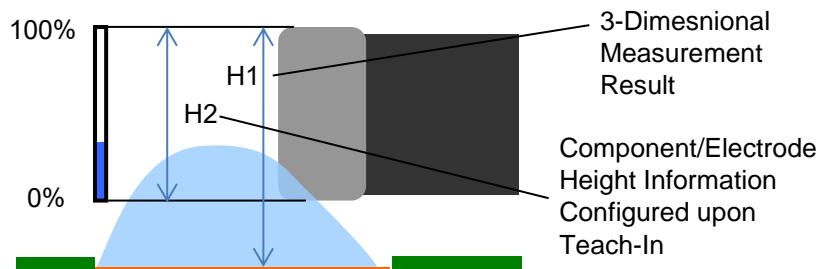
### ■ Inspection Criteria

Inspection Item	Setting Value	Measurement Value	Judge
■ Fillet Inspection			
Linked to the measured values of component/electrode height	<input checked="" type="radio"/> Yes	<input type="radio"/> No	

### ■ Processing Detail

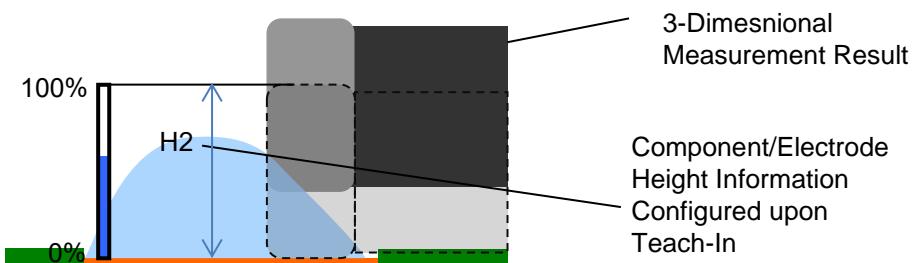
#### [Case: To be Linked]

1. Acquire a 3-dimensional measurement result of component/electrode.
2. Acquire H2, the height information of the component and electrode set at teaching.
3. Use the position obtained by subtracting H2 (acquired in Step 2.) from H1 (acquired in Step 1.) for the standard (0%) of the Fillet Height Inspection.



#### [Case: Not to be Linked]

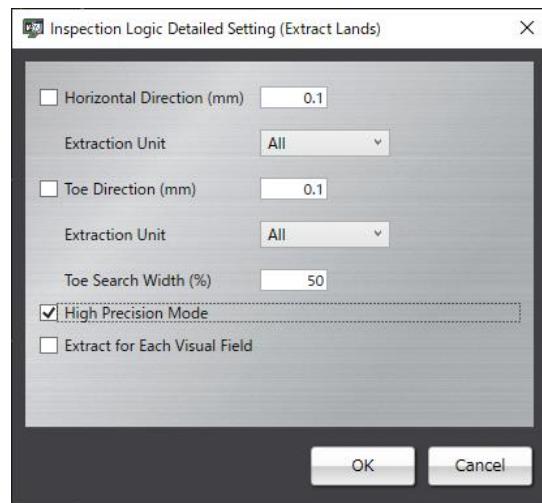
1. Acquire the component/electrode height information configured upon teach-in.  
Use the height information acquired in Step 1 as the fillet inspection height criteria.



**Detailed Settings (Gull wing lead, Chip termination (except for MELF Component)**

You can configure the solder shape recovery algorism used for fillet inspection.

Using the high-precision mode makes it less susceptible to secondary reflections.



Note the followings when using the "High Precision Mode".

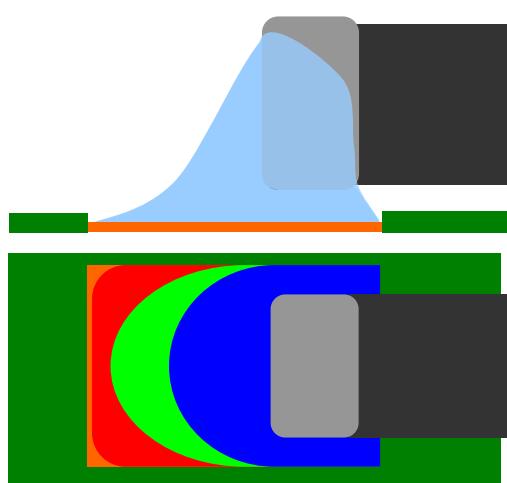
Inspection time may be longer depending on the number of leads and component placement in the component number for which high-precision mode is applied.

## 5.3 Fillet - Wettability Angle (Land Wettability)

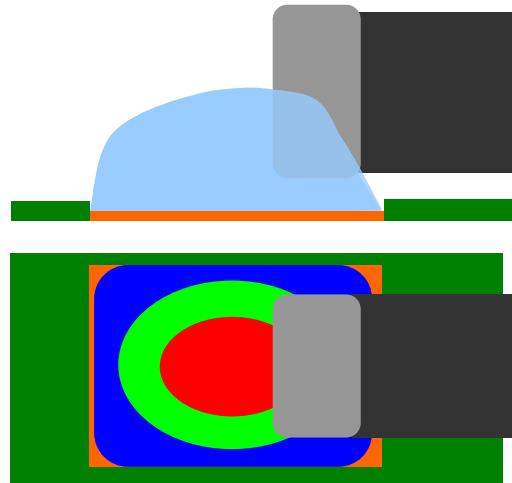
### ■ Outline

This system inspects the solder color detected in the Land Window to judge if sufficient solder is applied to the land.

OK Example: Sufficient Soldering



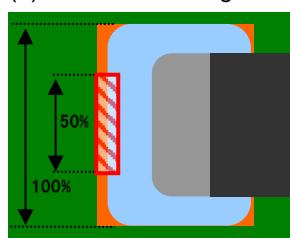
NG Example: Insufficient Soldering



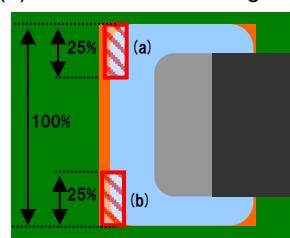
### ■ Inspection Range

Shaded Areas Below

(1) Center of the Edge



(2) Both Ends of the Edge



### ■ Characteristic Parameter

Fillet-Excluded Colors (Other colors than fillet, e.g. pad)

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
<input checked="" type="checkbox"/> Wettability Angle			
<input checked="" type="checkbox"/> Land Wettability			
<input checked="" type="checkbox"/> Center ( )	<input type="text"/>	—	<input type="text"/>
<input checked="" type="checkbox"/> Both Ends ( )	<input type="text"/>	—	<input type="text"/>



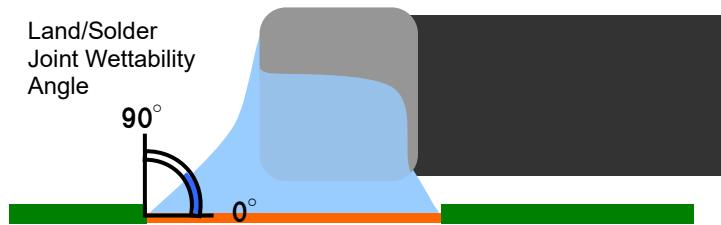
### ■ Processing Detail

#### Selecting Center of the Edge Inspection

"Wettability Error (Land)" is output if the joint angle between the land and solder in the inspection range is larger than the "Center ( )" or there is no solder applied in the inspection range.

#### Selecting Both Ends of the Edge Inspection

"Wettability Error (Land)" is output if the joint angle between the land and solder in either of inspection ranges (a) and (b) is larger than the "Both Ends ( )" or there is no solder applied in any of inspection ranges (a) and (b).



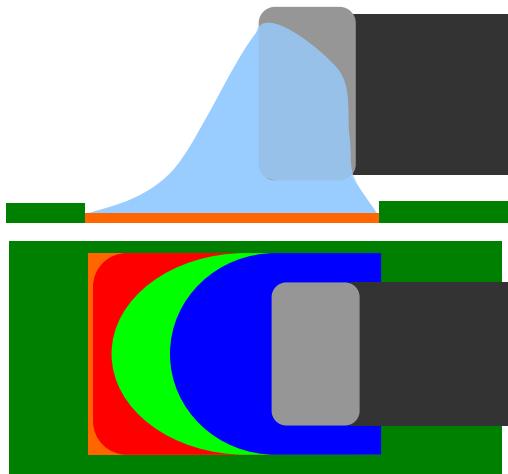
Fault Output: Wettability Error (Land)  
Fault Code: 160

## 5.4 Fillet - Wettability Angle (Lead Wettability)

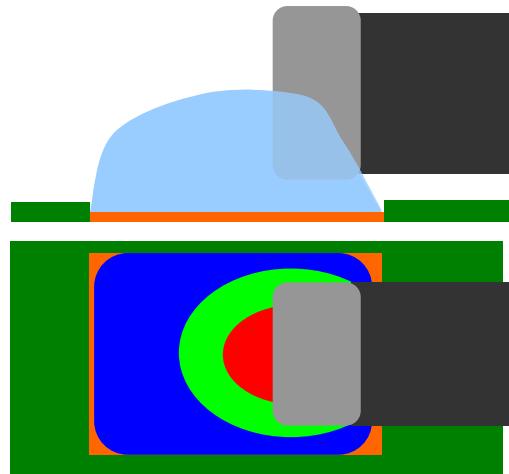
### ■ Outline

This system inspects the solder color detected in the Land Window to judge if sufficient solder is applied to the electrodes.

OK Example: Sufficient Soldering



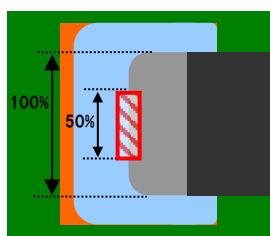
NG Example: Insufficient Soldering



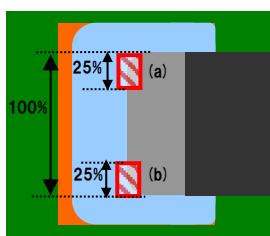
### ■ Inspection Range

Shaded Areas Below

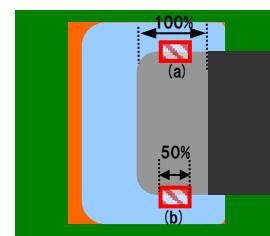
(1) Center Of Toe



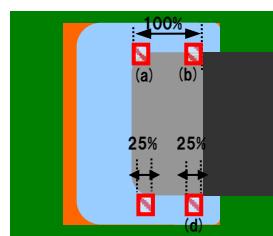
(2) Both Ends of Toe



(3) Center of Side



(4) Both Ends of Side



### ■ Characteristic Parameters

Fillet-Excluded Colors (Other colors than fillet, e.g. pad)

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

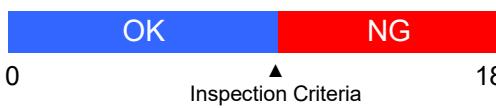
Inspection Item	Setting Value	Measurement Value	Judge
■ Wettability Angle			
■ Component Wettability			
■ Center Of Toe ( )	0	-	<input type="text"/>
■ Both Ends Of Toe ( )	0	-	<input type="text"/>
■ Center Of Side ( )	0	-	<input type="text"/>
■ Both Ends Of Side ( )	0	-	<input type="text"/>

Center Of Toe:

Both Ends of Toe:

Center of Side:

Both Ends of Side:



### ■ Processing Detail

#### Selecting Center Of Toe Inspection

"Wettability Error (Electrode End)" is output if the joint angle between the electrodes end and solder in the inspection range is larger than the "Center Of Toe ( )" or Not Inspected "-" is output if there is no solder applied in the inspection range.

#### Selecting Both Ends of Toe Inspection

"Wettability Error (Electrode End)" is output if the joint angle between the electrodes end and solder in either of inspection ranges (a) and (b) is larger than the "Both Ends Of Toe ( )" or Not Inspected "-" is output if there is no solder applied in any of inspection ranges (a) and (b).

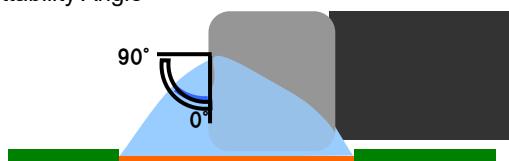
#### Selecting Center of Side Inspection

"Wettability Error (Electrode Side)" is output if the joint angle between the electrodes end and solder in either of inspection ranges (a) and (b) is larger than the "Center Of Side ( )" or Not Inspected "-" is output if there is no solder applied in any of inspection ranges (a) and (b).

#### Selecting Both Ends of Side Inspection

"Wettability Error (Electrode Side)" is output if the joint angle between the electrodes end and solder in any of inspection ranges (a), (b), (c) and (d) is larger than the "Both Ends Of Side ( )" or Not Inspected "-" is output if there is no solder applied in any of inspection ranges (a), (b), (c) and (d).

Electrodes  
End/Solder Joint  
Wettability Angle



**Fault Output: Wettability Error (Electrode End)**  
**Fault Code: 161**

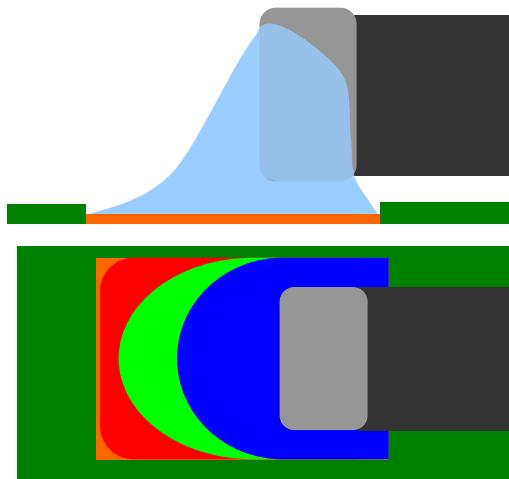
**Fault Output: Wettability Error (Electrode Side)**  
**Fault Code: 162**

## 5.5 Fillet - Fillet Height

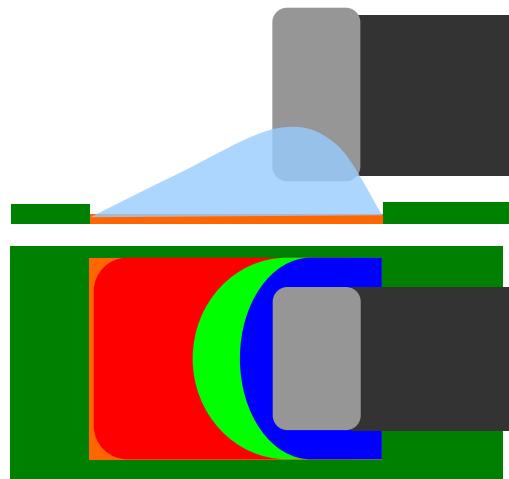
### ■ Outline

This system inspects if the fillet height is sufficient based on the solder color detected in the Land Window.

OK Example: Sufficient Fillet Height



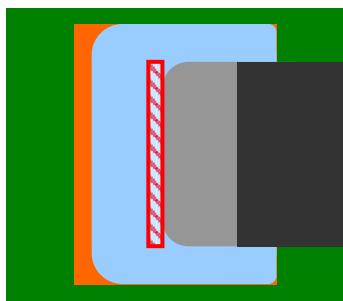
NG Example: Insufficient Fillet Height



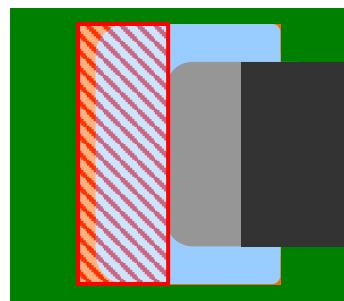
### ■ Inspection Range

Shaded Area Below

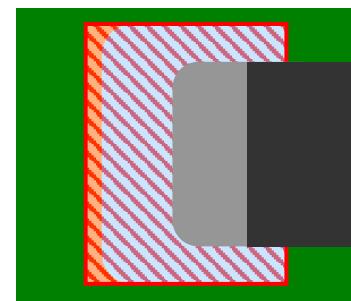
①Joint Block Height



②Maximum Height



③Height Specified Block



### ■ Characteristic Parameter

Fillet-Excluded Colors (Other colors than fillet, e.g. pad)

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the setting value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
<b>Fillet Height</b>			
Joint Block Height (%)	—	—	
Maximum Height (%)	—	—	
Height Specified Block			
Type	<input checked="" type="radio"/> Ave. Height <input type="radio"/> Max. Height		
Height (%)	—	—	
Height (mm)	—	—	
Inspection Area (Size)			
Unit	<input checked="" type="radio"/> % <input type="radio"/> mm		
Inspection Area (Position)			
Follow Electrode End			
Follow Electrode Side			

Joint Block Height:

Maximum Height

Height Specified Block (Height (%))



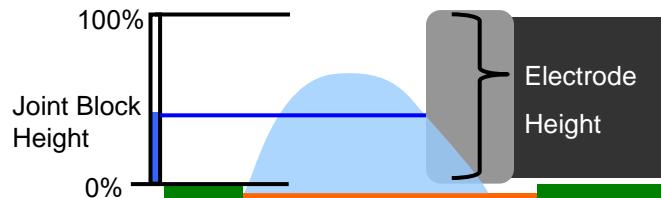
Height Specified Block (Height (mm))



### ■ Processing Details in the inspection area

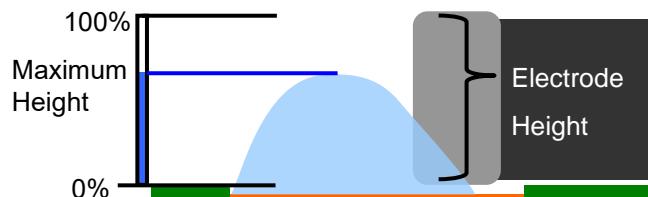
#### If Joint Block Height is selected:

If the maximum solder height is smaller than the lower limit of "Joint Block Height (%)" where the electrode height as 100%, it is judged as "Fillet Low." It is judged as "Fillet High" if it is larger than the upper limit.



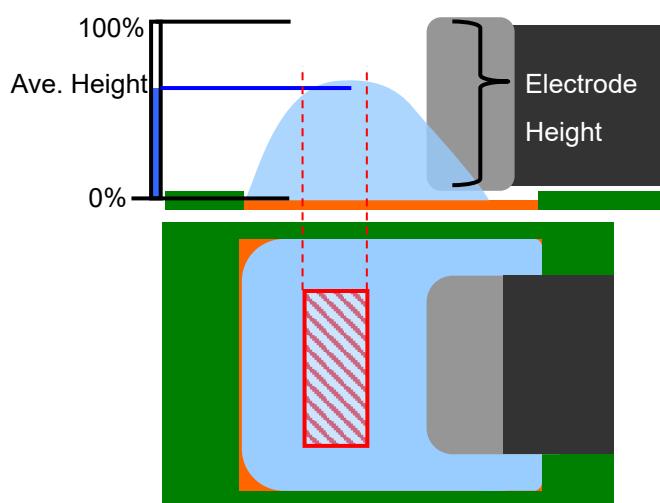
#### If Maximum Height is selected:

If the maximum solder height is smaller than the lower limit of "Max Height (%)" where the electrode height as 100%, it is judged as "Fillet Low." It is judged as "Fillet High" if it is larger than the upper limit.



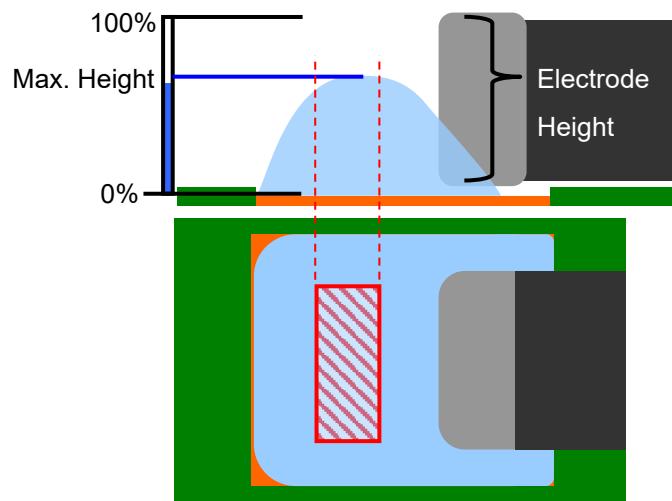
#### If Height Specified Block (Ave. Height ( )) is selected:

If the average solder height is smaller than the lower limit of "Height (%)" where the electrode height specified during teaching is defined as 100%, it is judged as "Fillet Low." It is judged as "Fillet High" if it is larger than the upper limit.

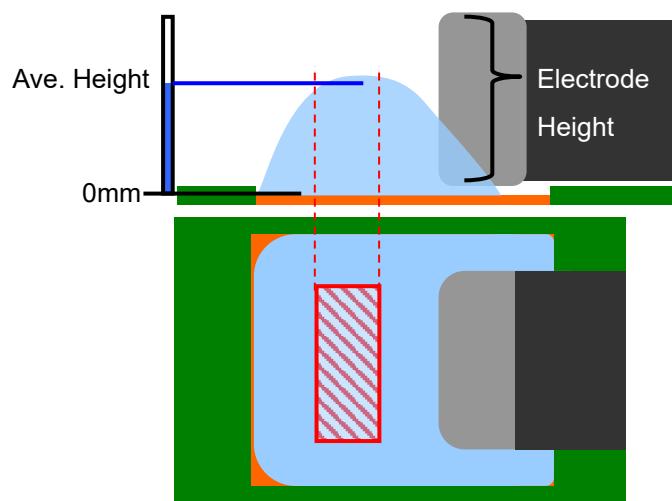


**If Height Specified Block (Max. Height ( )) is selected:**

If the maximum solder height is smaller than the lower limit of "Height (%)" where the electrode height specified during teaching is defined as 100%, it is judged as "Fillet Low." It is judged as "Fillet High" if it is larger than the upper limit.

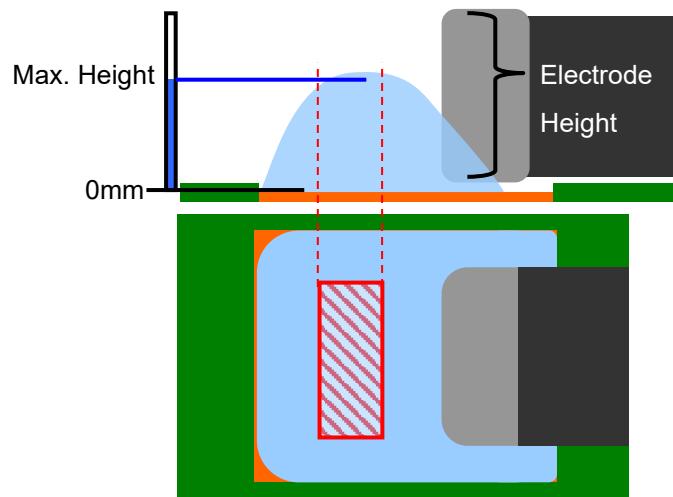
**If Height Specified Block (Ave. Height (mm)) is selected:**

If the average solder height is smaller than the lower limit of "Height (mm)," it is judged as "Fillet Low." It is judged as "Fillet High" if it is larger than the upper limit.



**If Height Specified Block (Max. Height (mm)) is selected:**

If the maximum solder height is smaller than the lower limit of "Height (mm)," it is judged as "Fillet Low." It is judged as "Fillet High" if it is larger than the upper limit.



**Fault Output: Low Fillet  
Fault Code: 163**

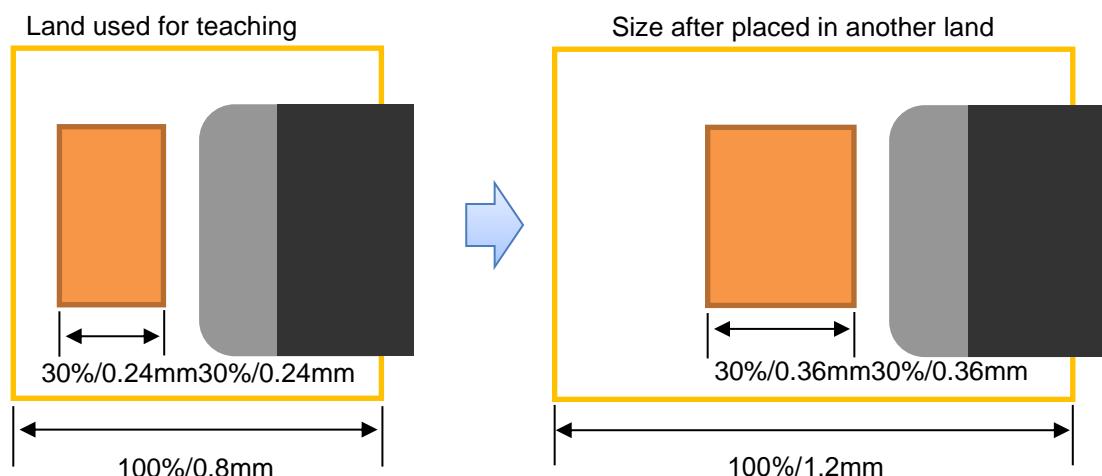
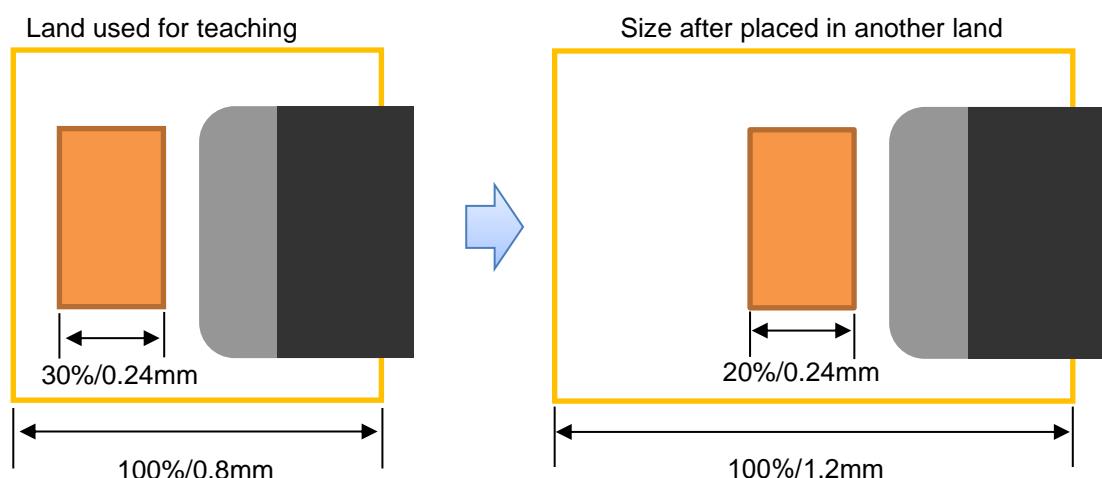
**Fault Output: High Fillet  
Fault Code: 164**

**Inspection Area (Size):**

When using the “Inspection Area (Size)” item, it is able to select the size according to which the area is placed in another land based on the land which was used to create the inspection area when teaching was conducted.

If placing the inspection area as keeping the same rate between the size of the land window used to create that area and the size of the inspection area, select “%” for the unit. If placing the inspection area in the same size irrelevant to the size of the land window which was used to create that area, select “mm” for the unit.

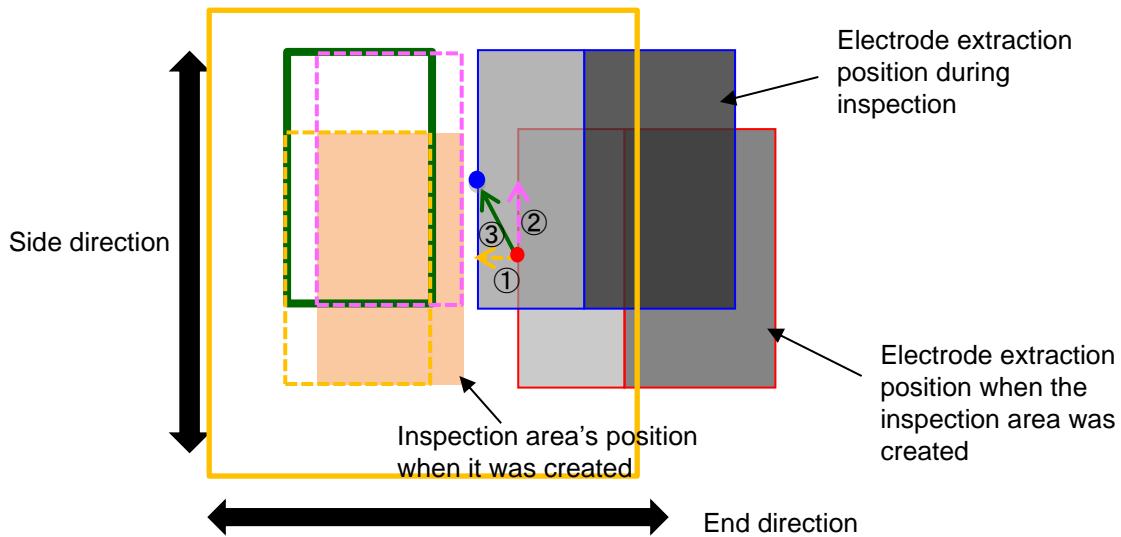
As an example, the figures below show the size when the inspection area is placed in another land after selecting % for unit, and the size after selecting mm for unit.

**Ex.) If selecting % for unit****Ex.) If selecting mm for unit**

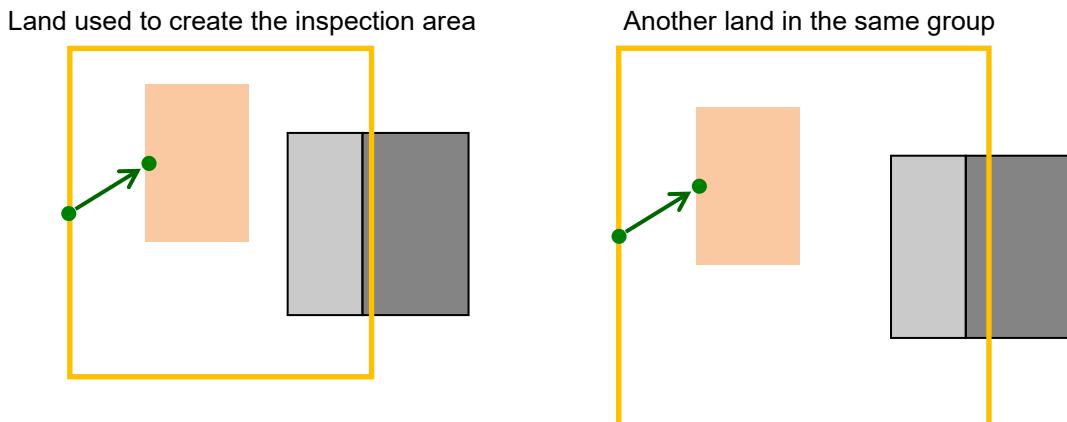
**Inspection Area (Position):**

If setting the Follow Electrode End/Side item ON, the inspection area follows the electrode extraction position.

In the figure below, when the red circle (indicating the central position of the electrode tip after the electrode tip is extracted from the land/electrode which was used to create that area) is moved to the blue circle (indicating the central position of the electrode tip after the electrode is extracted during inspection), if “Follow Electrode End” is ON, the area is moved in the direction by the distance indicated by arrow ①. If “Follow Electrode Side” is ON, the area is moved in the direction by the distance indicated by arrow ②. If both “Follow Electrode End” and “Follow Electrode Side” are ON, the area is moved in the direction by the distance indicated by arrow ③.



If both Follow Electrode End and Follow Electrode Side are set OFF, the inspection area is placed in another land at the position where the positional relation between the tip central position of the land which was used to create the inspection area and that inspection area is kept.

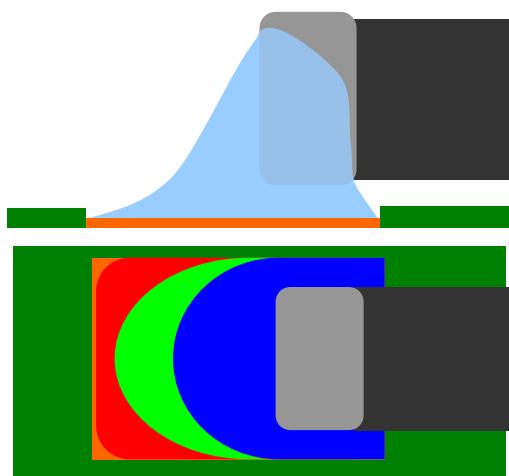


## 5.6 Fillet - Fillet Length

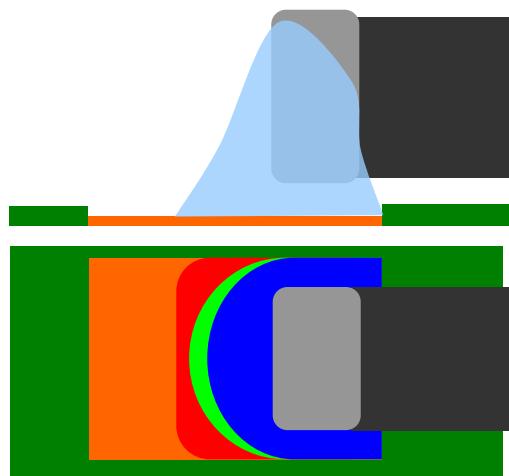
### ■ Outline

This system inspects the solder color detected in the Land Window to judge if the fillet length is sufficient to the land length.

OK Example: Sufficient Fillet Length

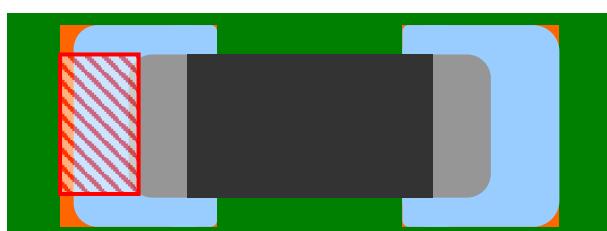


NG Example: Insufficient Fillet Length



### ■ Inspection Range

Shaded Area Below (Electrodes End Front)



### ■ Characteristic Parameter

Fillet-Excluded Colors (Other colors than fillet, e.g. pad)

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

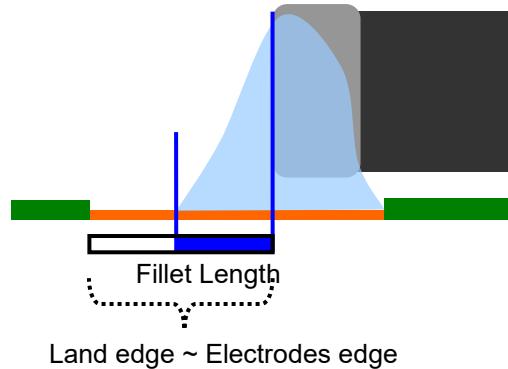
The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
	■ Fillet Length (%)	<input type="text"/>	— 100	



■ Processing Detail

"Short Fillet" is output if the ratio of the maximum length from the electrodes edge to the fillet edge in the inspection range to the length from the electrodes edge to the land edge (100%) is smaller than the "Fillet Length (%)".



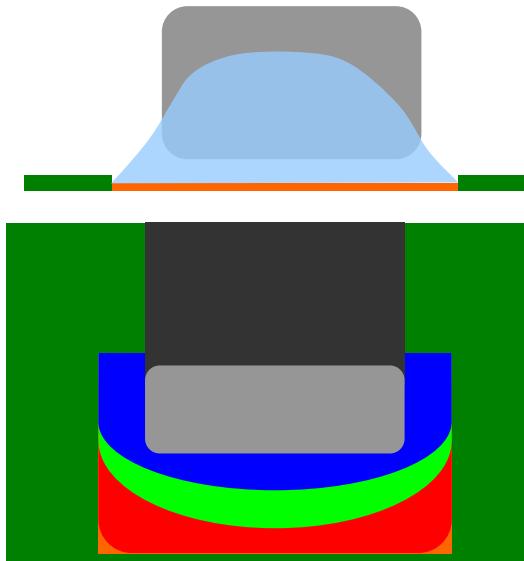
Fault Output: Short Fillet  
Fault Code: 165

## 5.7 Fillet - End Joint Width

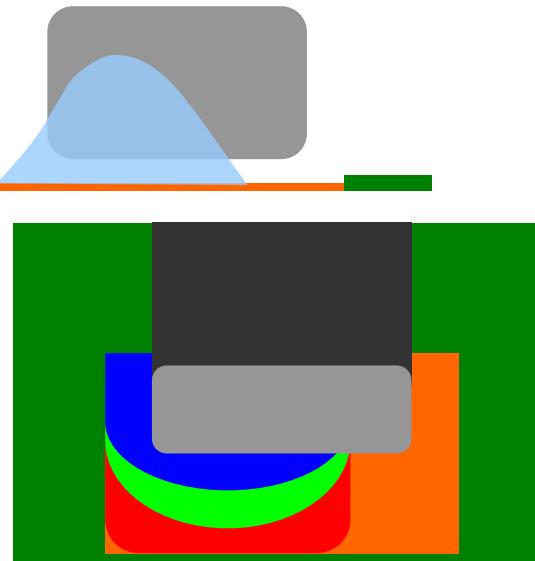
### ■ Outline

This system inspects the solder color detected in the Land Window to judge if the fillet joint width is sufficient to the electrodes end.

OK Example: Sufficient Fillet Joint Width

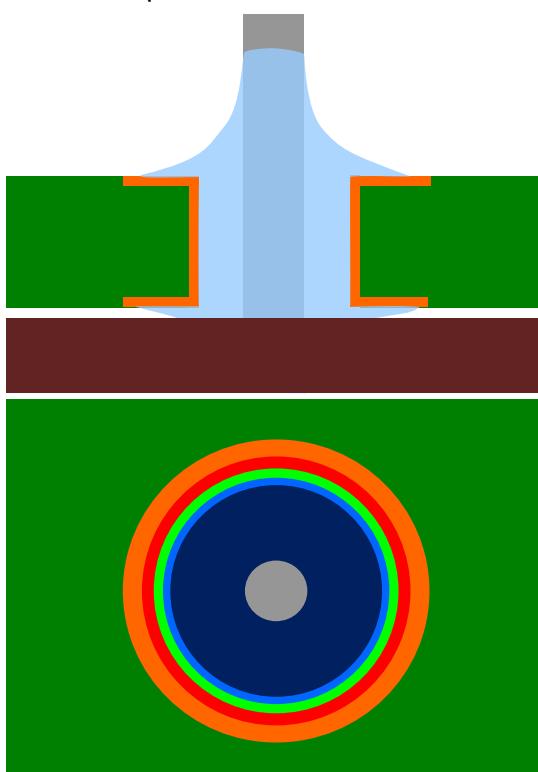


NG Example: Insufficient Fillet Joint Width

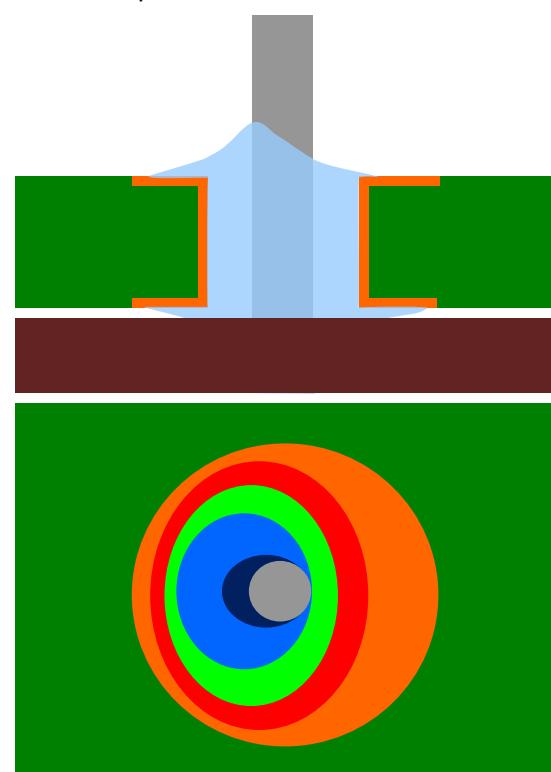


### Example) Insertion-Type Terminal

OK Example: Sufficient Fillet Joint Width



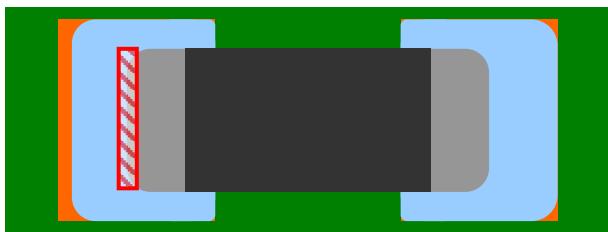
NG Example: Insufficient Fillet Joint Width



## ■ Inspection Range

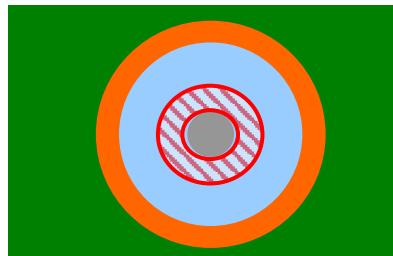
### Insertion-Type Terminal except

Shaded Area Below (Electrode Toes Front)



### Insertion-Type Terminal

Shaded Area Below (Outer Terminal Circumference)



## ■ Characteristic Parameter

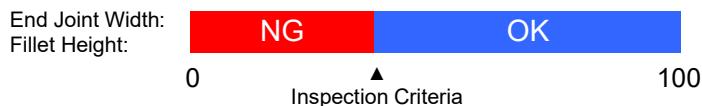
Fillet-Excluded Colors (Other colors than fillet, e.g. pad)

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

## ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

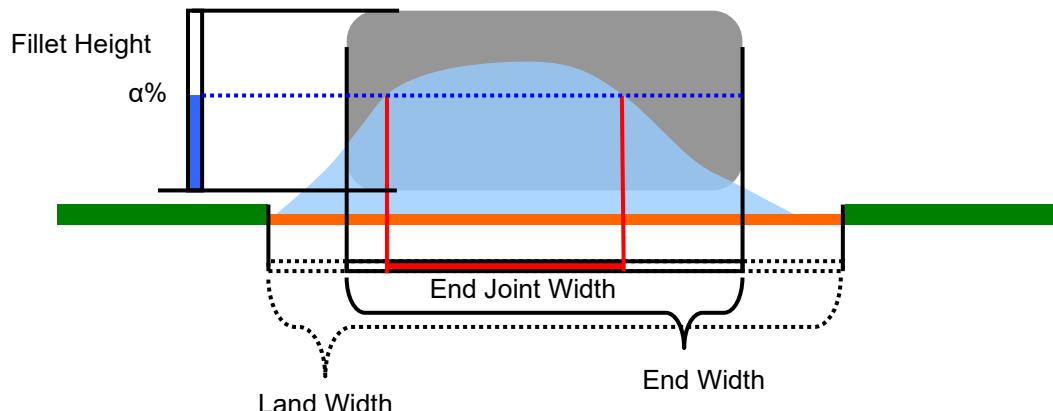
	Inspection Item	Setting Value	Measurement Value	Judge
■ Fillet Joint Length				
■ End Joint Width (%)	<input type="text"/>	—	100	
Fillet Height (%)	<input type="text"/>	—	100	



## ■ Processing Detail

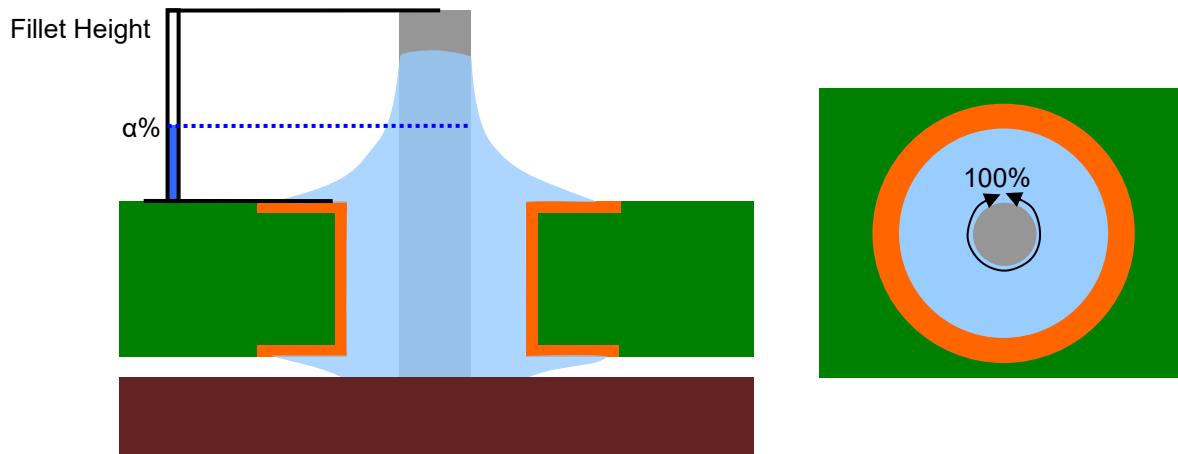
### Insertion-Type Terminal except

1. The system measures the end joint width at a point equal to  $\alpha\%$  of the "Fillet Height" in the inspection range.
2. "Short End Joint Width" is output if the ratio of the end joint width obtained in Step 1 to either the smaller of the end width and land width (100%) is smaller than the "End Joint Width (%)" . The same judgment is also output if there is no soldering applied in the inspection window.



#### Insertion-Type Terminal

1. The system measures the end joint width at a point equal to  $\alpha\%$  of the "Fillet Height" in the inspection range.
2. "Short End Joint Width" is output if the ratio of the end joint width obtained in Step 1 to the terminal outer circumference (100%) is smaller than the "End Joint Width (%)" . The same judgment is also output if there is no soldering applied in the inspection window.



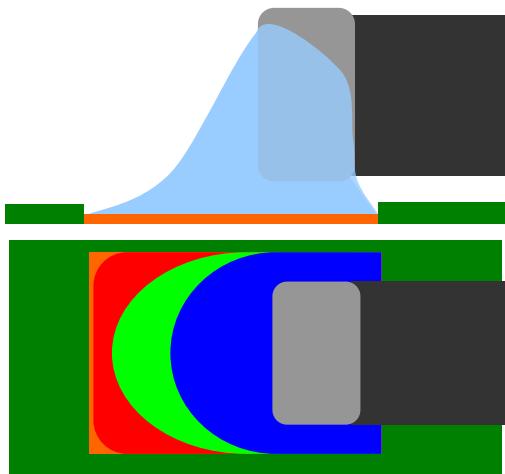
**Fault Output: Short End Joint Width  
Fault Code: 166**

## 5.8 Fillet - Side Joint Length

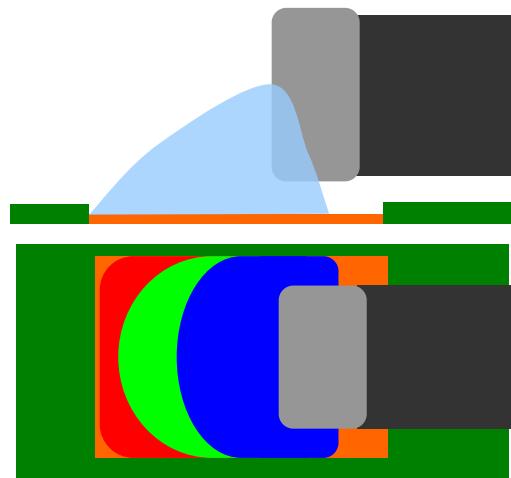
### ■ Outline

This system inspects the solder color detected in the Land Window to judge if the fillet joint length is sufficient to the electrodes side.

OK Example: Sufficient Fillet Joint Length

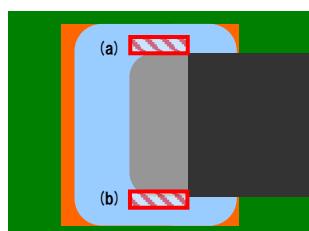


NG Example: Insufficient Fillet Joint Length

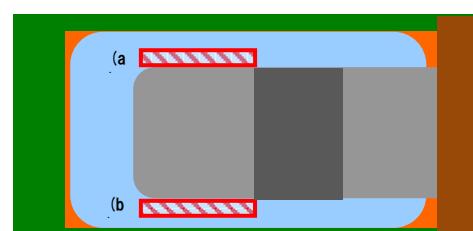


### ■ Inspection Range

Shaded Areas Below (Electrodes Side Front)  
Except Gull Wing Leads



Gull Wing Leads



### ■ Characteristic Parameter

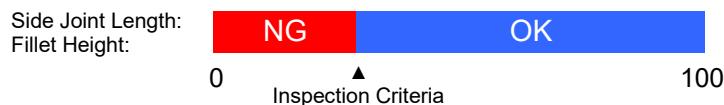
Fillet-Excluded Colors (Other colors than fillet, e.g. pad)

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

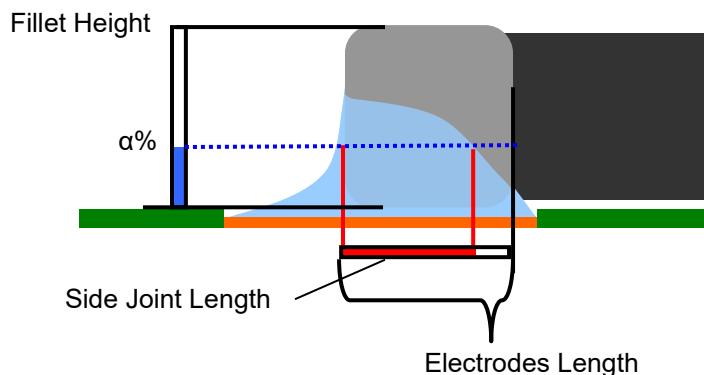
The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
■ Fillet Joint Length			
■ Side Joint Length (%)		— 100	
Fillet Height (%)		— 100	



### ■ Processing Detail

1. The system measures the side joint length at a point equal to  $\alpha\%$  of the "Fillet Height" individually in inspection ranges (a) and (b).
2. "Short Side Joint Length" is output if either ratio of the side joint lengths obtained in Step 1 to the lead length (100%) is shorter than the "Side Joint Length (%)" . The same judgment is also output if there is soldering applied in neither of inspection window (a) or (b).



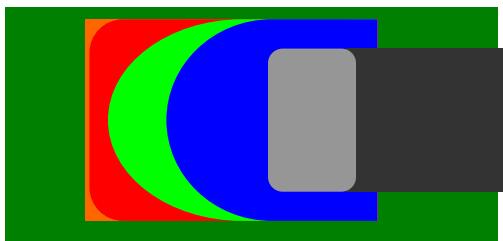
**Fault Output: Short Side Joint Length**  
**Fault Code: 167**

## 5.9 Exposed Land

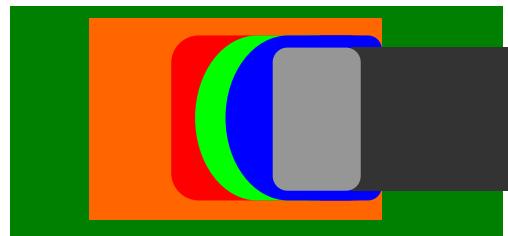
### ■ Outline

This system inspects the land color detected in the Land Window to judge if the basis metal is exposed.

OK Example: Basis Metal Not Exposed



NG Example: Basis Metal Exposed



### ■ Inspection Range

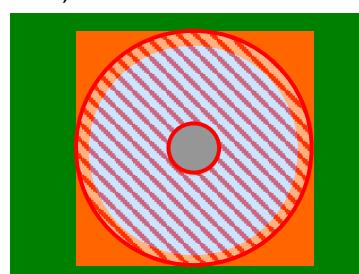
#### Insertion-Type Terminal except

Shaded Area Below (Remaining colors of land with component and electrode colors removed)



#### Insertion-Type Terminal

Shaded Area Below (Remaining colors of land window inscribed circle with inserted electrode colors removed)



### ■ Characteristic Parameter

#### Exposed Land Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
	■ Exposed Basis Metal (%)	0 -	<input type="text"/>	



### ■ Processing Detail

The pixels matching the characteristic parameters are extracted from the inspection range. "Exposed Basis Metal" is output if the ratio of the extracted pixel area to the inspection range area is larger than the "Exposed Basis Metal (%)".

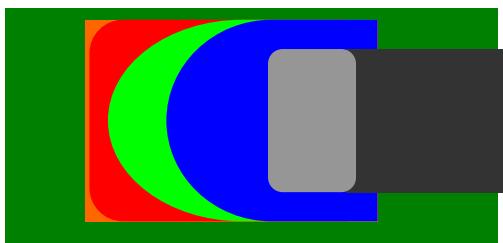
Fault Output: Exposed Basis Metal  
Fault Code: 168

## 5.10 Land Error

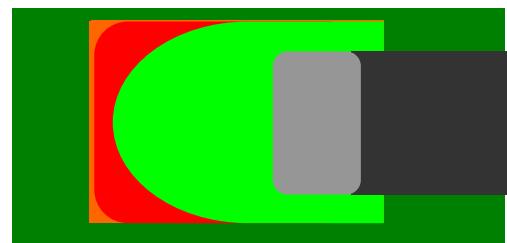
### ■ Outline

Inspection is made whether a land is normal or not for unusual colors detected in the land window.

OK Example: No Land Error found



NG Example: Land Error found

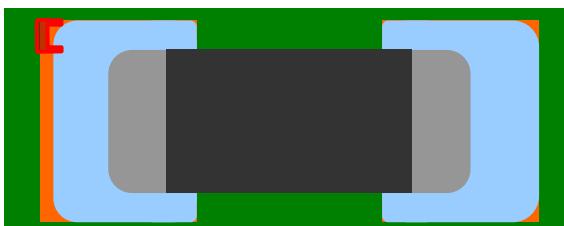


### ■ Inspection Range

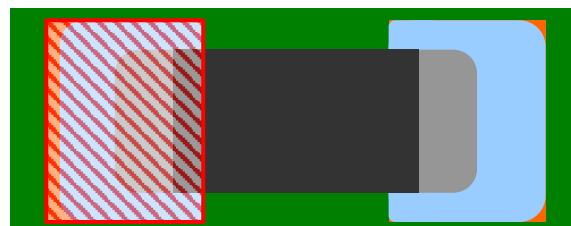
#### Other than insertion terminal

Shaded area below

(a) [ExcludeForComponentAndElectrode] ON



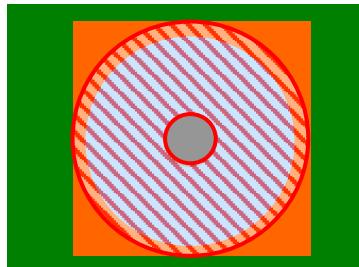
(b) [ExcludeForComponentAndElectrode] OFF



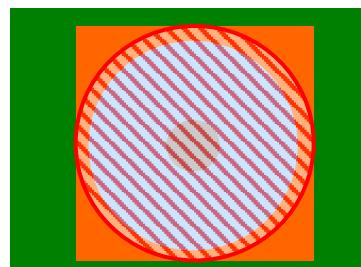
#### Insertion Terminal

Shaded area below (inscribed circle of Land Window excluding components and electrodes)

(a) [ExcludeForComponentAndElectrode] ON



(b) [ExcludeForComponentAndElectrode] OFF



### ■ Characteristic Parameter

#### Land Error Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
■ Land Error				
■ Setting 1 (%)		—		
■ FollowLeadEnd				
■ FollowLeadSide				
■ Specify Distance (mm)				
■ ExcludingComponentAndLead				
■ Fixed Lead Side				
■ Land Plane Exclusion				
Width (%)				
Length (mm)				
■ Setting 10 (%)		—		
■ FollowLeadEnd				
■ FollowLeadSide				
■ Specify Distance (mm)				
■ ExcludeForComponentAndLead				
■ Fixed Lead Side				
■ Land Plane Exclusion				
Width (%)				
Length (mm)				



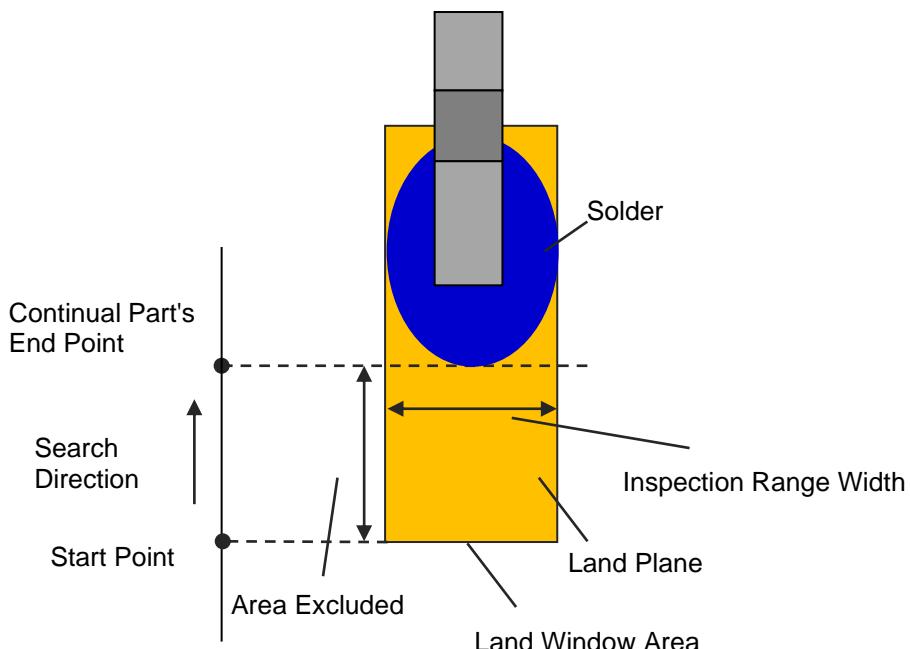
### ■ Processing Detail

If an area of pixels extracted for the characteristic parameter in the inspection range is larger than [Land Error (%)], it is judged as "Land Error". If there is more than one Land Error, the largest of the "Land Error (%)" will be displayed as the measured value.

Fault Output: Land Error  
Fault Code: 169

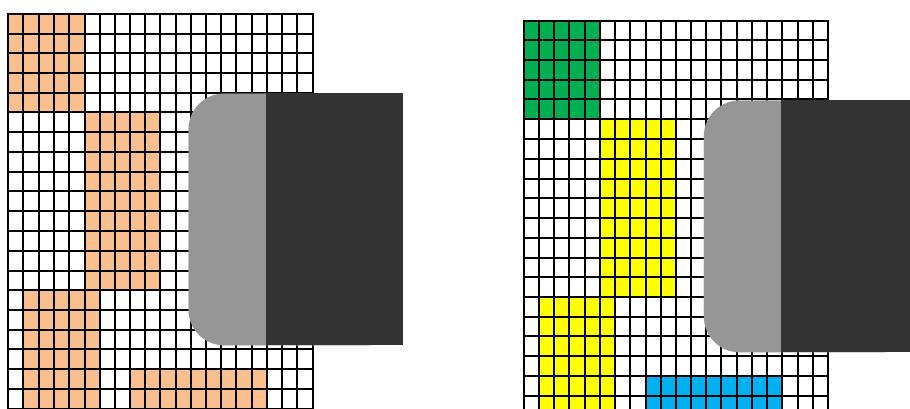
### Land Plane Exclusion

In the inspection area, the part where the width of the pixel extracted by the target color is equal to or larger than "Width (%)" of the inspection area width and which continues more than "Length (mm)" is determined as the land plane, and the land plane is excluded from the land window area. The excluded area is replaced with a land window area and used for subsequent inspection. If no land plane is detected, the land window range will not be changed.



### Note for Inspection Area

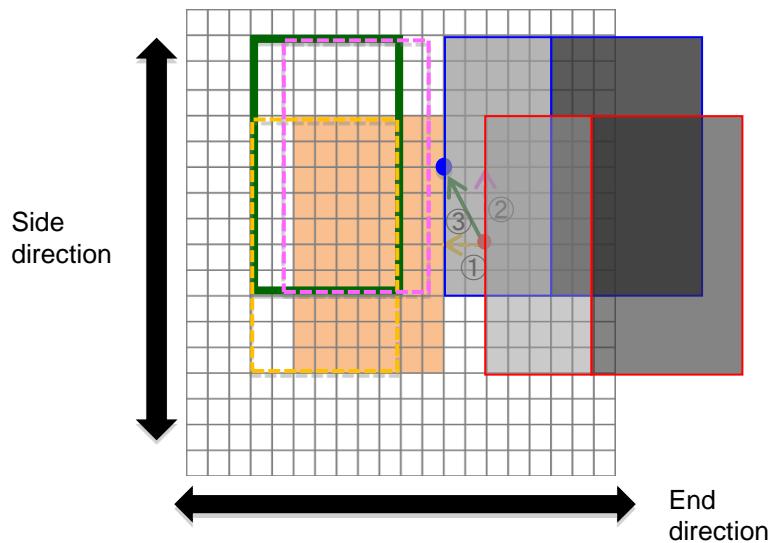
In the Land Window, inspection ranges can be configured as many as you want in any shapes. Blocks that adjoins horizontally or vertically are handled as one inspection range. The figures shown below indicate configured inspection ranges (left) and actual inspection ranges (right). Inspection is done for the actual inspection ranges.



### Follow Electrode End and Follow Electrode Side

Turning ON the FollowElectrodeEnd and FollowElectrodeSide follows the inspection range to the extraction position of the electrode. In the following chart, if it is moved from ● (the electrode tip)

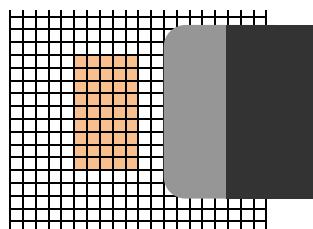
central position before electrode extraction) to ● (the electrode tip central position after electrode extraction), turning on “Follow ElectrodeEnd” moves the direction and volume of (1). Turning on “FollowElectrodeSide” moves the direction and volume of (2). Turning on both “Follow ElectrodeEnd” and “Follow Electroside” moves the direction and volume of (3).



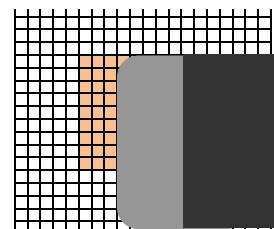
---

If the inspection range is set as below, the example shows the inspection range to be actually inspected.

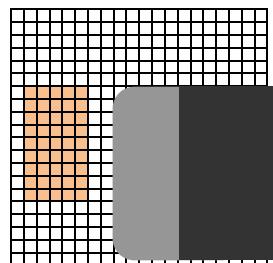
Configured inspection area



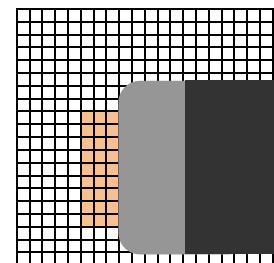
FollowElectrodeSide: OFF



FollowElectrodeEnd: ON,  
FollowElectrodeSide: OFF



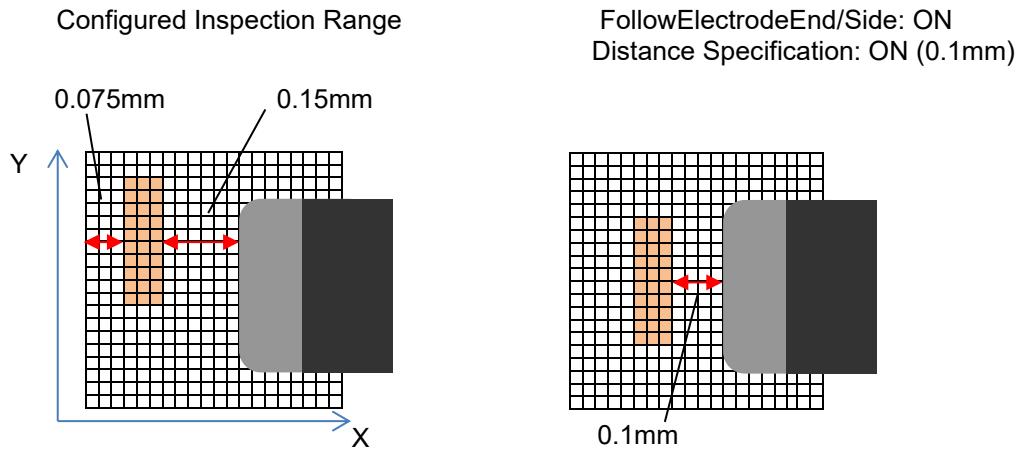
FollowElectrodeEnd: OFF,  
FollowElectrodeSide: ON



When FollowElectrodeEnd and FollowElectrodeSide are set to ON, sometimes the inspection range may protrude over the land window. When this happens, the protruded range is not used for the inspection.

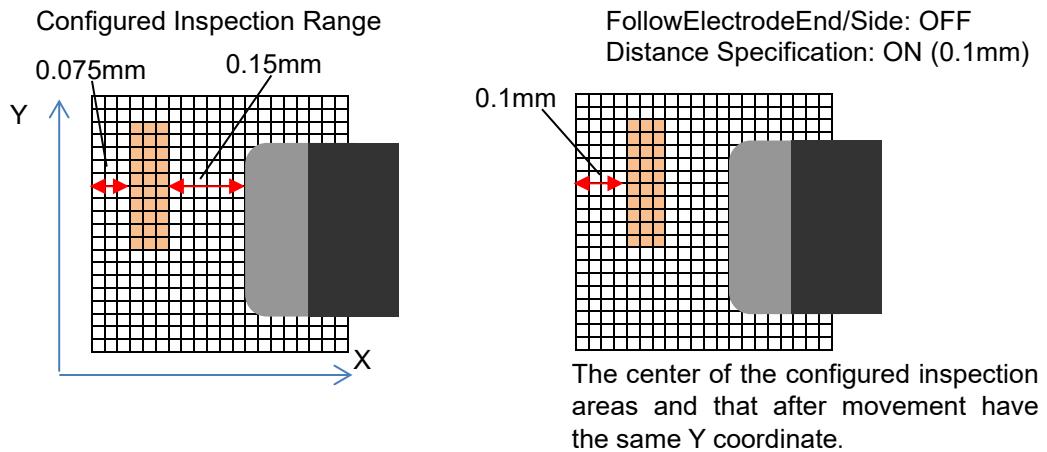
### Distance Specification

If either FollowElectrodeEnd or FollowElectrodeSide is ON and Distance Specification is ON, the inspection is performed moving the inspection range from the electrode tip position to the specified distance, regardless of the inspection range position configured upon teach-in.



The center of the electrode end and that of inspection areas after movement have the same Y coordinate.

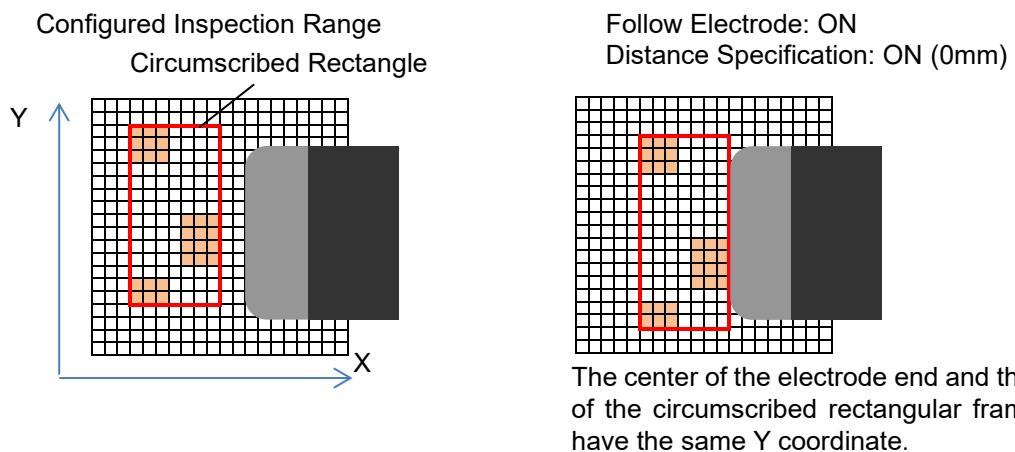
If both FollowElectrodeEnd and FollowElectrodeSide are OFF and Distance Specification is ON, the inspection is performed moving the inspection range from the land tip position to the specified distance, regardless of the inspection range position configured upon teach-in.



The center of the configured inspection areas and that after movement have the same Y coordinate.

### Distance Specification for Multiple Inspection Areas being Configured

If either FollowElectrodeEnd or FollowElectrodeSide is ON and Distance Specification is ON while multiple inspection ranges are being configured, the inspection is performed moving the inspection ranges in the circumscribed rectangular frame from the electrode tip position to the specified distance. In such a case, the center of the electrode end and that of the circumscribed rectangular frame have the same Y coordinate. If both FollowElectrodeEnd and FollowElectrodeSide are OFF and Distance Specification is OFF, the inspection is performed moving the inspection ranges in the circumscribed rectangular frame from the land tip position to the specified distance. In such a case, the center of the circumscribed rectangular frame of the inspection ranges and that after the movement have the same Y coordinate.



### Inspection Area Length with Distance Specification ON

If the distance specification is ON, the inspection is performed deploying the inspection range length of a terminal, with the shortest land length in the same component and same electrode group, to other terminal of the same electrode group. The inspection range widths are determined by the land size of respective terminal. As a consequence, inspection ranges of one electrode group have the same length but different widths.

### Fixed Lead Side

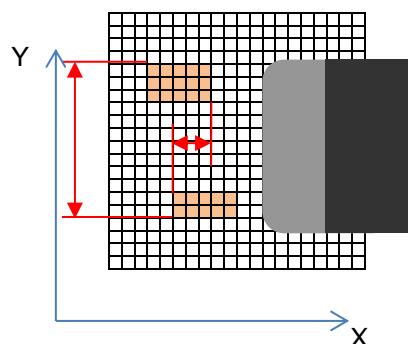
When "Fixed Lead Side" is ON, the inspection area in the land width direction is created in the position specified by the cell regardless of the electrode window position.

When "Fixed Lead Side" is ON and "FollowLeadSide" is ON, "FollowLeadSide" is invalid.

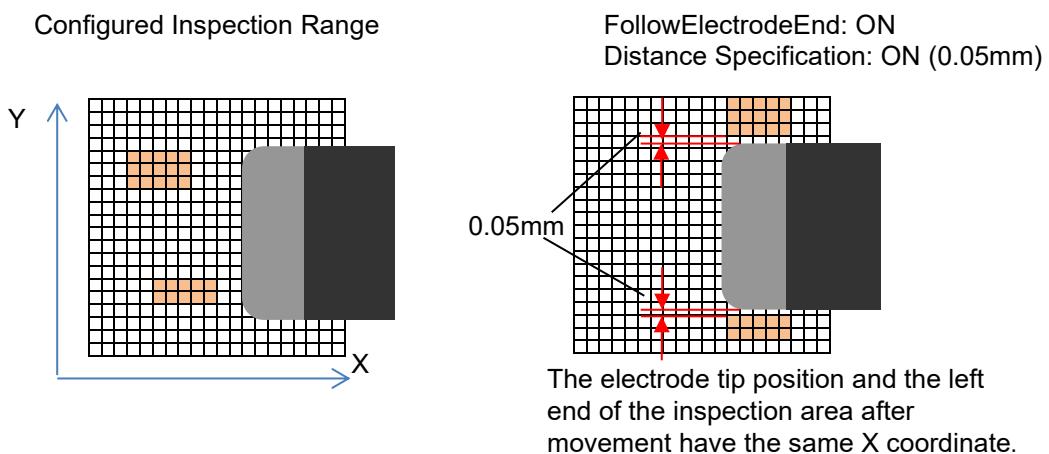
### Configuration of Electrode Side Inspection Area

When all conditions from (1) to (4) below are satisfied, you can configure an inspection range that follows an electrode on the electrode side.

- (1) FollowElectrodeEnd or FollowElectrodeSide is ON
- (2) Distance Specification: ON
- (3) Two inspection ranges close to a component share the same X coordinate
- (4) The distance of the Y coordinate of the two inspection ranges close to a component is larger than the electrode width.



The following example shows an actual inspection range to inspect if the original inspection range is configured as shown below.



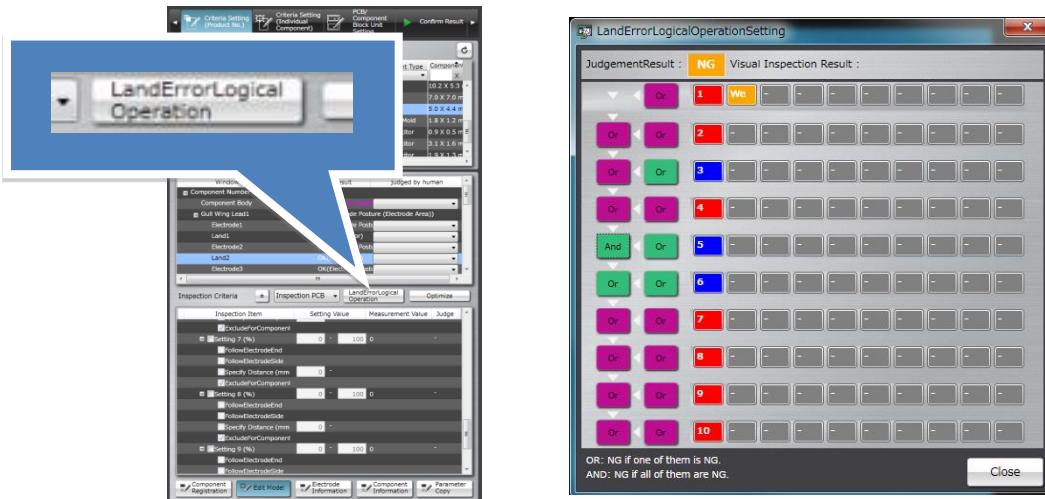
### Range Evaluation of Electrode End and Side

If two inspection ranges close to a component do not satisfy the inspection range setting conditions on the electrode side, all inspection ranges are configured as electrode end inspection ranges.

If two inspection ranges close to a component satisfy the inspection range setting conditions on the electrode side, only these two inspection ranges are configured as electrode side inspection ranges, while all the others are configured as electrode end inspection ranges.

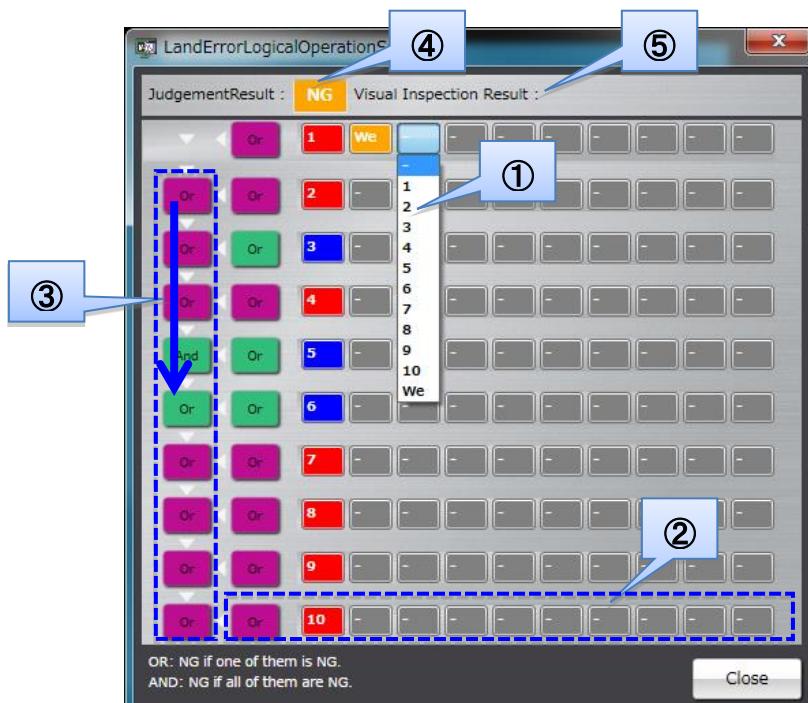
### Land Error Logical Operation

Land error logical operation setting can make logical judgment in the inspection result of land error logical operation setting 1-10 and wettability inspection.



The following explains land error logical operation setting dialog.

- Using pull-down menu, designate land error setting No (1) –(10) or “Wettability inspection.”
- Using the toggle button at the second row from left, set “OR” or “AND” for judgment result of the line.
- The judgment result by the line comes from top to bottom. Using the toggle button at the first row from left, set “OR” or “AND” for judgment results of the line and coming from top.
- Judgment result of land error is indicated.
- If visual inspection result is input, visual inspection result is indicated.
- Execution of "component test", "component number test" and "group test" renews judgment result.

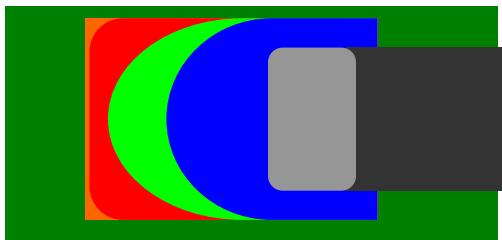


## 5.11 Foreign Material (On Land)

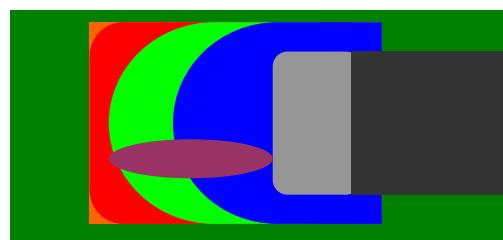
### ■ Outline

This system inspects the color of the foreign material detected in the Land Window to judge if the foreign material is included within the land.

OK Example: Foreign Material Not Included



NG Example: Foreign Material Included



### ■ Inspection Range

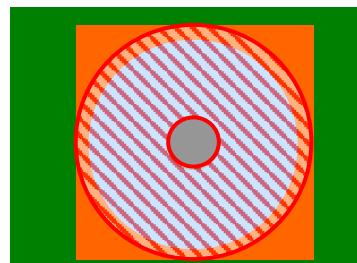
#### Insertion-Type Terminal except

Shaded Area Below (Remaining colors of land with component and electrode colors removed)



#### Insertion-Type Terminal

Shaded Area Below (Remaining colors of land window inscribed circle with inserted electrode colors removed)



### ■ Characteristic Parameter

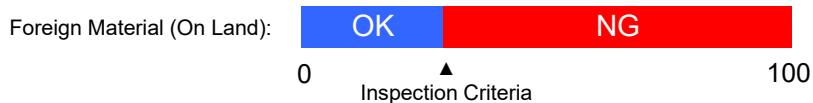
#### Foreign Material Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
■ Foreign Material (On Land) (%)	0 -	<input type="text"/>		



### ■ Processing Detail

The pixels matching the characteristic parameters are extracted from the inspection range. "Foreign Material (On Land)" is output if the ratio of the extracted pixel area to the inspection range area is larger than the "Foreign Material (On Land) (%)".

Fault Output: Foreign Material (On Land)  
Fault Code: 170

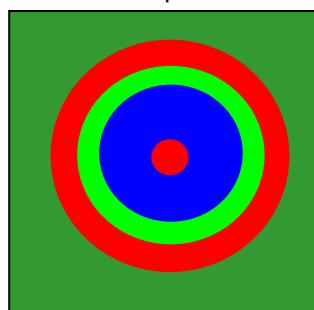
## 5.12 Blow Hole

### ■ Outline

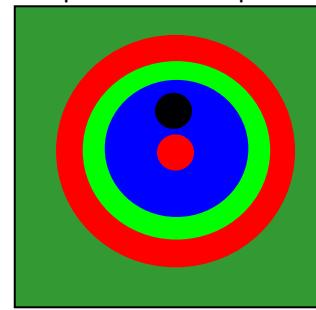
This system inspects the shape of the blow hole color detected in the Land Window to judge whether a blow hole is formed or not in the land.

\*This can be applied to an insertion lead.

OK Example: No Black Lump on the Circle

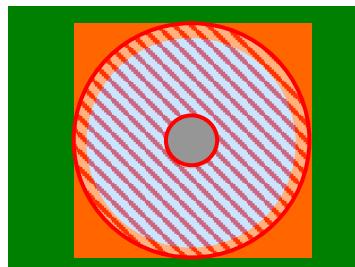


NG Example: Black Lump on the Circle



### ■ Inspection Range

Shaded Areas Below (Area excluding an insertion lead from the inscribed circle of the Land Window)



### ■ Characteristic Parameter

Blow Hole Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
<b>Blow Hole (mm)</b>				
Diameter (mm)	0	—	<input type="text"/>	
Ratio (%)	0	—	<input type="text"/>	
Area Rate (%)	0	—	<input type="text"/>	



---

■ **Processing Detail**

1. The system sets the range specified in “Inspection Range specification” as the Inspection Range.
2. Binarization is carried out using the characteristic parameter.
3. A connected pixel cluster whose “Ratio” AND “Area Rate” are out of the set range becomes a candidate for the blow hole.
4. “Blow Hole” is output if the narrow side of the pixel cluster which became a candidate in Step 3 is out of the set range of “Diameter (mm).”

**Fault Output: Blow Hole  
Fault Code: 188**

## 5.13 Inter-pin Solder Ball

### ■ Outline

This system detects for a solder ball formed in the component surrounding based on the solder color detected in the Inspection Range Window.

\* It cannot be used for components such as chip component, 2-pin mini mold and electrolytic capacitor with no inter-land property.

OK Example: No Solder Ball Detected

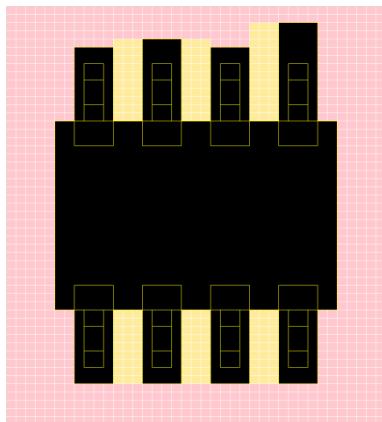


NG Example: Solder Ball Detected



### ■ Inspection Range

Yellow area in the drawing.



### ■ Characteristic Parameter

#### Solder Ball Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

## ■ Inspection Criteria

The item will be judged as good if the value is within the range of settings. The available range for setting is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
■ Solder Ball	Judgment Type	<input checked="" type="radio"/> Length Diameter Ratio <input type="radio"/> Aspect Ratio		
Solder Ball Diameter (mm)	0	—	<input type="text"/>	
Ratio (%)	0	—	<input type="text"/>	
Area Rate (%)	0	—	<input type="text"/>	
Excluded Area (Component Side)(mm)	0	—	<input type="text"/>	
Excluded Area (Land Side)(mm)	0	—	<input type="text"/>	



### ■ Processing Details

1. Set the range specified by “Inspection Area Limitation” as an inspection area.
2. Use feature parameters to binarize the area.
3. In the connected pixel group, if the “Rate” of the method specified by the judgment method is out of the setting range and the “Area Rate” is out of the setting range, the pixel group becomes a candidate solder ball.
4. If the short side of the pixel group which has become a candidate at step 3 is out of the setting range of “Solder Diameter (mm),” the pixel group is judged as a “Solder Ball.” If there are more than one solder ball present, the maximum solder diameter (mm) is displayed as a measured value. However, all measured values are output as inspection results.

**Fault Output: Solder Ball (Between Lands)**  
**Fault Code: 220**

### Judgment Method

Long-Short Diameter Ratio and Aspect Ratio are defined as follows:

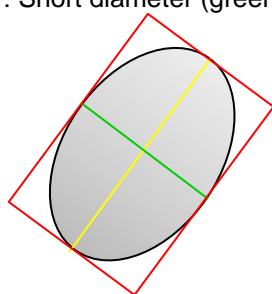
Long-Short Diameter Ratio: Ratio between the long side and short side of an approximated ellipse

Aspect Ratio: Ratio between the long side and short side of the bounding rectangle in the inspection window's coordinate system

Long-Short Diameter Ratio

S: Area rate (rate of solder color inside the red frame)  
 L: Long diameter (yellow line)

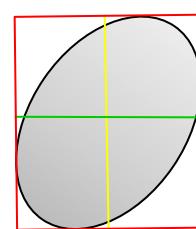
W: Short diameter (green line)



Aspect Ratio

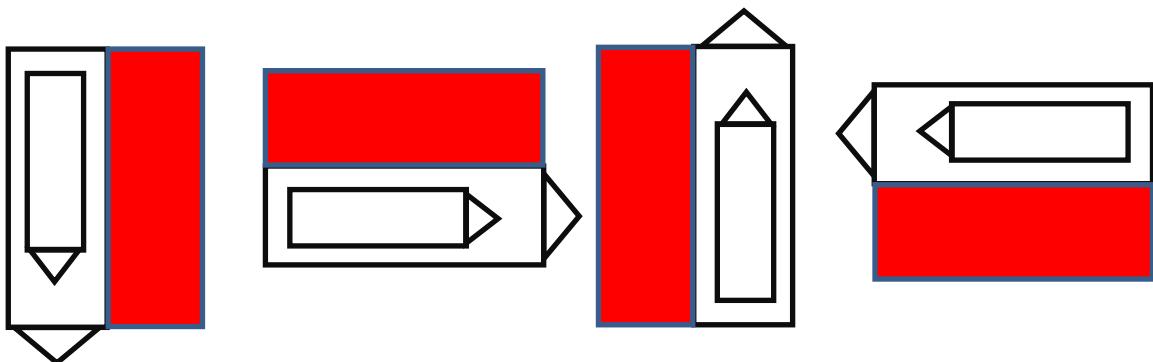
S: Area rate (rate of solder color inside the red frame)  
 L: Vertical length (yellow line)

W: Horizontal length (green line)



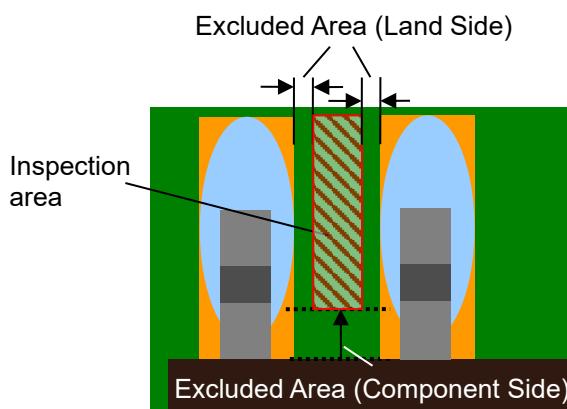
### Inspection Area of Each Land

The area of land window's 90-degree direction shall be set to the inspection area of each land. The inspection area is indicated by the red shaded area shown below. Areas which are partly protruding from the inspection area are considered to be in between lands, and the protruding sections are included in the process.



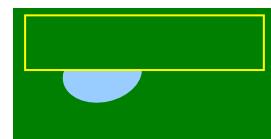
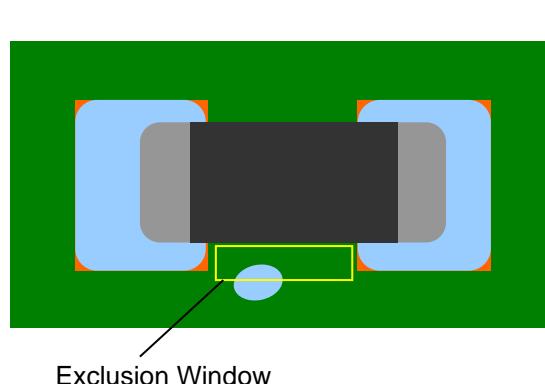
### Exclusion Area

A part of area between lands is excluded by setting the exclusion area to set the inspection area.



### Exclusion Window

Inside of an exclusion window is not used for inspection. If a connected pixel cluster extracted by the characteristic parameters does not satisfy the "solder ball" condition due to an exclusion window, it is not judged as "Solder Ball".

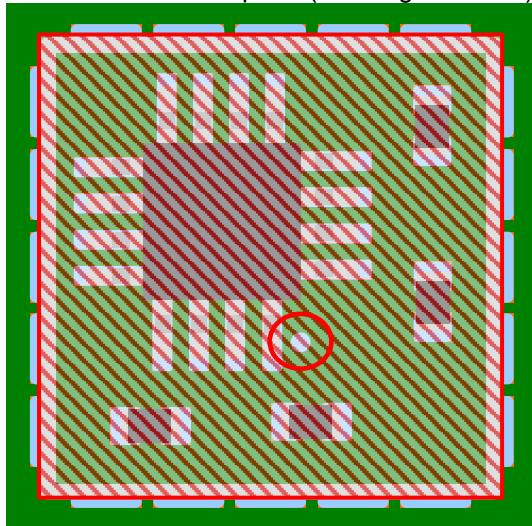


Inside of an exclusion window  
is not used for inspection.

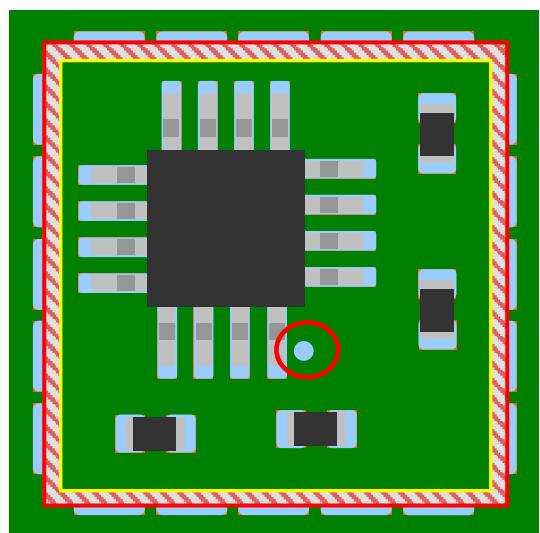
**Precautions when the component body window, electrode window, and land window overlap the inspection area.**

In the case of shield components and SoC (system-on-chip) components, where additional components are mounted inside the component, or in connector parts, the solder balls are not subject to inspection in the component body window, electrode window, or additional window, both for own parts and other components, so there is a possibility that they may be missed. Be sure to set up an exclusion window for the area where you want to perform the inspection. However, even if you set an exclusion window for electrodes and land windows, they will not be subject to inspection.

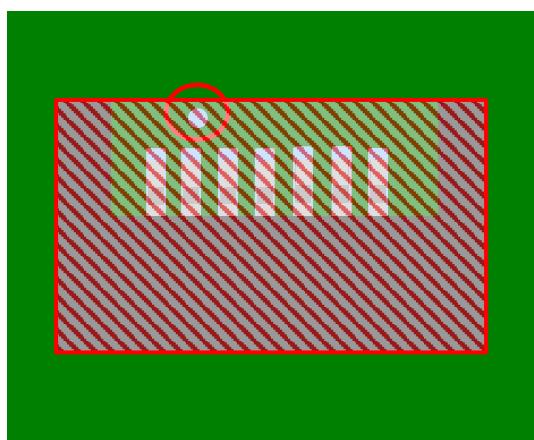
Areas not subject to inspection by the part body window of shielded parts (red diagonal area)



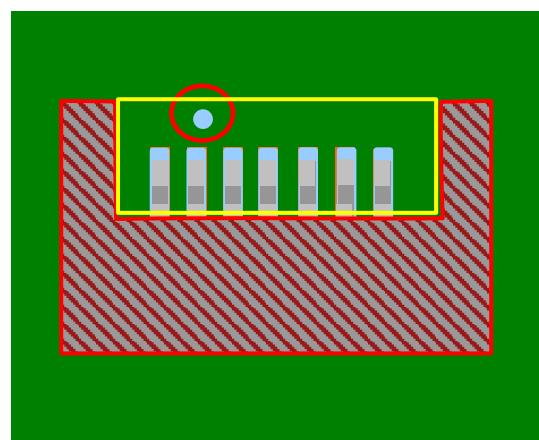
Set the exclusion window (yellow frame)



Areas not subject to inspection by the component body window (red shaded area)



Set the exclusion window (yellow frame)

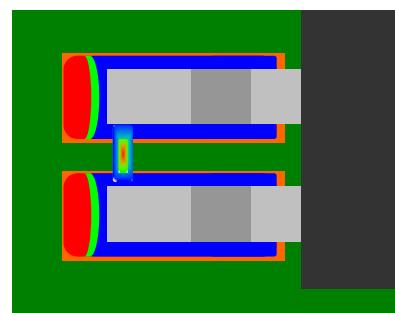
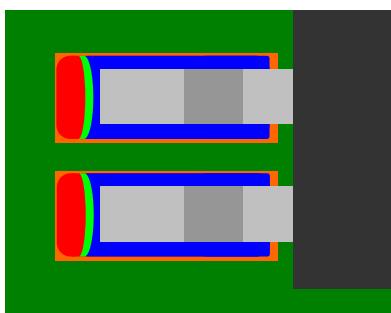


## 5.14 Inter-pin Solder Bridge

### ■ Outline

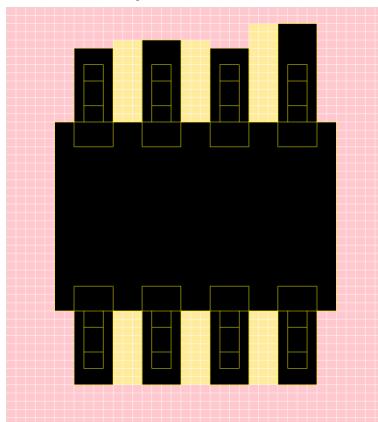
This system detects for a solder bridging based on the solder color detected in the Inspection Range Window.

OK Example: No Solder Bridging Detected    NG Example: Solder Bridging Detected



### ■ Inspection Range

Yellow sections in the figure below. A part of area between lands is excluded by setting the exclusion area to set the inspection area.



### ■ Characteristic Parameter

Bridging color and bridging (lead shoulder) color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
<input checked="" type="checkbox"/>	Solder Bridging			
	Bridging Width (mm)	0 —	<input type="text"/>	
	Excluded Area (Component Side) (mm)	0 —	<input type="text"/>	
	Excluded Area (Land Side) (mm)	0 —	<input type="text"/>	



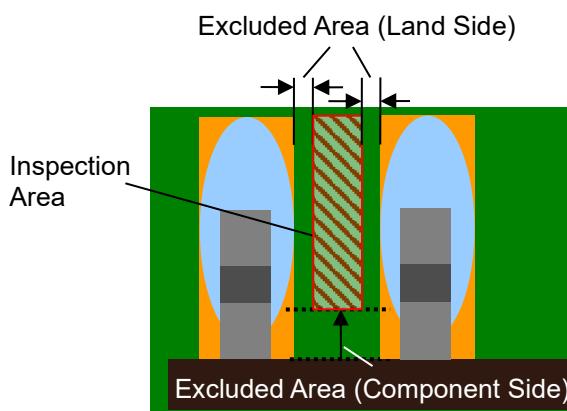
### ■ Processing Detail

1. The system searches and extracts a connected pixel cluster extracted from the inspection range using the characteristic parameters that runs across the Land Window or Electrode Window. For the same direction of the same component, the system searches and extracts, between electrodes, one that runs across the inspection range excluding the smaller one of either 15% or 100  $\mu\text{m}$  of the width against the smaller one of the width between lands or between electrodes as 100%.
2. If the average width extracted in the step 1 is larger than "Bridging Width (mm)", it is judged as "Solder Bridging".  
If there is more than one solder bridging, the largest of the "Bridging Width (mm)" will be displayed as the measured value. Note that all the measured values are provided as the inspection result.

**Fault Output: Solder Bridging (Between Lands)**  
**Fault Code: 221**

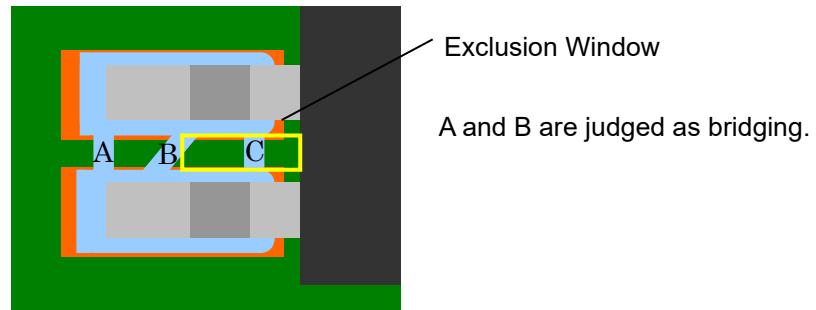
### Exclusion Window

A part of area between lands is excluded by setting the exclusion area to set the inspection area.



### Exclusion Window

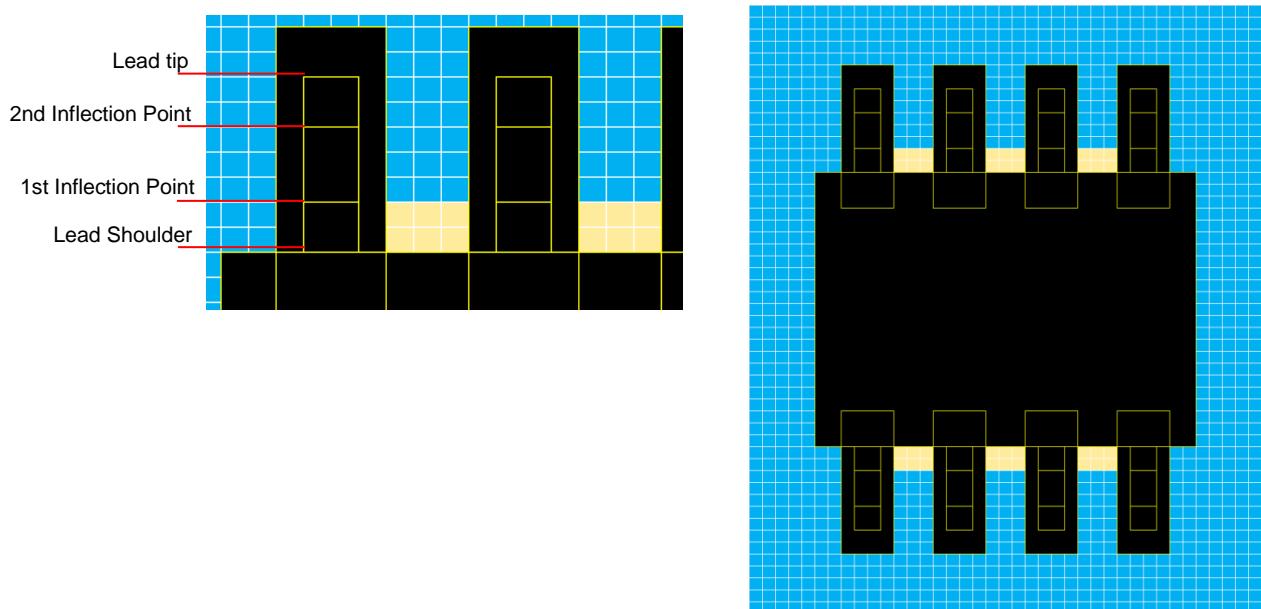
Inside of an exclusion window is not used for inspection. If a connected pixel cluster extracted by the characteristic parameters is not connected and does not run across lands or electrode windows due to an exclusion window, it is not judged as "Solder Bridging".



### Usable Area of Feature Parameters (Bridging, Bridging (Lead Shoulder))

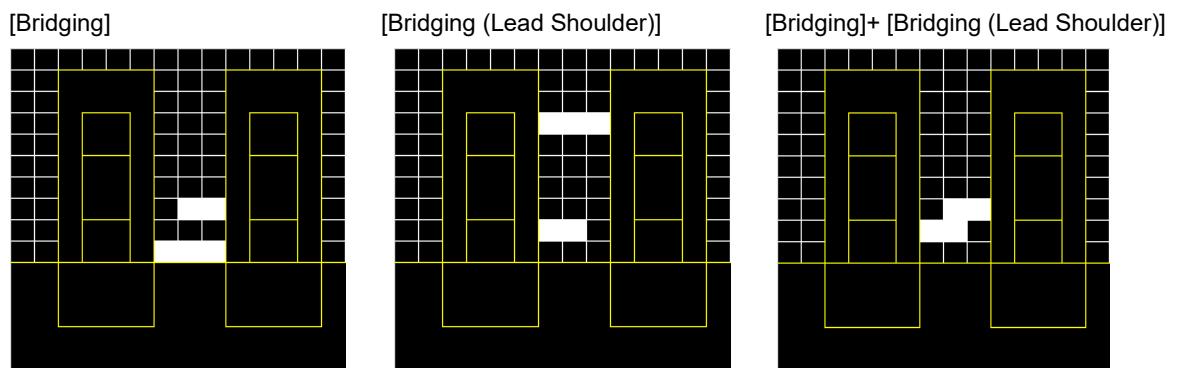
Binarize the inter-lead area of the gullwing leads (yellow cells) ranging from [Lead Shoulder] to [First Inflection Point] using the [Bridging (Lead Shoulder)] color. Binarize the other areas (blue cells) using the [Bridging] color.

However, if the [Bridging (Lead Shoulder)] color is empty, binarize the area using the [Bridging] color. If it is not necessary to inspect the area ranging from [Lead Shoulder] to [First Inflection Point], set an exclusion window.



### Synthesis of Feature Parameters (Bridging, Bridging (Lead Shoulder))

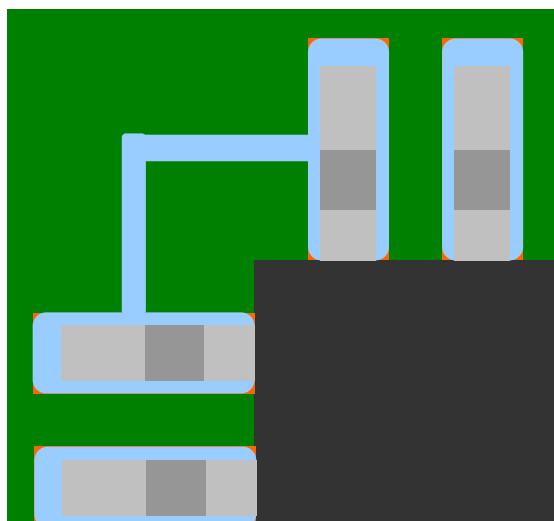
The following areas inside the red frames do not appear on the final binarization result data because they are not applicable to binarization by the respective colors. In addition, although the inter-land areas are not bridged by the respective colors, these areas are bridged by the binarization result data after the final synthesis of [Bridging] and [Bridging (Lead Shoulder)] is completed, judged as bridges.



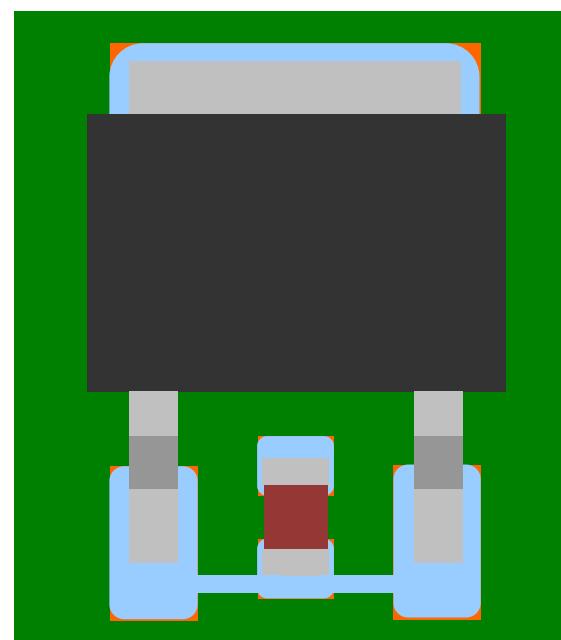
**What is the difference between a pin-to-pin solder bridge and an inspection range solder bridge?**

- The following solder bridges are subject to solder bridge inspection in the inspection range window, so they will not be detected by pin-to-pin solder bridge inspection.
- The following cases should be detected by the bridge inspection in the inspection range window.

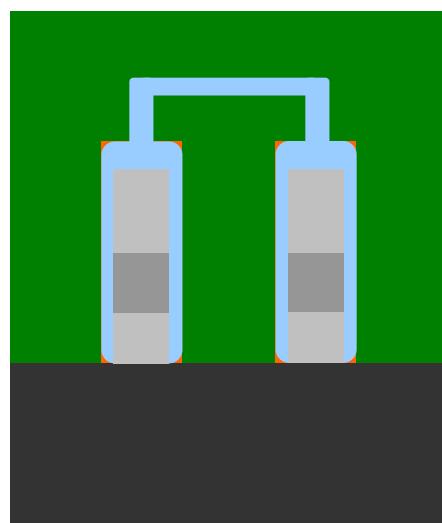
Solder bridges between lands with different land directions



Land and solder bridges for other parts



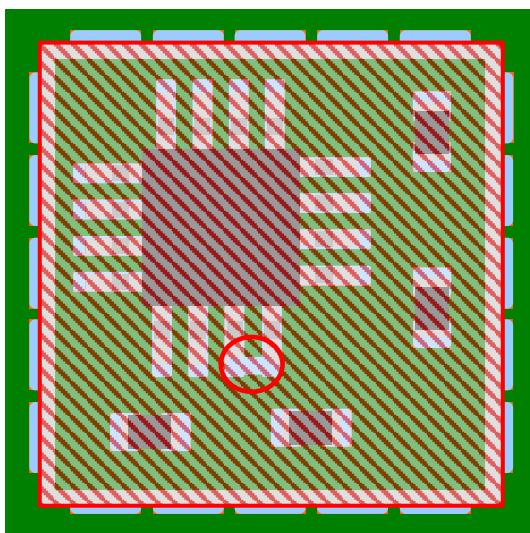
Solder bridging outside the inspection area of pin-to-pin solder bridges



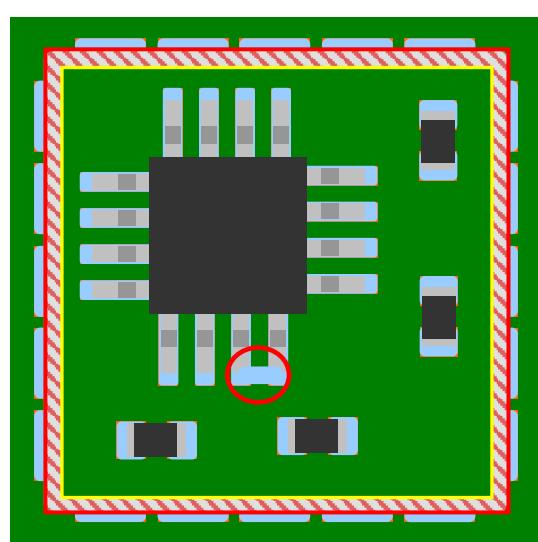
**Precautions when the component body window, electrode window, and land window overlap the inspection area.**

In the case of shield components and SoC (system-on-chip) components, where additional components are mounted inside the component, or in connector parts, the solder bridges are not subject to inspection in the component body window, electrode window, or additional window, both for own parts and other components, so there is a possibility that they may be missed. Be sure to set up an exclusion window for the area where you want to perform the inspection. However, even if you set an exclusion window for electrodes and land windows, they will not be subject to inspection.

Areas not subject to inspection by the part body  
window of shielded parts (red diagonal area)



Set the exclusion window (yellow frame)



# 6

# Component Surrounding Inspection

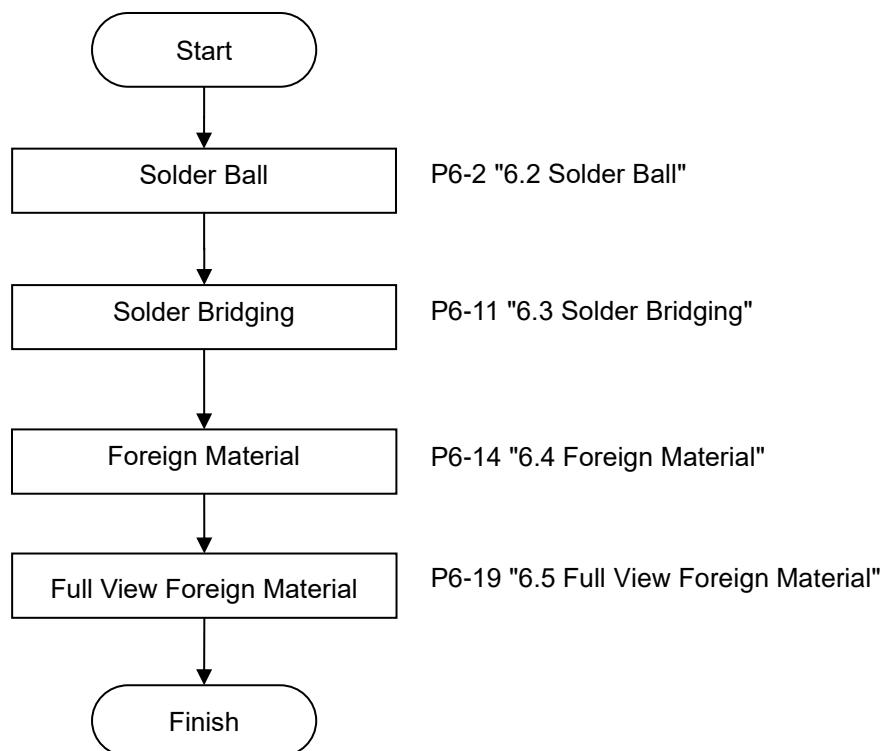
\* The description regarding the inspection logic is as follows.

No symbol: Common for VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500,

S1080 : S1080 S1040 : S1040 Z600 : Z600 S730 : S730-H/S730 S720A : S720A S530 : S530 S500 : S500

## 6.1 Flow of Component Surrounding Inspection

This section describes the inspection logics used for component surrounding inspection.  
The following chart shows the flow of component surrounding inspection.

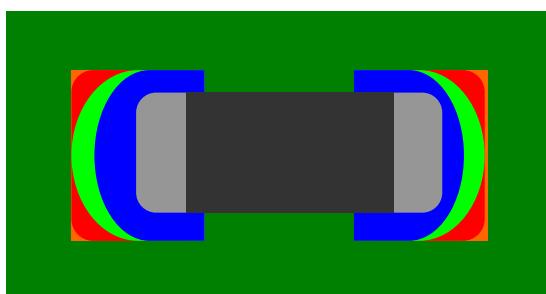


## 6.2 Solder Ball

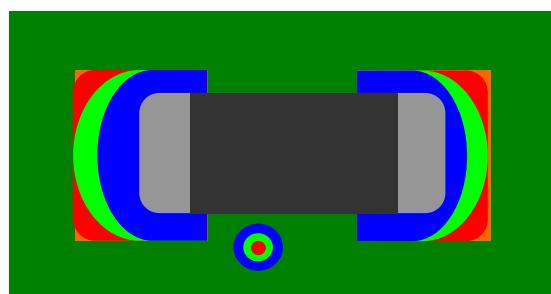
### ■ Outline

This system detects for a solder ball formed in the component surrounding based on the solder color detected in the Inspection Range Window.

OK Example: No Solder Ball Detected



NG Example: Solder Ball Detected

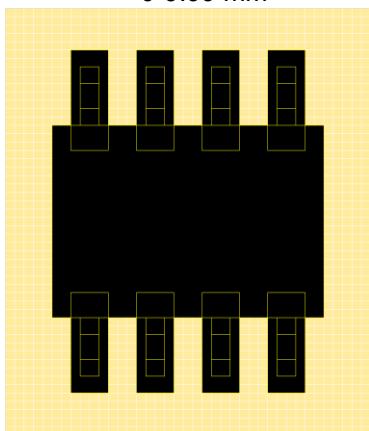


### ■ Inspection Range

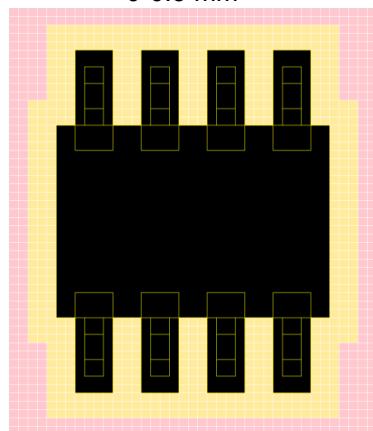
Yellow area in the drawing (This is the area set by “inspection area limitation” in the inspection range window. (However, land, component body, and inside of the electrode window are not included.))

Ex.: Specification of inspection area

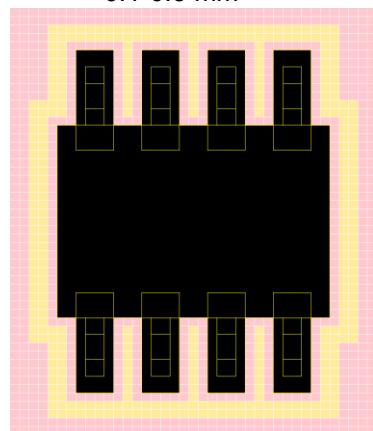
0-9.99 mm



0-0.3 mm



0.1-0.3 mm



### ■ Characteristic Parameter

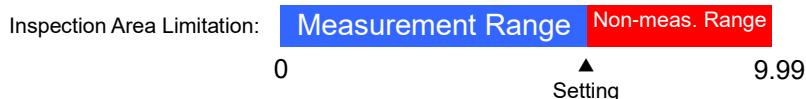
Solder Ball Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The item will be judged as good if the value is within the range of settings. The available range for setting is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
Solder Ball			
Judgment Type	<input checked="" type="radio"/> Length Diameter Ratio <input type="radio"/> Aspect Ratio		
Solder Ball Diameter (mm)	0 — <input type="text"/>		
Ratio (%)	0 — <input type="text"/>		
Area Rate (%)	0 — <input type="text"/>		
■ Inspection Area Limitation (mm)	<input type="text"/> — <input type="text"/>		



### ■ Processing Details

1. Set the range specified by “Inspection Area Limitation” as an inspection area.
2. Use feature parameters to binarize the area.
3. In the connected pixel group, if the “Rate” of the method specified by the judgment method is out of the setting range and the “Area Rate” is out of the setting range, the pixel group becomes a candidate solder ball.
4. If the short side of the pixel group which has become a candidate at step 3 is out of the setting range of “Solder Diameter (mm),” the pixel group is judged as a “Solder Ball.” If there are more than one solder ball present, the maximum solder diameter (mm) is displayed as a measured value. However, all measured values are output as inspection results.

**Fault Output: Solder Ball**  
**Fault Code: 152**

### Judgment Method

Long-Short Diameter Ratio and Aspect Ratio are defined as follows:

Long-Short Diameter Ratio: Ratio between the long side and short side of an approximated ellipse

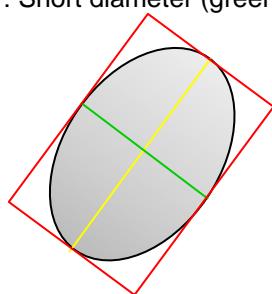
Aspect Ratio: Ratio between the long side and short side of the bounding rectangle in the inspection window's coordinate system

Long-Short Diameter Ratio

S: Area rate (rate of solder color inside the red frame)

L: Long diameter (yellow line)

W: Short diameter (green line)

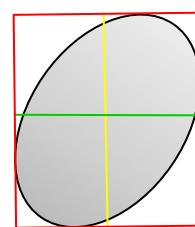


Aspect Ratio

S: Area rate (rate of solder color inside the red frame)

L: Vertical length (yellow line)

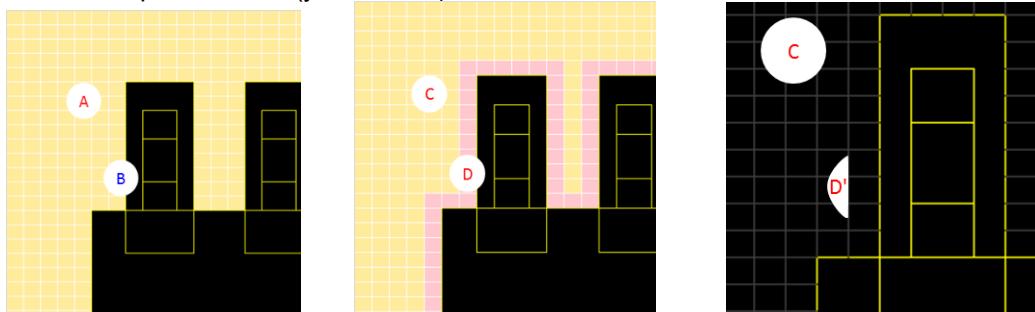
W: Horizontal length (green line)



### Inspection Area Limitation

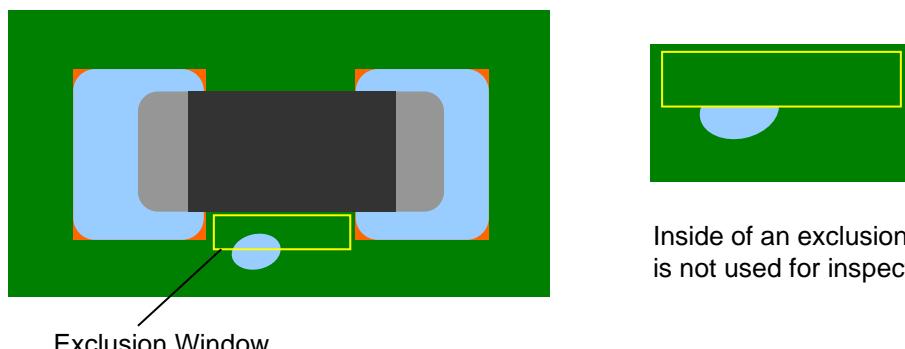
If a pixel group applicable to a solder ball, which is binarized by solder ball color, contacts one of a land, component body, or electrode window, the pixel group does not become a candidate solder ball. So, in the drawing below, objects A and C become candidate solder balls, however, object B does not become it because this object contacts a land window but does not contact the non-inspection area.

To regard an object contacting a land like object B as a candidate solder ball, set the lower limit of the inspection area specification (red cells in the drawing below). Then, the pixel group is disconnected and does not contact a land, component body, or electrode window, so that it becomes a candidate solder ball. Consequently, a portion of D which is called D' and intersects with the inspection area (yellow cells) becomes a candidate solder ball.



### Exclusion Window

Inside of an exclusion window is not used for inspection. If a connected pixel cluster extracted by the characteristic parameters does not satisfy the "solder ball" condition due to an exclusion window, it is not judged as "Solder Ball".

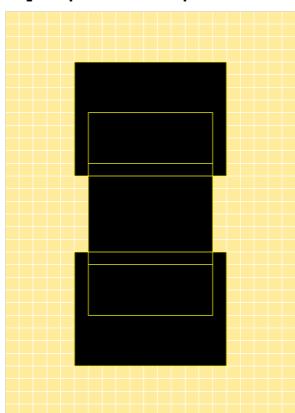


Inside of an exclusion window  
is not used for inspection.

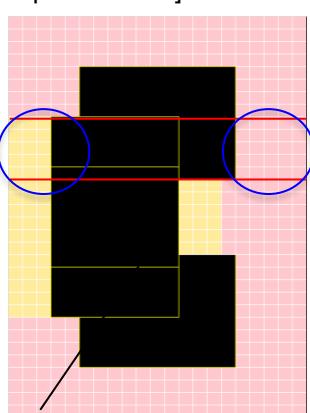
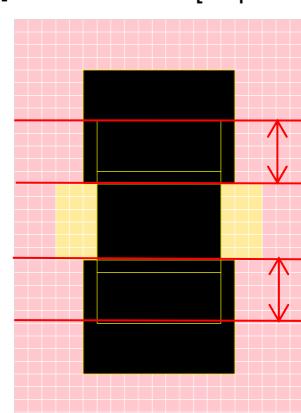
**Detailed Setting****(1) Inspect component side plane only**

In the chip component with two lands, since a solder ball is easy to occur on the component side plane, arrange so that the inspection area can be configured on its section. However, in case the component side plane is on the land, its area is not specified as the inspection area.

[Inspect Component Side Plane Only] OFF



[Inspect Only Component Side] ON



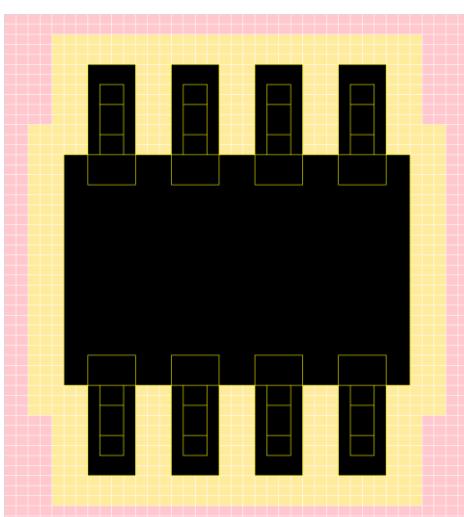
If the component side plane is on the land,  
the area on its side plane is not specified  
as the inspection area.

Since the right side plane of the  
component is in the land, it does not  
become the inspection area.

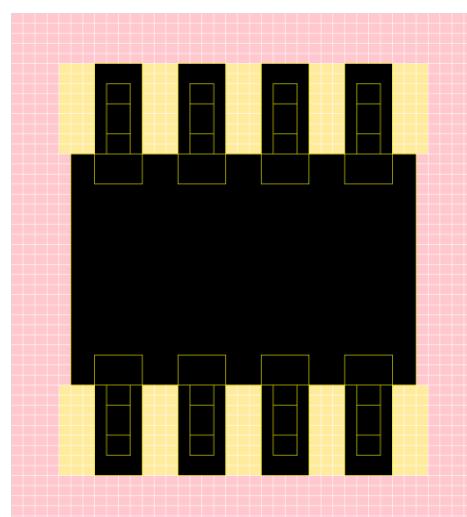
**(2) Inspect land side plane only**

In SOP/QFP components, since a solder ball is easy to occur on the land side plane, arrange so that the inspection area can be configured on its section.

[Inspect Land Side Plane Only] OFF



[Inspect Land Side Plane Only] ON

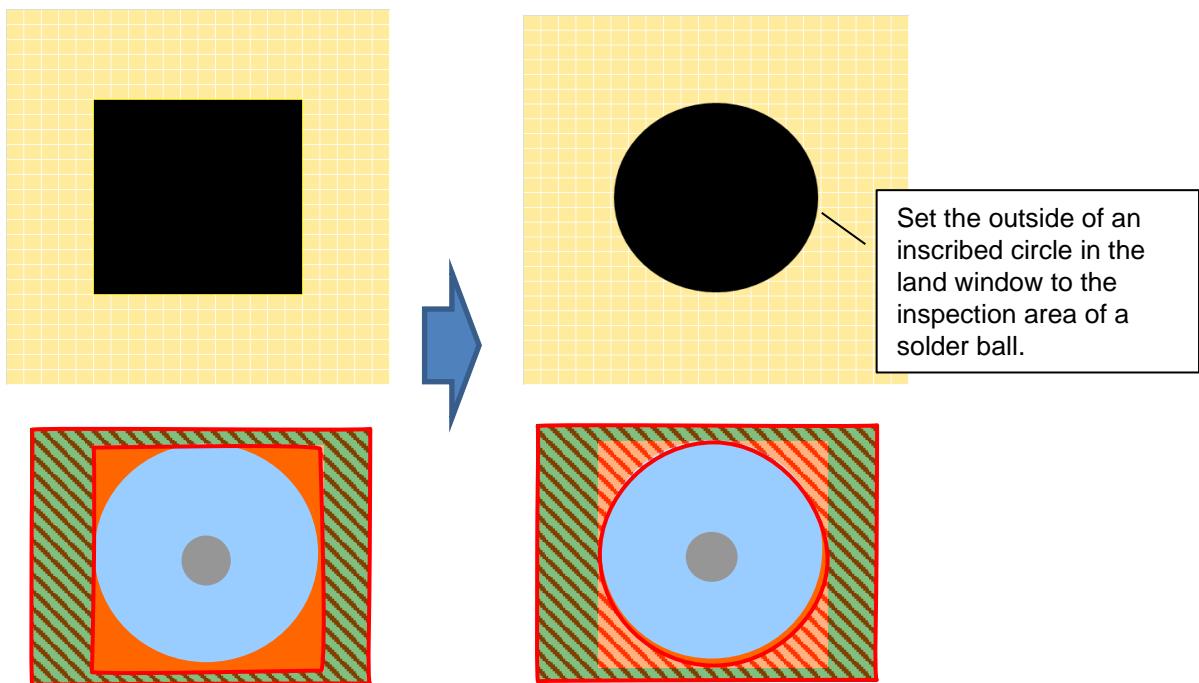


(3) Inspect land shape as circular form (Insertion terminal only)

In the insertion terminal, set the outside of an inscribed circle in the land window to the inspection area for a solder ball.

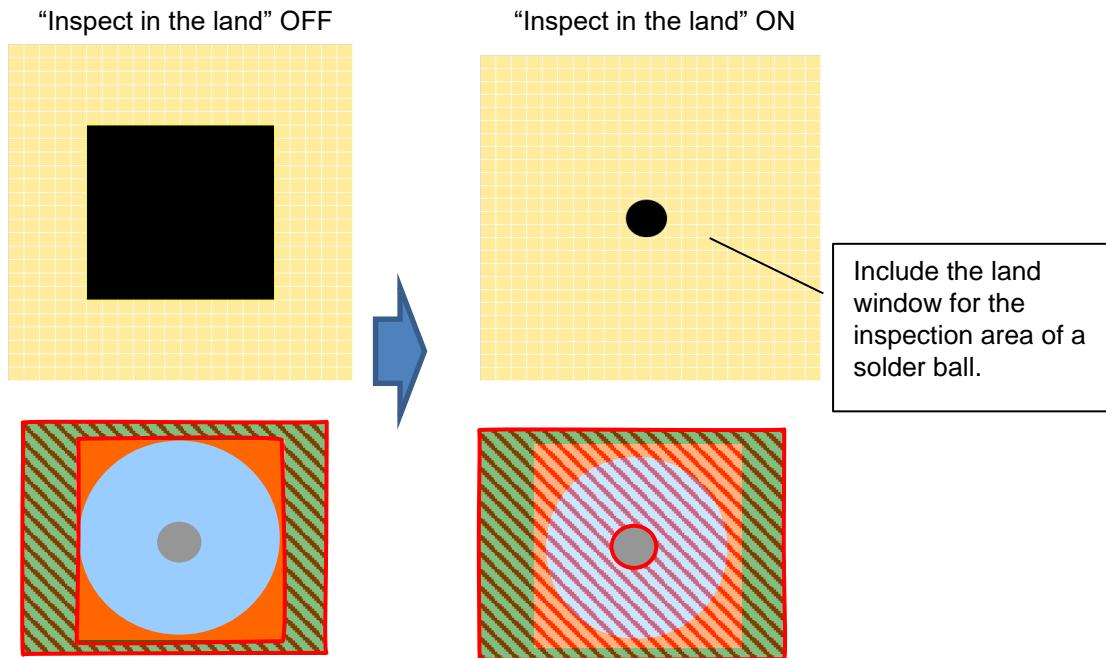
[Conduct inspection as regarding the land shape as an inscribed circle.] OFF

[Conduct inspection as regarding the land shape as an inscribed circle.] ON



(4) Inspect in the land (Insertion terminal only)

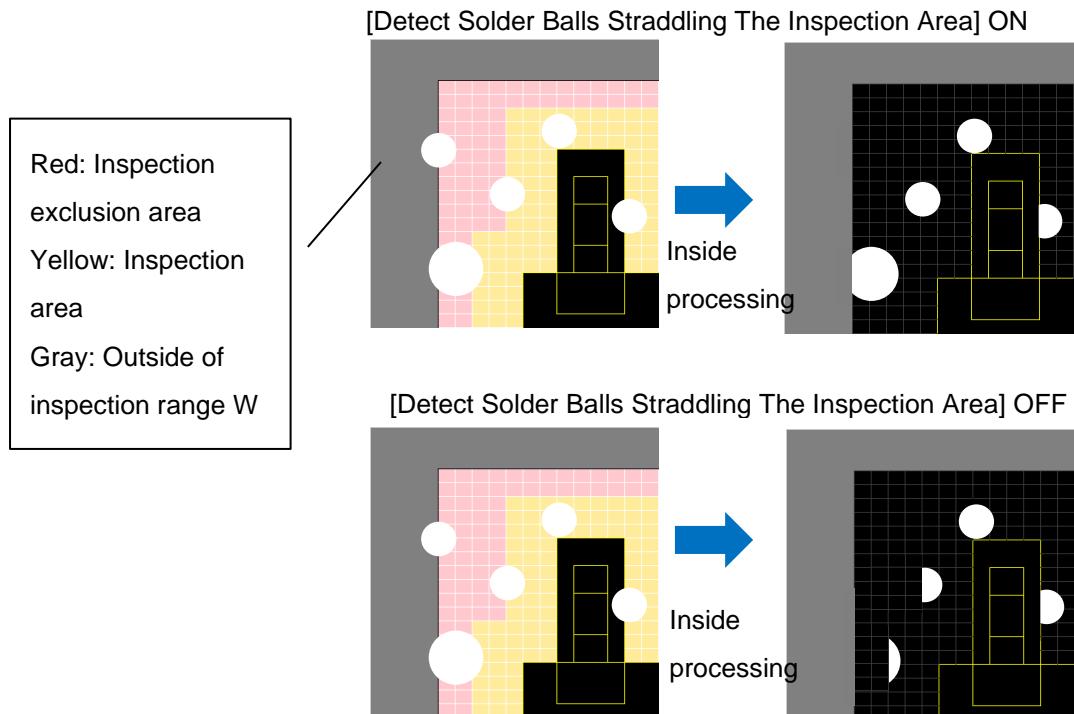
In the insertion terminal, set to the inspection area of a solder ball including in the land window. However, an area in the electrode window (after extracting electrodes) is excluded.



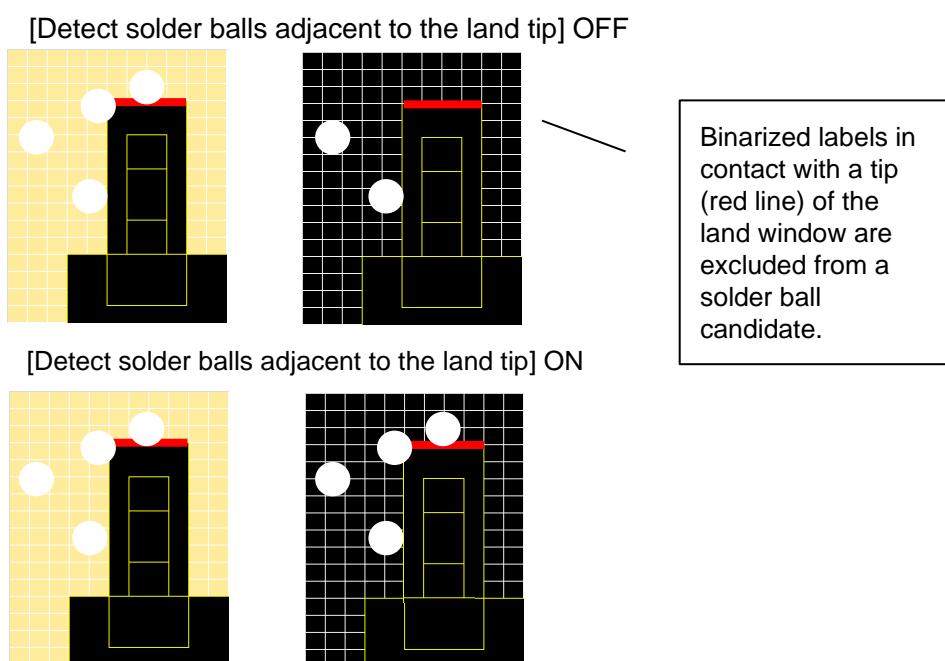
(5) Automatically binarize in the land (insertion terminal only)

For inspection in the land of the insertion terminal, inspection is performed by binarization performed with automatically generated characteristic parameter.

(6) Detect solder balls straddling the inspection area. (All component types) If the inspection area is limited (Inspection area where a yellow cell shown below was limited), the binarized pixels of other areas (red cell shown below) are ignored, but if it is the same label as that in the area (yellow cell) limited by its binarized pixels, it should be the inspection target without ignoring its binarized pixels.



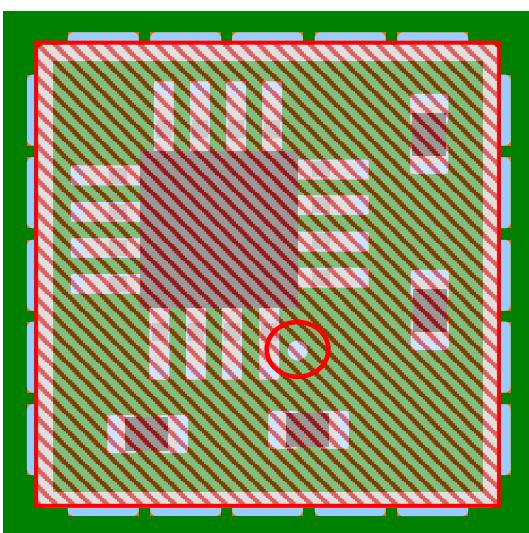
(7) Detect solder balls in contact with the land tip (All component types)  
 If the inspection area is not limited, the binarized label in contact with the land window should be specified as a solder ball candidate, but when this setting is set OFF, the binarized labels in contact with the land tip (red line shown below) are excluded from a candidate.



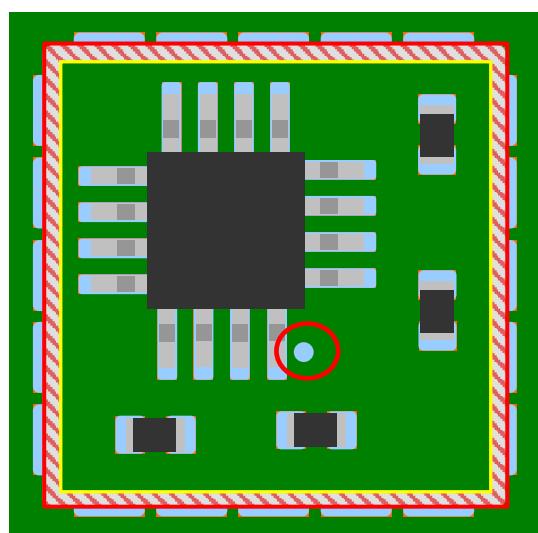
**Precautions when the component body window, electrode window, and land window overlap the inspection area.**

In the case of shield components and SoC (system-on-chip) components, where additional components are mounted inside the component, or in connector parts, the solder balls are not subject to inspection in the component body window, electrode window, or additional window, both for own parts and other components, so there is a possibility that they may be missed. Be sure to set up an exclusion window for the area where you want to perform the inspection. However, even if you set an exclusion window for electrodes and land windows, they will not be subject to inspection.

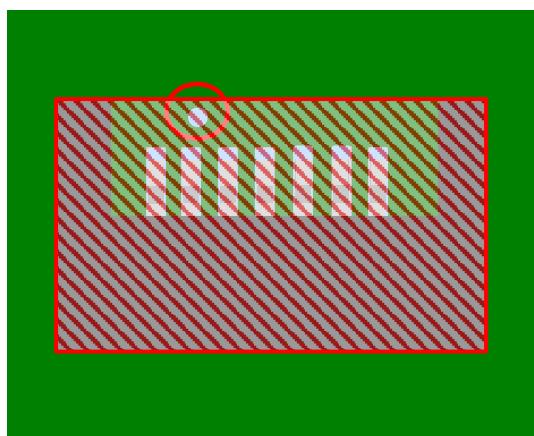
Areas not subject to inspection by the part body window of shielded parts (red diagonal area)



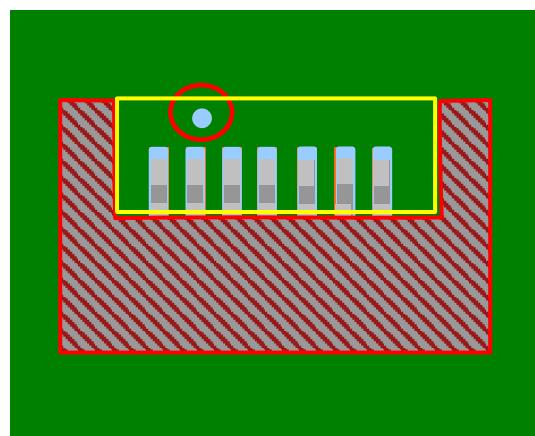
Set the exclusion window (yellow frame)



Areas not subject to inspection by the component body window (red shaded area)



Set the exclusion window (yellow frame)

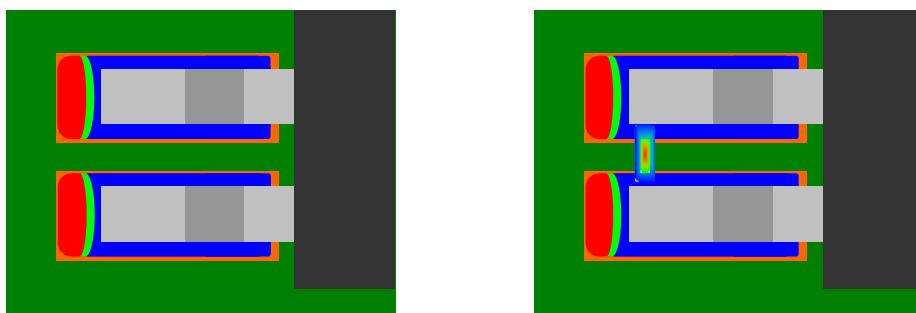


## 6.3 Solder Bridging

### ■ Outline

This system detects for a solder bridging based on the solder color detected in the Inspection Range Window.

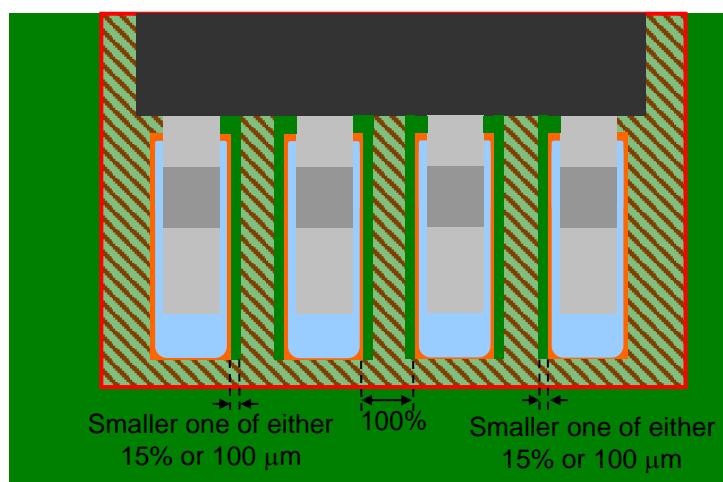
OK Example: No Solder Bridging Detected    NG Example: Solder Bridging Detected



### ■ Inspection Range

Shaded Area Below (Except Land/Component Unit/Electrode Windows in Inspection Range Window)

Between electrodes in the same direction of one component, however, an inspection area is configured as an area excluding a width of either the smaller one of 15% or 100  $\mu\text{m}$  where either the smaller width between lands or electrodes as 100%.



### ■ Characteristic Parameter

Bridging color and bridging (lead shoulder) color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

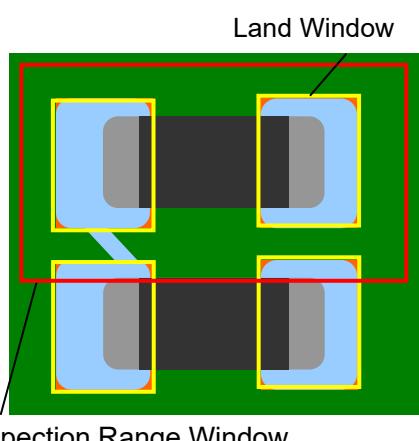
Inspection Item	Setting Value	Measurement Value	Judge
■ Solder Bridging			
Bridging Width (mm)	0 - <input type="text"/>		



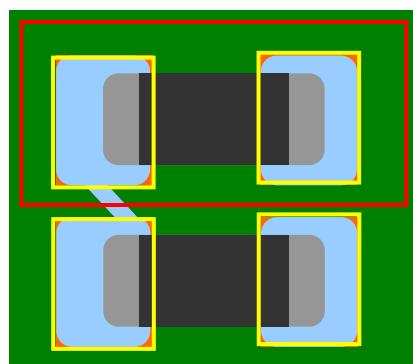
### ■ Processing Detail

1. The system searches and extracts a connected pixel cluster extracted from the inspection range using the characteristic parameters that runs across the Land Window or Electrode Window. For the same direction of the same component, the system searches and extracts, between electrodes, one that runs across the inspection range excluding the smaller one of either 15% or 100  $\mu\text{m}$  of the width against the smaller one of either of the width between lands or between electrodes as 100%.

**In case across lands**



**In case not across lands**

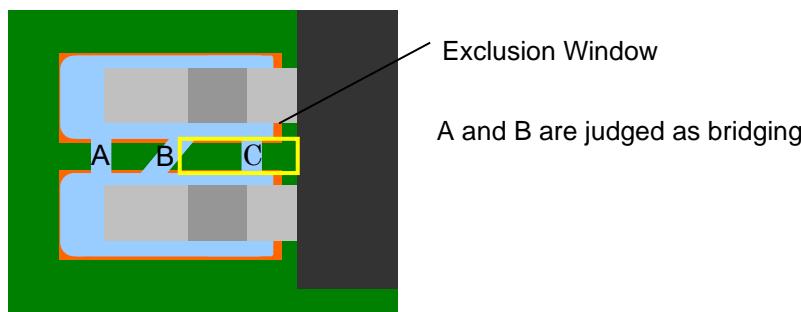


2. If the average width extracted in the step 1 is larger than "Bridging Width (mm)", it is judged as "Solder Bridging".  
If there is more than one solder bridging, the largest of the "Bridging Width (mm)" will be displayed as the measured value. Note that all the measured values are provided as the inspection result.

**Fault Output: Solder Bridging  
Fault Code: 153**

### Exclusion Window

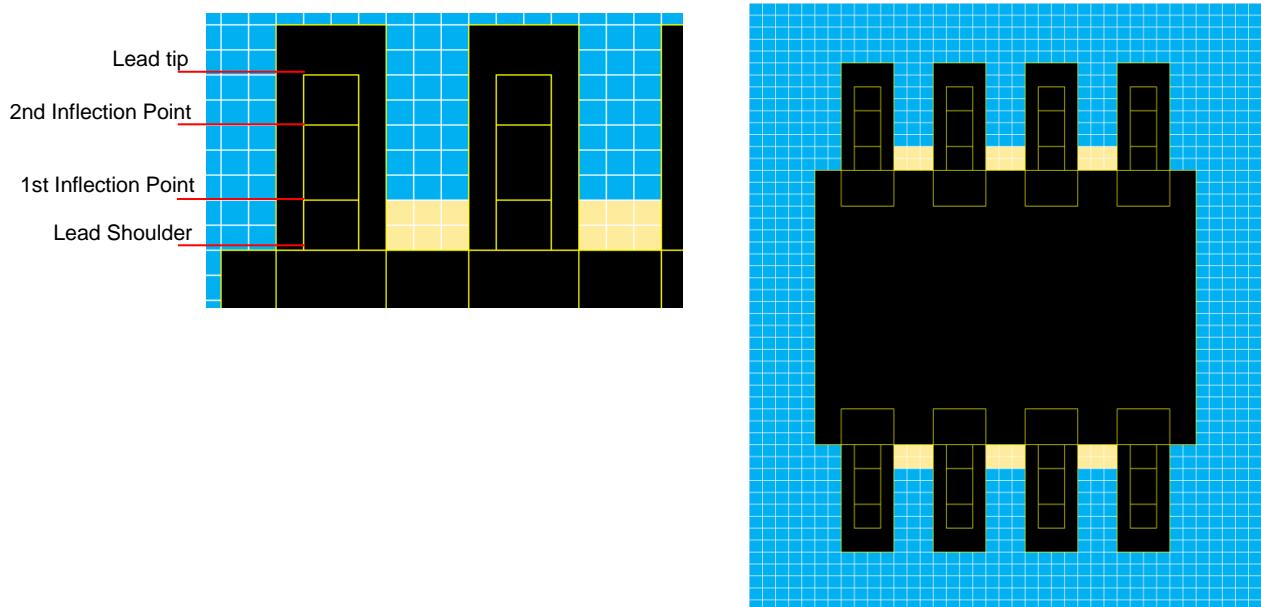
Inside of an exclusion window is not used for inspection. If a connected pixel cluster extracted by the characteristic parameters is not connected and does not run across lands or electrode windows due to an exclusion window, it is not judged as "Solder Bridging".



### Usable Area of Feature Parameters (Bridging, Bridging (Lead Shoulder))

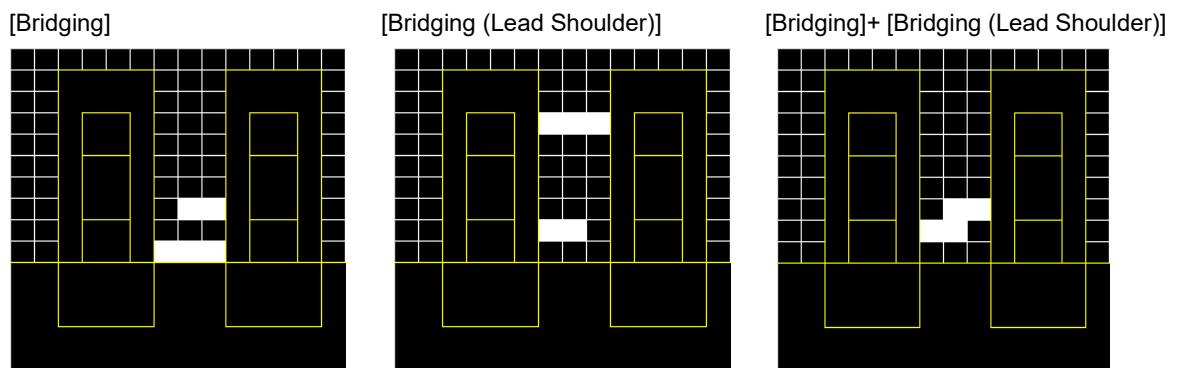
Binarize the inter-lead area of the gullwing leads (yellow cells) ranging from [Lead Shoulder] to [First Inflection Point] using the [Bridging (Lead Shoulder)] color. Binarize the other areas (blue cells) using the [Bridging] color.

However, if the [Bridging (Lead Shoulder)] color is empty, binarize the area using the [Bridging] color. If it is not necessary to inspect the area ranging from [Lead Shoulder] to [First Inflection Point], set an exclusion window.



### Synthesis of Feature Parameters (Bridging, Bridging (Lead Shoulder))

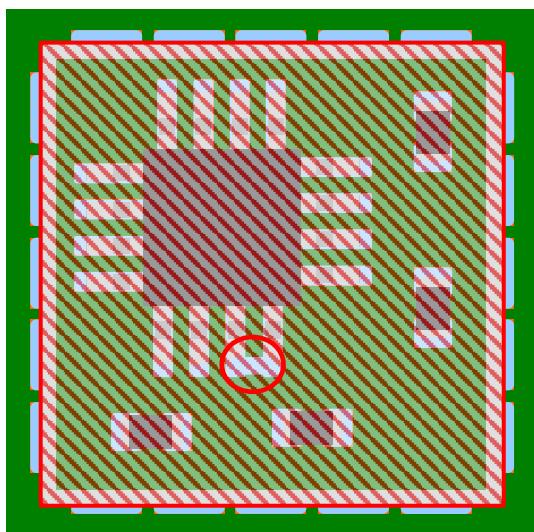
The following areas inside the red frames do not appear on the final binarization result data because they are not applicable to binarization by the respective colors. In addition, although the inter-land areas are not bridged by the respective colors, these areas are bridged by the binarization result data after the final synthesis of [Bridging] and [Bridging (Lead Shoulder)] is completed, judged as bridges.



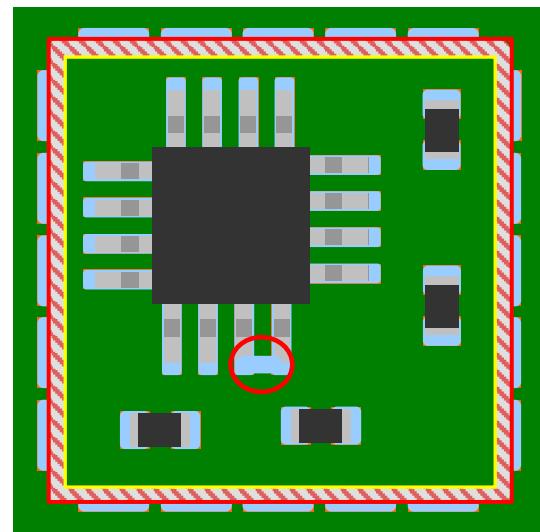
**Precautions when the component body window, electrode window, and land window overlap the inspection area.**

In the case of shield components and SoC (system-on-chip) components, where additional components are mounted inside the component, or in connector parts, the solder bridges are not subject to inspection in the component body window, electrode window, or additional window, both for own parts and other components, so there is a possibility that they may be missed. Be sure to set up an exclusion window for the area where you want to perform the inspection. However, even if you set an exclusion window for electrodes and land windows, they will not be subject to inspection.

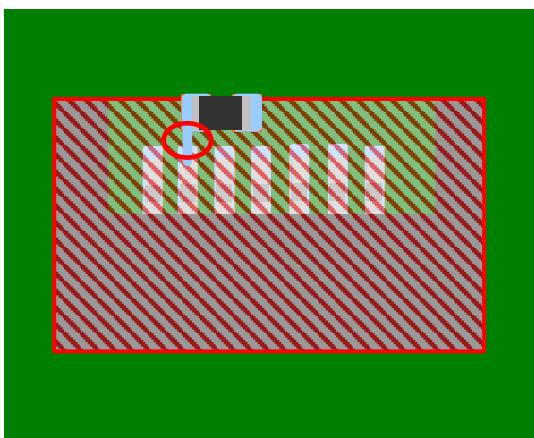
Areas not subject to inspection by the part body window of shielded parts (red diagonal area)



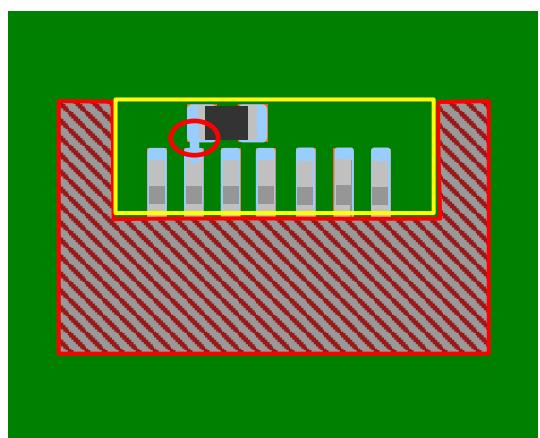
Set the exclusion window (yellow frame)



Areas not subject to inspection by the component body window (red shaded area)



Set the exclusion window (yellow frame)

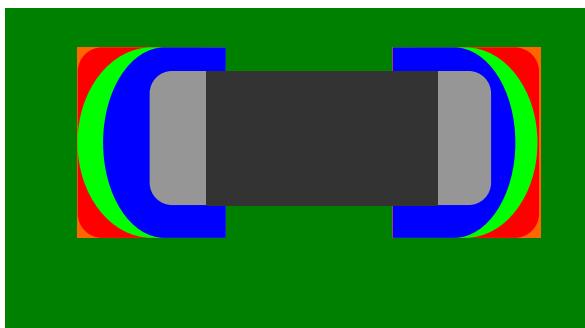


## Foreign Material

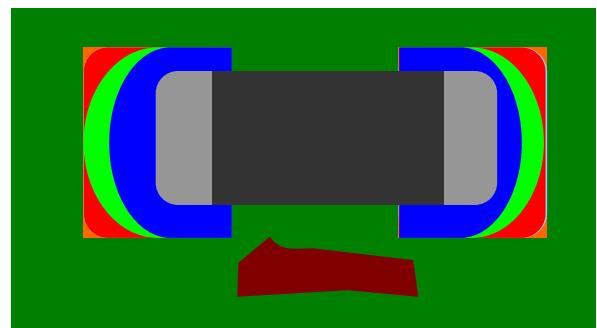
### ■ Outline

This system detects for foreign material deposited in the component surrounding based on the foreign material colors detected in the Inspection Range Window.

OK Example: No Foreign Material Deposited

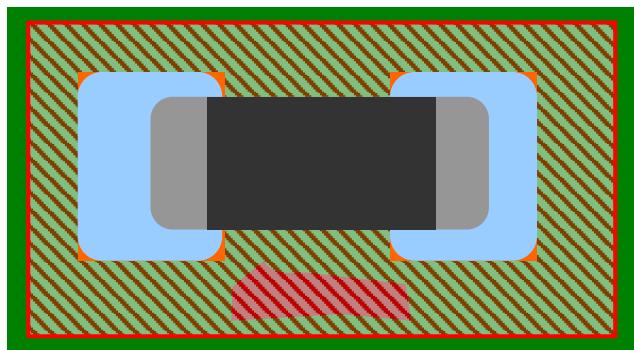


NG Example: Foreign Material Deposited



### ■ Inspection Range

Shaded Area Below (Except Land/Component Unit/Electrode Windows in Inspection Range Window)



### ■ Characteristic Parameter

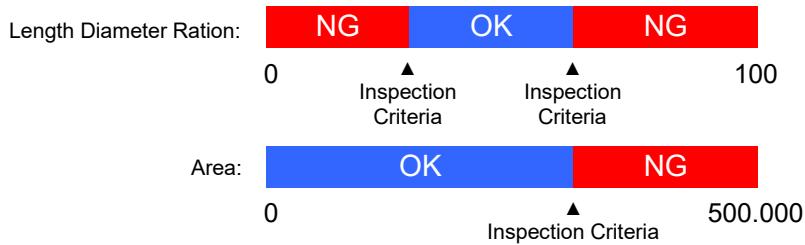
PCB Color (Color Excluding Resist, Land, Through-Hole, Silk or Other Colors Shown as Part of Normal Result)

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

Inspection Item	Setting Value	Measurement Value	Judge
■ Foreign Material			
Length Diameter Ratio (%)	■ - ■		
Area (mm <sup>2</sup> )	0 - ■		



### ■ Processing Detail

#### Foreign material inspection method: Selecting (Color)

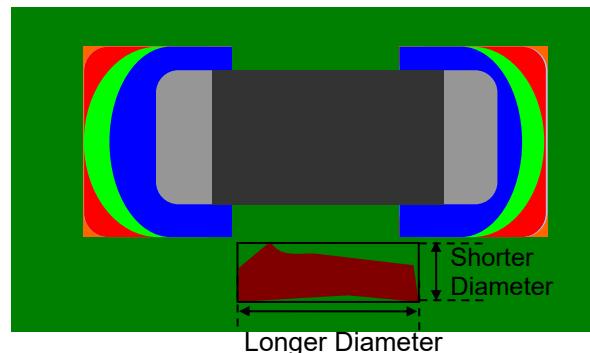
1. "Foreign Material" is output if the long-to-short diameter ratio of a connected pixel cluster extracted from the inspection range using the characteristic parameters is smaller than the lower limit of the "Length Diameter Ratio (%)" and the pixel cluster area is larger than the "Area (mm<sup>2</sup>)".
2. "Foreign Material" is output if the long-to-short diameter ratio of a pixel cluster extracted from the inspection range using the characteristic parameters is larger than the upper limit of the "Length Diameter Ratio (%)" and the pixel cluster area is larger than the "Area (mm<sup>2</sup>)".

If a multiple number of foreign materials are detected, the one with the largest "Area (mm<sup>2</sup>)" is displayed as the measure value. However, all the measured values are output as the inspection result.

#### Foreign material inspection method: Selecting (Template)

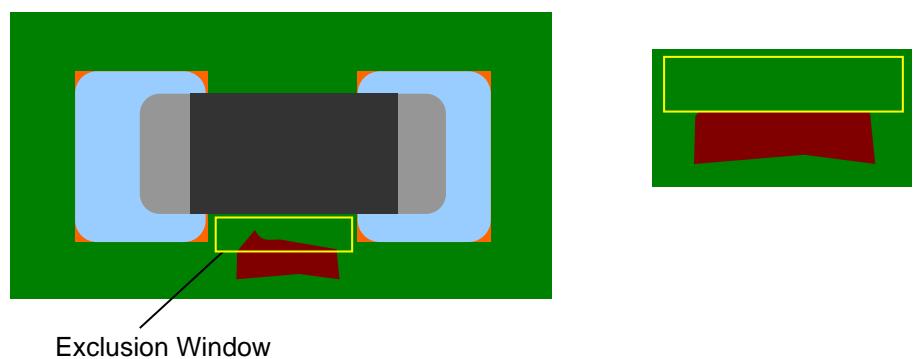
1. Compares the brightness values of the image inside the inspection range and the image cut out from the template PCB registered in advance, and then extracts the pixel that exceeds the threshold in which the distance of the brightness value has been specified.
2. "Foreign Material" is output if the long-to-short diameter ratio of the connected pixel cluster extracted on 1 is smaller than the lower limit of the "Length Diameter Ratio (%)" and the area of pixel cluster is larger than "Area (mm<sup>2</sup>)".
3. "Foreign Material" is output if the long-to-short diameter ratio of the connected pixel cluster extracted on 1 is larger than the upper limit of the "Length Diameter Ratio (%)" and the area of pixel cluster is larger than "Area (mm<sup>2</sup>)".

If a multiple number of foreign materials are detected, the one with the largest "Area (mm<sup>2</sup>)" is displayed as the measure value. However, all the measured values are output as the inspection result.



### Exclusion Window

Inside of an exclusion window is not used for inspection. If a connected pixel cluster extracted by the characteristic parameters does not satisfy the "foreign material" condition due to an exclusion window, it is not judged as "Foreign material".

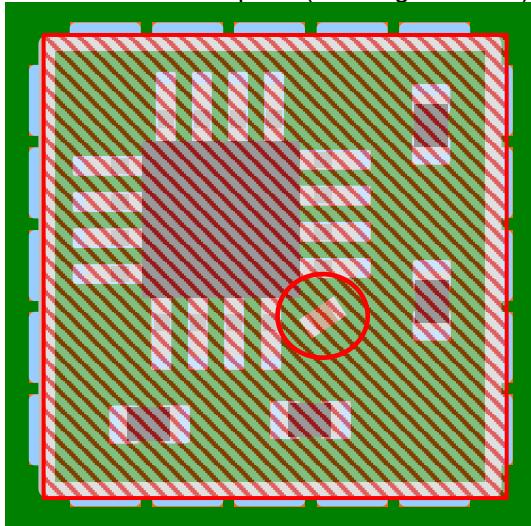


Fault Output: Foreign Material  
(Around Component)  
Fault Code: 150

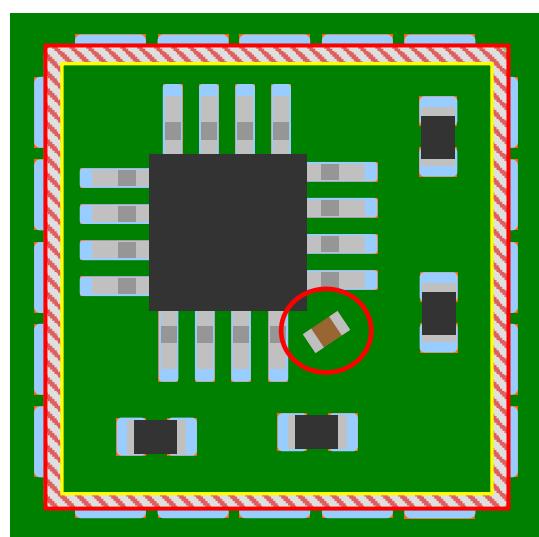
**Precautions when the component body window, electrode window, and land window overlap the inspection area.**

In the case of shield components and SoC (system-on-chip) components, where additional components are mounted inside the component, or in connector parts, the foreign materials are not subject to inspection in the component body window, electrode window, or additional window, both for own parts and other components, so there is a possibility that they may be missed. Be sure to set up an exclusion window for the area where you want to perform the inspection. However, even if you set an exclusion window for electrodes and land windows, they will not be subject to inspection.

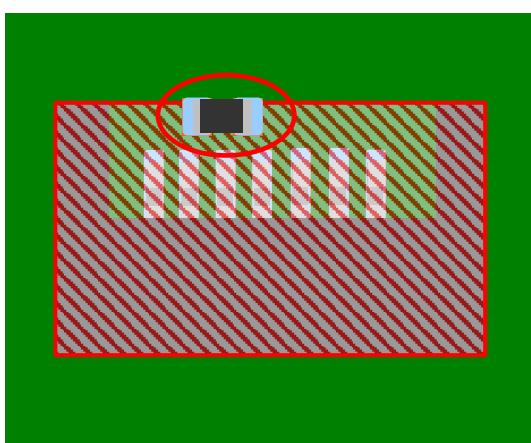
Areas not subject to inspection by the part body window of shielded parts (red diagonal area)



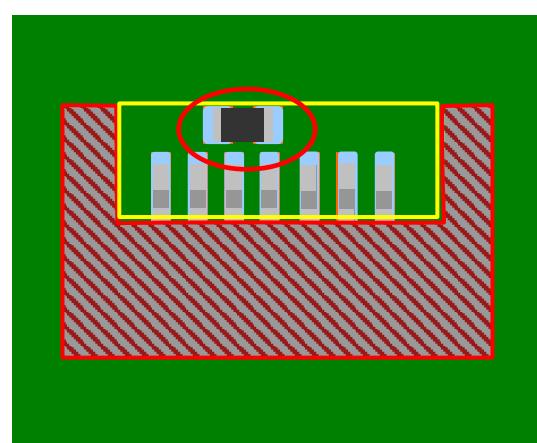
Set the exclusion window (yellow frame)



Areas not subject to inspection by the component body window (red shaded area)



Set the exclusion window (yellow frame)



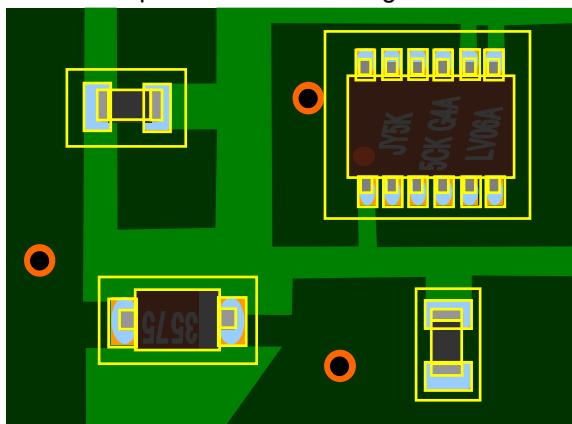
## 6.5 Full View Foreign Material

### ■ Outline

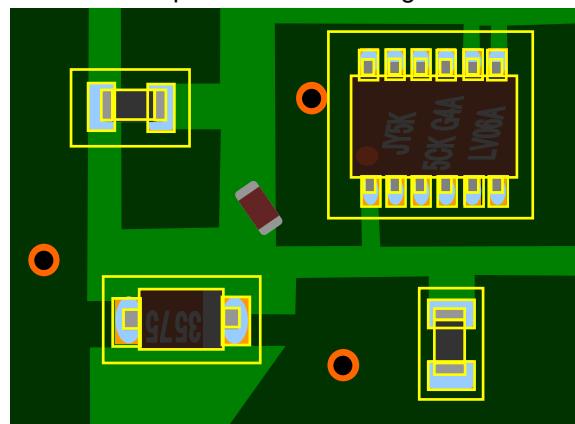
Foreign materials are detected according to the color and height of the foreign material detected in an area which is within the inspection view and does not include any component windows, electrode windows, or land windows.

\*Height is not usable for VT-Z600/S720/S500.

OK example: There is no foreign material

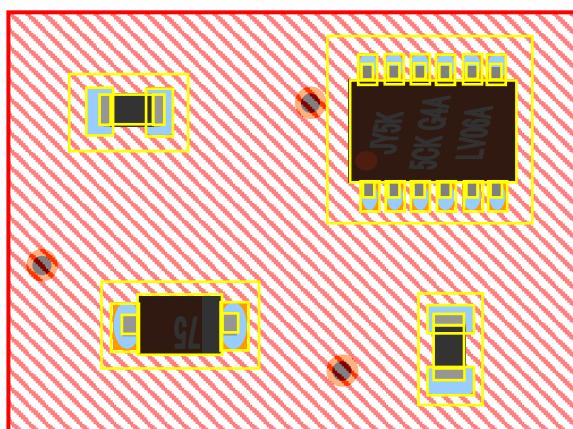


NG example: There is a foreign material



### ■ Inspection area

Hatched area in the figure (area in the inspection range window not including any lands, component main bodies, or electrode windows)



### ■ Characteristic parameters

- Difference from the OK template image (It is not allowed to set arbitrary colors.)
- Height information when the object is higher than the specified height  
(VT-S1080/S1040/S730-H/S730/S530 only)

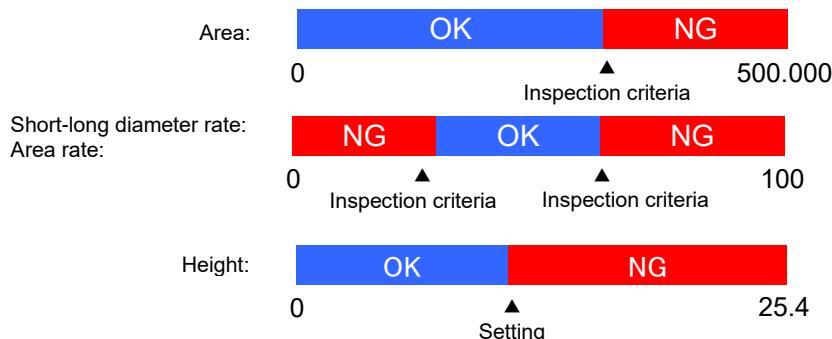
### ■ Inspection criteria

If the value is within the range of the set value, it is judged as OK. The ranges of the numerical values which can be set as the set value are shown in the figure below.

\*Height is not displayed when the machine is VT-Z600/S720/S500.

\* The inspection method line appears only on the VT-S1080/S1040/Z600.

Inspection item	Set value	Measured value	Judgment
<b>■ Foreign material</b>			
Inspection method	<input checked="" type="radio"/> Fixed <input type="radio"/> Variable	<input type="button" value="Regeneration"/>	
Area (mm <sup>2</sup> )	0 —		
Short-long diameter rate (%)			
Area rate (%)			
■ Height (mm)			
Height criteria	<input checked="" type="radio"/> PCB <input type="radio"/> Model		
Height (mm)			



### ■ Processing details

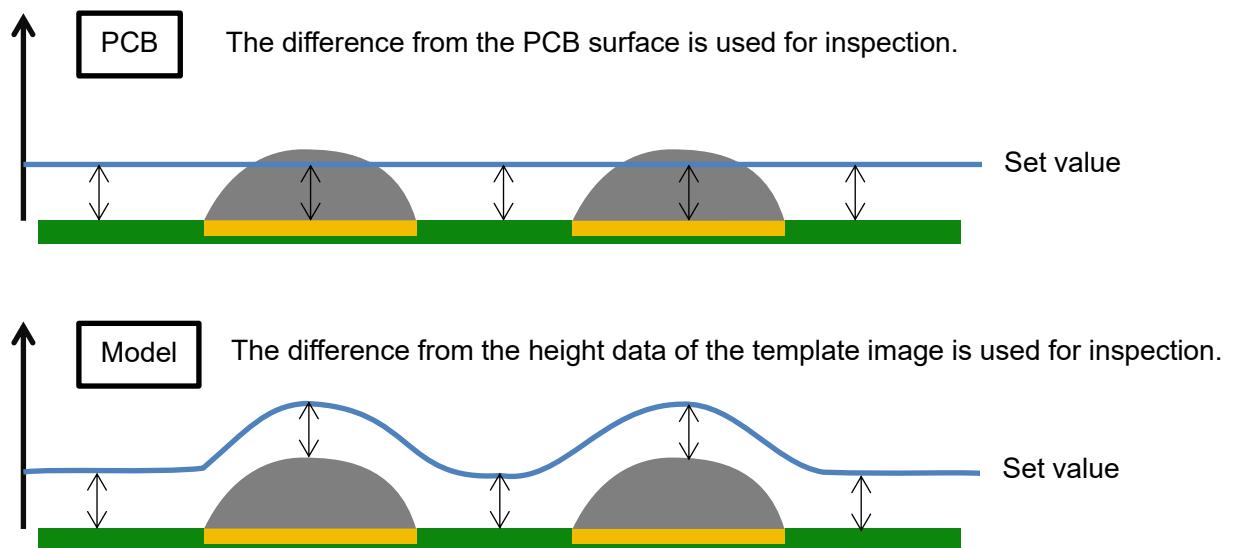
Available patterns for each equipment model are as follows. (Information with \* will not be displayed on the screen)

Model	Inspection method	Height inspection
VT-S1080	Either Fixed or Variable available	Available
VT-S1040	Either Fixed or Variable available	Available
VT-Z600	Either Fixed or Variable available	Unavailable*
VT-S730/S730-H	Only Fixed available*	Available
VT-S530	Only Fixed available*	Available
VT-S500	Only Fixed available*	Unavailable*
VT-S720	Only Fixed available*	Unavailable*

#### Case: Selecting " Fixed" as the inspection method

1. The brightness values of images within the inspection area and images cut from a pre-registered template PCB are compared, and a binarized image is created with pixels whose brightness value distance exceeds a pre-specified threshold value.
2. In the height data within the inspection area, a binarized image is created with pixels that exceed the specified "height (mm)". (If the height inspection is OFF or unavailable, skip this step and go to step 3)

## Height Criteria



- 3.** The following processing is performed on each pixel of the images in steps **1** and **2** according to the logical formula in the detailed settings.  
 (If the height inspection is OFF or unavailable, the same processing as selecting "Color only" is performed)

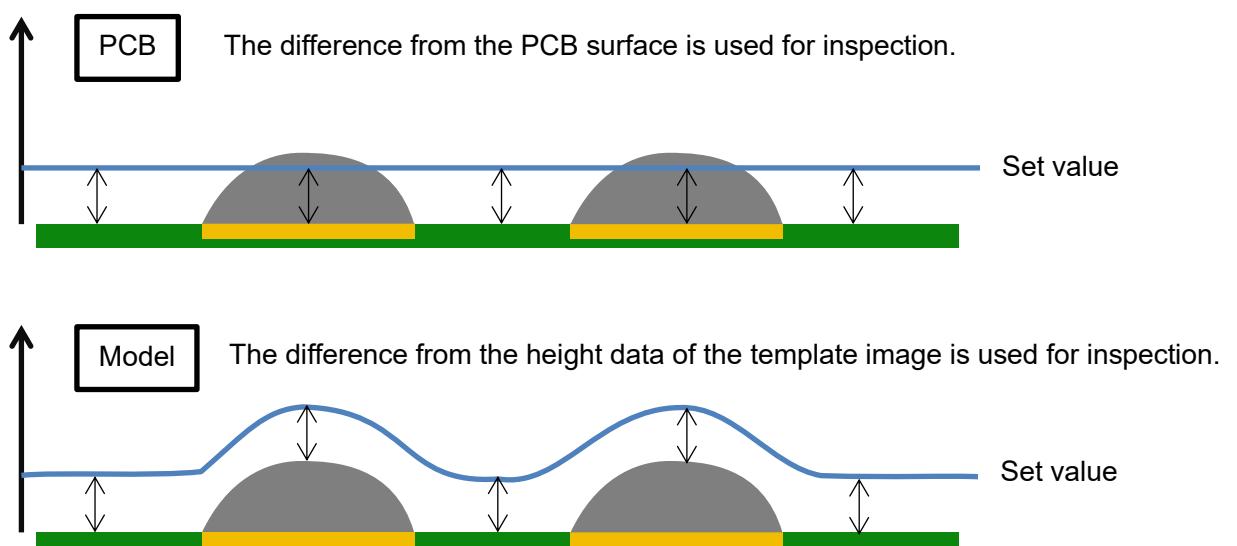
Logical formula in detailed settings	Description
Color only	The image of step <b>1</b> is used as it is.
Height only	The image of step <b>2</b> is used as it is.
Color AND Height	Logical AND (white if both are white, black otherwise) is taken for each pixel of the images in steps <b>1</b> and <b>2</b> .
Color OR Height	Logical OR (white if either is white, black otherwise) is taken for each pixel of the images in steps <b>1</b> and <b>2</b> .

- 4.** If the "long-short diameter ratio (%)" of the connected pixel set extracted in step **3** is outside the set range and the "area ratio (%)" is outside the set range, the pixel set is a candidate for a foreign object.
- 5.** If the area of the pixel set judged as the candidate in step **4** is outside the set range of the "area (mm<sup>2</sup>)", it is judged as a foreign object.

**Case: Selecting " Variable" as the inspection method**

1. A reference image is created by adding a pre-specified threshold value to each pixel of the pre-generated color model. (Color models are described later)
2. The brightness values of images within the inspection area and images cut from a pre-registered template PCB are compared, and a binarized image is created with pixels whose brightness value distance exceeds the brightness value of the reference image.
3. In the height data within the inspection area, a binarized image is created with pixels that exceed the specified "height (mm)". (If the height inspection is OFF or unavailable, skip this step and go to step 4)

## Height Criteria



4. The following processing is performed on each pixel of the images in steps 2 and 3 according to the logical formula in the detailed settings.  
(If the height inspection is OFF or unavailable, the same processing as selecting "Color only" is performed)

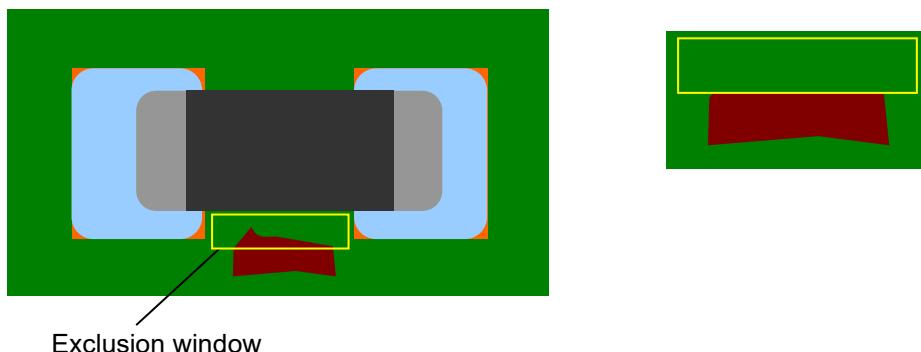
Logical formula in detailed settings	Description
Color only	The image of step 2 is used as it is.
Height only	The image of step 3 is used as it is.
Color AND Height	Logical AND (white if both are white, black otherwise) is taken for each pixel of the images in steps 2 and 3.
Color OR Height	Logical OR (white if either is white, black otherwise) is taken for each pixel of the images in steps 2 and 3.

5. If the "long-short diameter ratio (%)" of the connected pixel set extracted in step 3 is outside the set range and the "area ratio (%)" is outside the set range, the pixel set is a candidate for a foreign object.
6. If the area of the pixel set judged as the candidate in step 4 is outside the set range of the "area (mm<sup>2</sup>)", it is judged as a foreign object.

### Exclusion window

The inside of the exclusion window is not used for inspection. If the condition of being a foreign material is not satisfied by applying the exclusion window, the object is not judged as a foreign material.

Note that you can select between PCB and Individual destination. If you select PCB, the exclusion window is common for all destinations. If you select Individual destination, the exclusion window is added to the destination program displayed in [Captured Destination] of the image selected as the master in the PCB list.



S1080 S1040

Z600

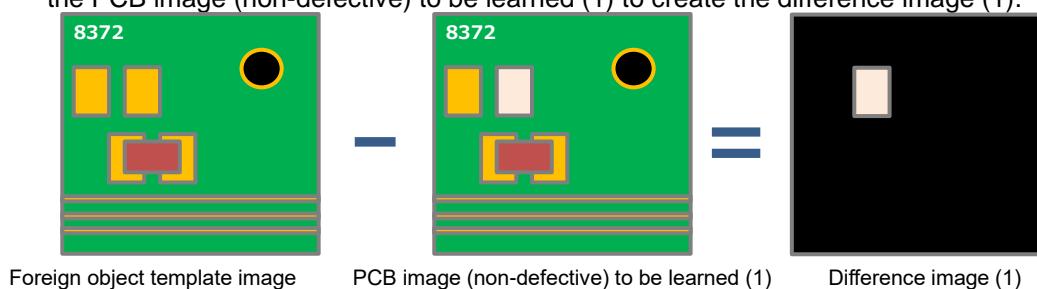
### Color Model

A color model refers to a composite difference image created by generating difference images between a foreign material template image and multiple PCB images (non-defective) and combining them. Each pixel in the color model represents a mass production variation learned from the PCB image (non-defective), which can be used for inspection to reduce false calls due to color.

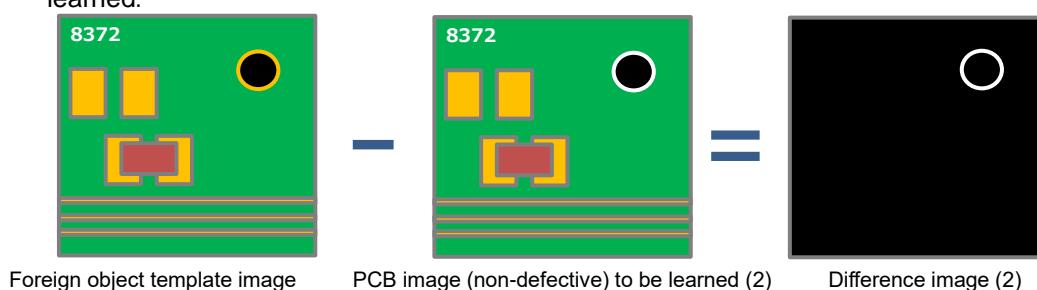
The flow of color model generation is shown below.

The example uses two PCB images (non-defective) to be learned.

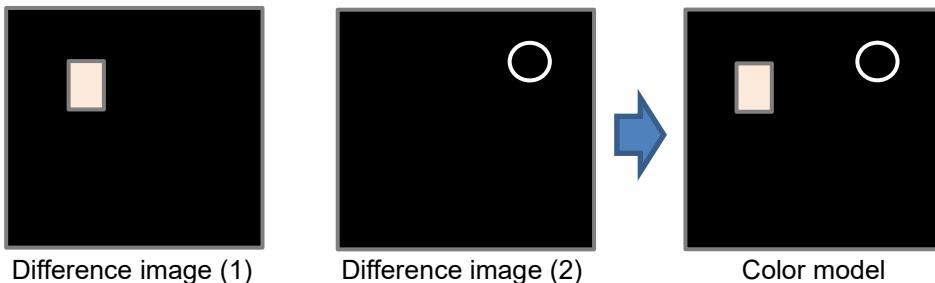
1. Calculate the difference in brightness values between the foreign object template image and the PCB image (non-defective) to be learned (1) to create the difference image (1).



2. Create the difference image (2) in the same way for the PCB image (non-defective) (2) to be learned.



3. Compare each pixel in the difference images (1) and (2), take the maximum value, and register it as a color model.

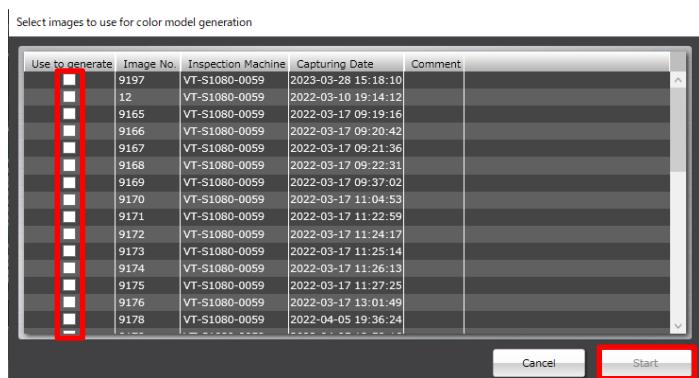


Inspection using color models can be performed with the Inspection Method as Variable.

When the inspection method is set as Variable, the PCB selection screen appears.

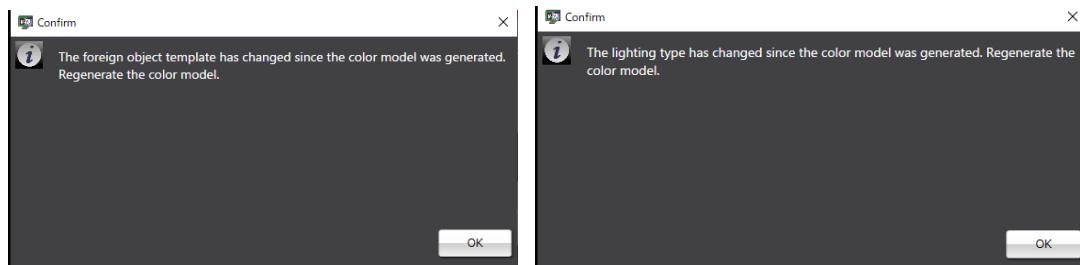
Select the check box of the PCB image (non-defective) which you want to use for color model generation, and press [Start].

After generation is complete, the color model can be used for inspection.



As the color model is uniquely generated by the set foreign object template image and illumination type, changing any of these settings requires regeneration of the color model. (The following message appears)

Regeneration of the color model can be performed by pressing [Regenerate] in the inspection criteria tree.

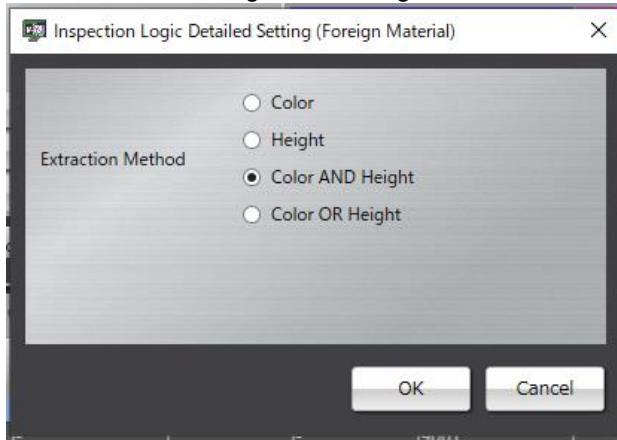


S1080

S1040

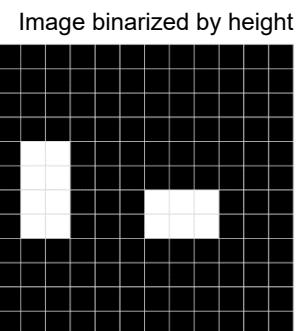
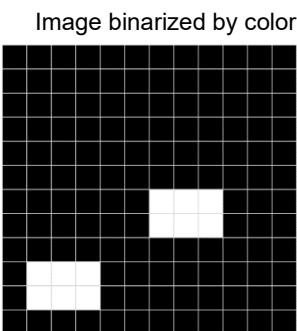
### Detailed Settings

In the detailed settings screen, logical formula for color and height can be constructed.

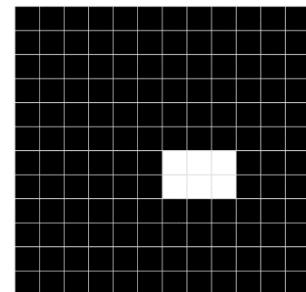


If the extraction method is "Color AND Height", logical AND (white if both are white, black otherwise) is taken for each pixel of the binarized image extracted by "color" and that extracted by "height".

Binarization using logical AND of color and height

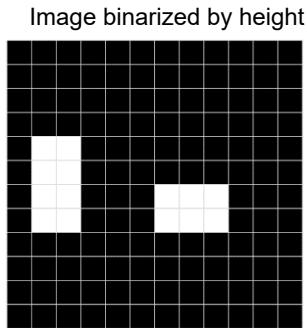
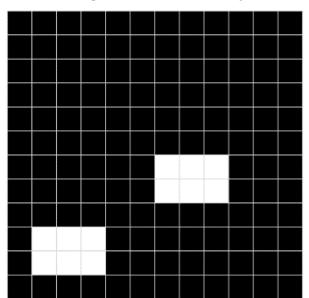


AND

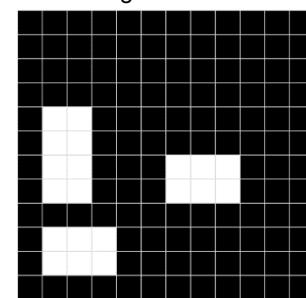


If the extraction method is "Color OR Height", logical AND (white if both are white, black otherwise) is taken for each pixel of the binarized image extracted by "color" and that extracted by "height".

Binarization using logical AND of color and height



OR



By combining logical formulas and inspection methods, the following situations can be handled.

<b>Logical formula</b>	<b>Inspection Method</b>	<b>Usage Situation</b>
Height only	-	Used to detect foreign objects with height. e.g.: Scraps of PCB
Color only	Fixed	Used to detect foreign objects that are not high and have a color difference from the background (e.g. PCB color). e.g.: tape, measing
	Variable	When false calls in color frequently occur in the above mentioned method, they can be reduced in this method.
Color AND Height	Fixed	Used to detect foreign objects that are high and have a color difference from the background (e.g. PCB color). e.g.: Solder ball
	Variable	When false calls in color frequently occur in the above mentioned method, they can be reduced in this method.
Color OR Height	Fixed	Used when foreign objects that are not high and foreign objects with no color difference are mixed and both are to be detected.
	Variable	When false calls in color frequently occur in the above mentioned method, they can be reduced in this method.

**Fault Output: Foreign Material (Full View)**  
**Fault Code: 151**

# 7 Oblique Inspection

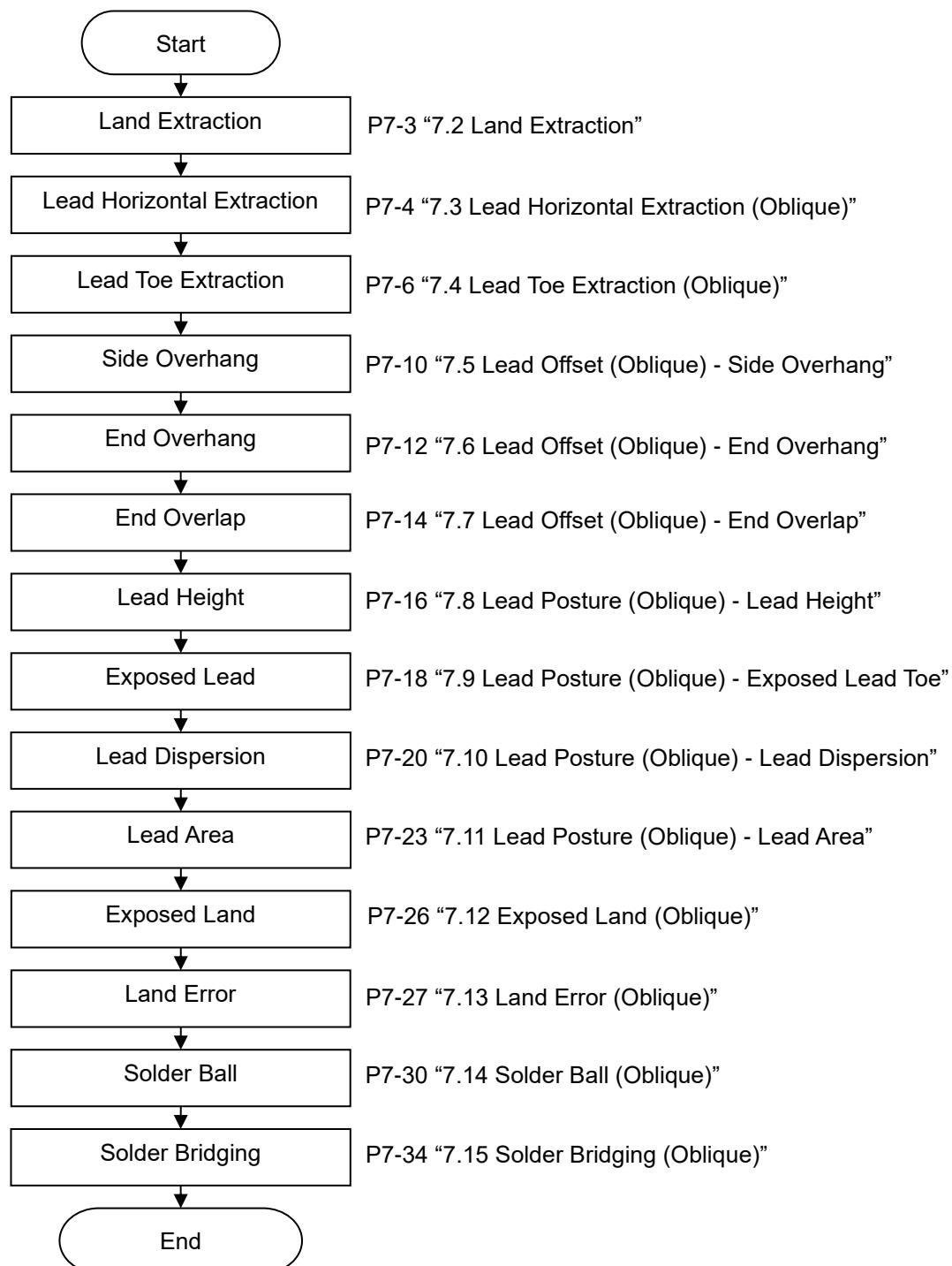
\* The description regarding the inspection logic is as follows.

No symbol: Common for VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500,

**S1080** : S1080 **S1040** : S1040 **Z600** : Z600 **S730** : S730-H/S730 **S720A** : S720A **S530** : S530 **S500** : S500

## 7.1 Oblique Inspection Flow

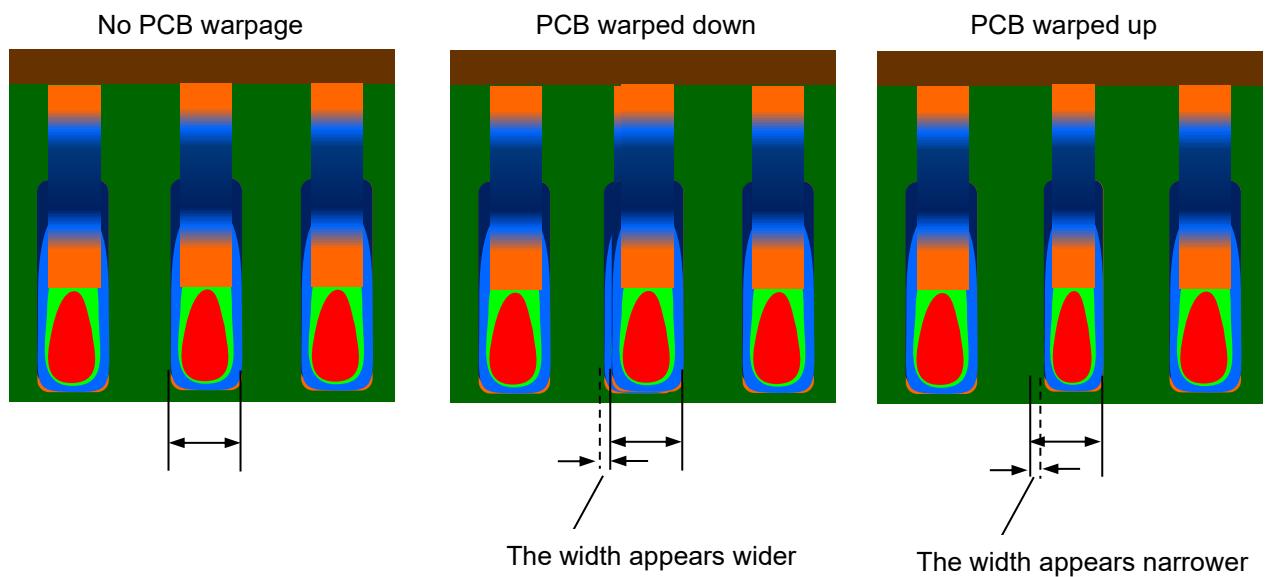
This section describes inspection logic used for oblique inspection.  
The oblique inspection is conducted in the order shown below.



**Image seams for multi-screen component**

If leads or lands do not fit in one visual field, images are taken in two or more visual fields and combined to form a single inspection image. This creates image seams, and depending on the degree of warpage of the PCB, the image may shift more at the seams.

If a seam occurs on a land/lead, or if the PCB is warped down, the width of the land/lead appears wider. If the PCB is warped up, the width of the land/lead appears narrower.

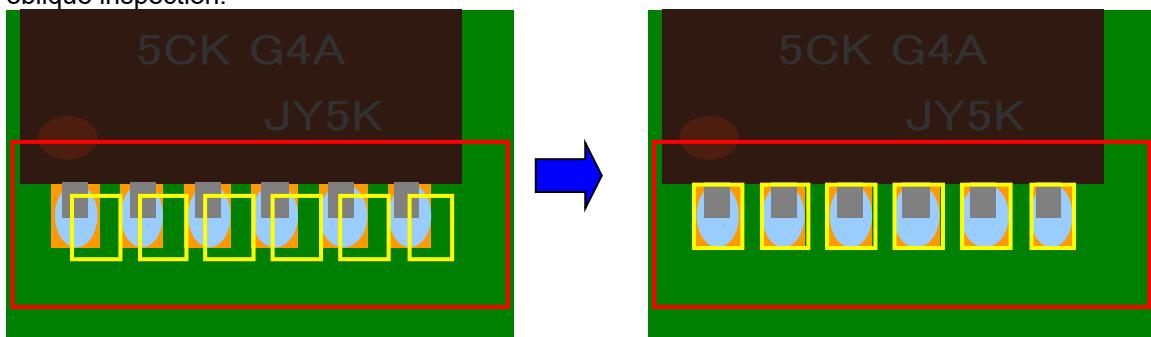


S1080  
S730  
S720A

## 7.2 Land Extraction

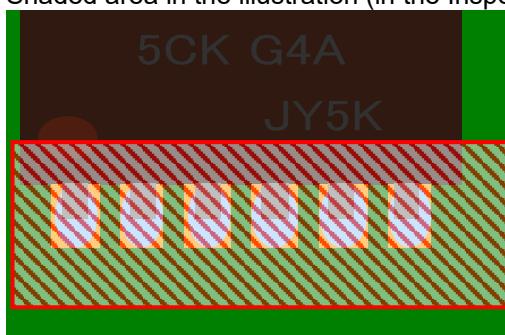
### ■ Overview

The land is extracted in the Inspection Range Window and assigned as the reference position of the oblique inspection.



### ■ Inspection Range

Shaded area in the illustration (in the Inspection Range Window)



### ■ Characteristic Parameter

Land and solder color

Illumination type (available only for S1080): Color highlight, enhanced white illumination

### ■ Inspection Criteria

None (only the land extraction is made without performing measurement and inspection)

### ■ Process Details

1. A group of pixels having the same size as all the land windows and having the same arrangement (extracted based on the characteristic parameter) is horizontally searched and extracted in the inspection range.
2. The land window is moved to the position extracted in Step 1.
3. A search is made through the inspection range in the component direction, to find an area where the pixel width extracted for the characteristic parameter is equal to or more than [50%] of the land width. (The process is done for each land)
4. All the land window ends are moved to the center of each land found in Step 3. (Relative positions of all the lands will not change)

<b>Fault Output</b>	: None
<b>Fault Code</b>	: None

S1080  
S730  
S720A

## 7.3 Lead Horizontal Extraction (Oblique)

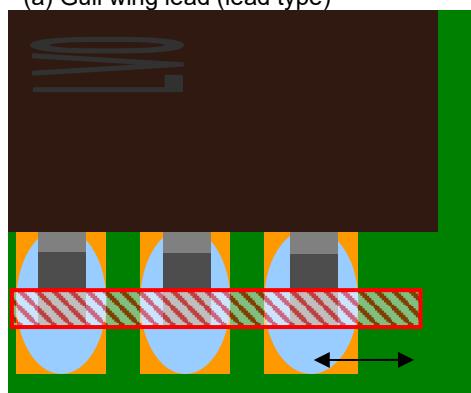
### ■ Overview

Leads are extracted in the Inspection Range window. Then, the position of the lead window is corrected and set as the reference position for lead inspection.

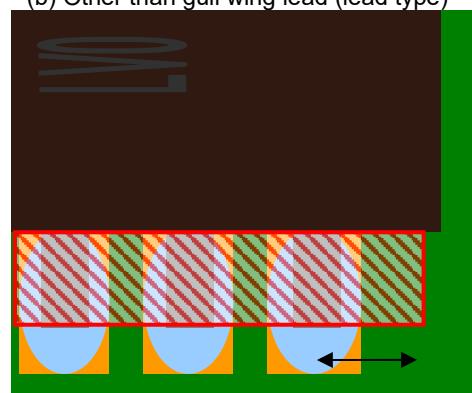
### ■ Inspection Range

Hatched portion on the figure

(a) Gull wing lead (lead type)



(b) Other than gull wing lead (lead type)



### ■ Characteristic Parameters

Lead color (oblique)

Illumination type (available only for S1080): Color highlight, enhanced white illumination

### ■ Inspection Criteria

Only lead horizontal extraction is executed, so measurement or inspection is not conducted. If the lead type is chip lead, no inspection criteria is present.

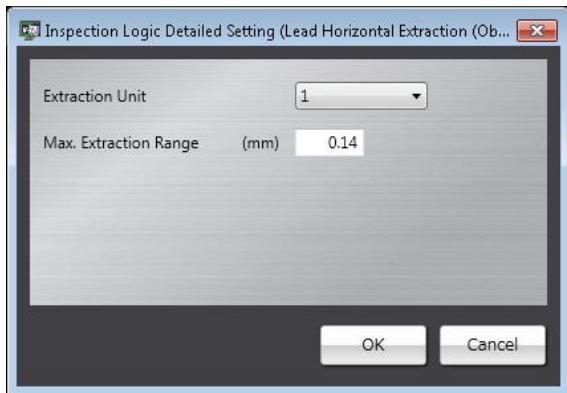
	Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Horizontal Extraction (Oblique)				

### ■ Process Details

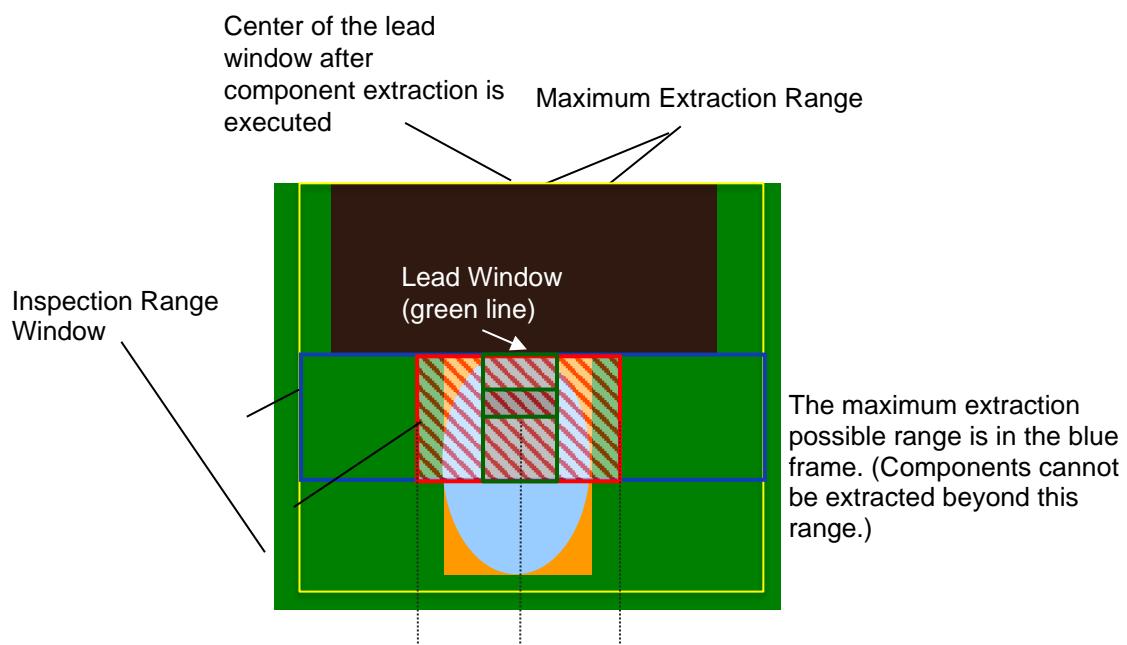
1. In the inspection range, a binarized image is created using the characteristic parameters.
2. In the image created by step 1, the system horizontally searches for a part whose shape most matches the shape of the all lead windows of the same direction in the taught same lead group.
3. The lead window is moved to the position searched by step 2 and set as the lead position.

### Detailed Setting

The unit of lead horizontal extraction and the maximum search range can be set. As the unit of extraction, 1, 4, 8, 16, or All are selectable.



The setting range of the maximum extraction range is as follows:



Fault Output : None  
Fault Code : None

S1080  
S730 S720A

## 7.4 Lead Toe Extraction (Oblique)

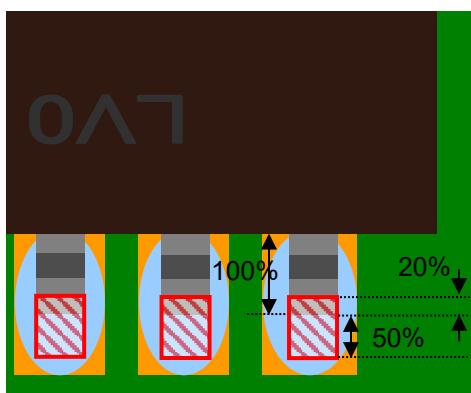
### ■ Overview

Leads are extracted in the Inspection Range window. Then, the position and size of the lead window are corrected and set as the reference position and size for lead inspection.

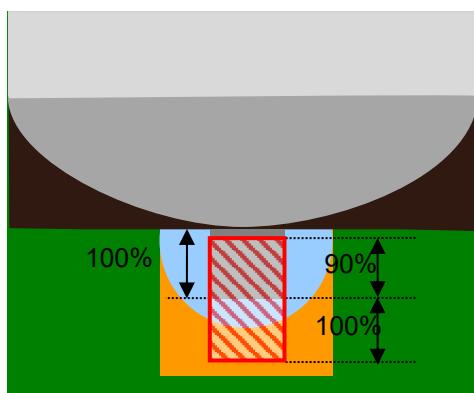
### ■ Inspection Range

Hatched portion on the figure

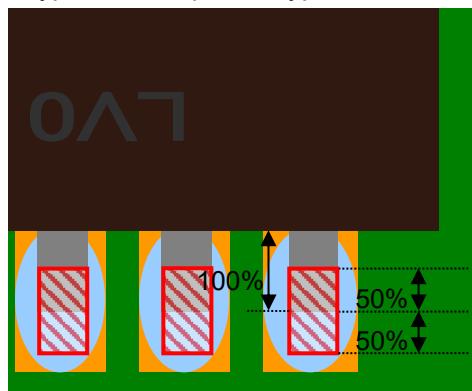
(a) Gull wing lead (lead type)\*



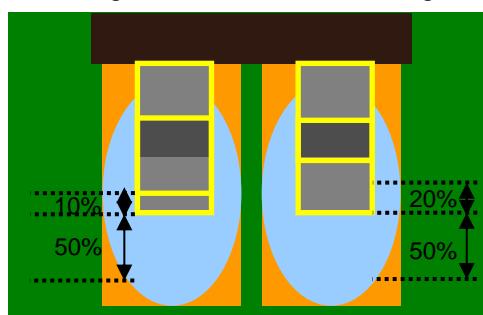
(b) Electrolytic capacitor (component type)



(c) Lead type and component type other than (a) or (b)



\*The lead toe extraction range of gull wing lead is 20% from the lead toe to front (component side) and 50% from the lead toe to rear (land side), respectively when the lead window size (long side) is set to 100%. However, if the range setting of the lead toe is narrow like the lead shown on the left side of the figure below, the search range of front (component side) becomes narrow and lead extraction might fail. So, set the toe range according to the actual lead.



Lead window setting of gull wing lead (Left: good example, right: bad example)



For the setting method of lead toe length (inflection point length), refer to Section 2.4.5.4 "Electrode Setting" of v-TS Teaching Manual.

### ■ Characteristic Parameters

Lead color (oblique)

Illumination type (available only for S1080): Color highlight, enhanced white illumination

### ■ Inspection Criteria

Only lead toes are extracted, so measurement and inspection are not conducted.

	Inspection Criteria	Setting Value	Measurement Value	Judge
■ Lead Toe Extraction				
Extraction Unit				
	1			
	4			
	8			
	16			
	ALL			

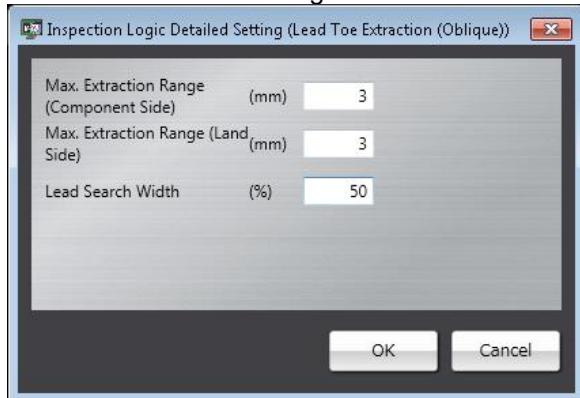
### ■ Process Details

1. Leads in the same direction of the same lead group are grouped by the number of leads specified as extraction unit.
2. The system searches for the position from which the total width of the pixels extracted in the inspection range grouped by step 1 is continuously 50% or more of the total width of the grouped lead window vertically from the component side to the land toe.
3. If the position of step 2 is detected, the end point is defined as lead toe.  
Otherwise, the position extracted by component extraction is used (not handled as a fault).  
The toes of the leads grouped by step 1 have the same position by this process.

Fault Output : None
Fault Code : None

### Detailed Setting

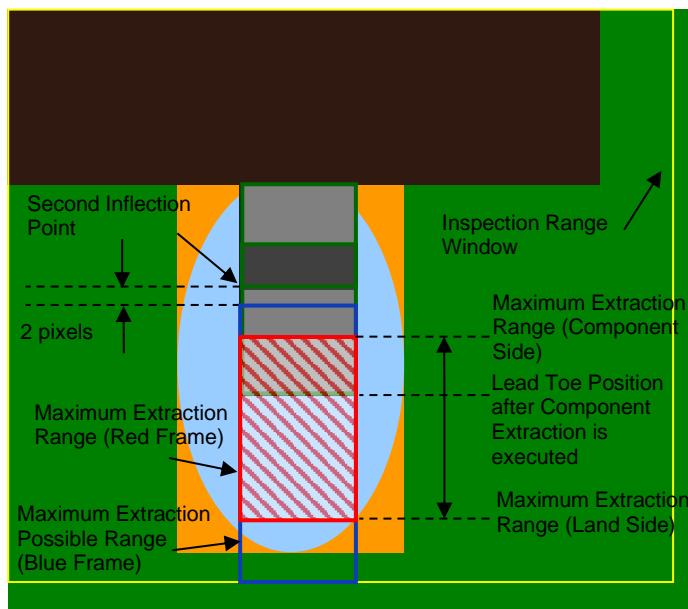
The maximum extraction range and lead search width of lead tow extraction can be set.



#### • Inspection Area of Gull Wing Lead

An illustration of the maximum extraction range of gull wing lead is shown below.

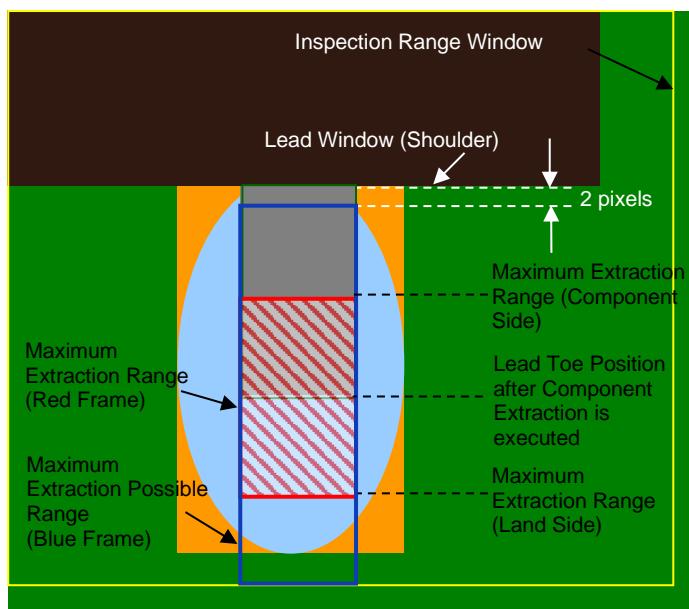
The maximum extraction range is the inspection range. It is not possible to extract beyond this range.



• Inspection Range of Other Than Gull Wing Lead

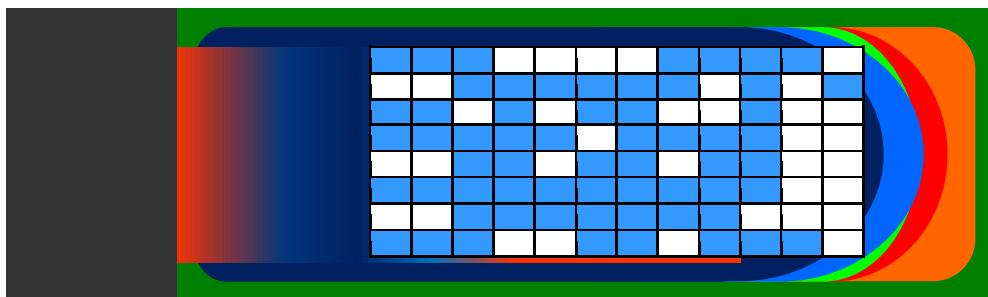
An illustration of the maximum extraction range of other than gull wing lead is shown below.

The maximum extraction range is the inspection range. It is not possible to extract beyond this range.

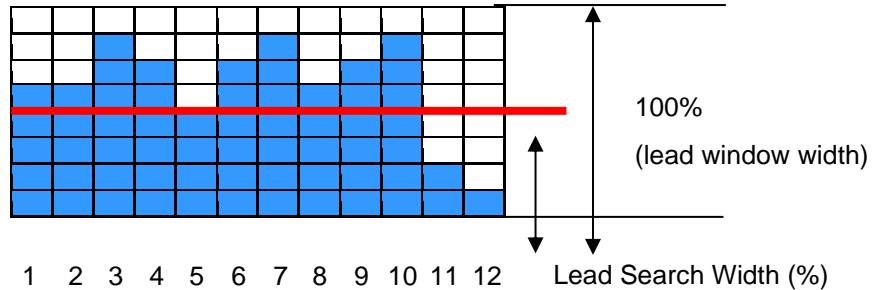


• Lead Search Width

The system vertically searches for the position from which the width of the pixels extracted by the lead color in the inspection range continues equally to or beyond the lead search width (%) to the width of the lead window from the component side to the land toe.



Given that the set value of width is 50%, the number of pixels which have 50% width and continue in the longitudinal direction is 10. The measurement value of length is 10 pixels.



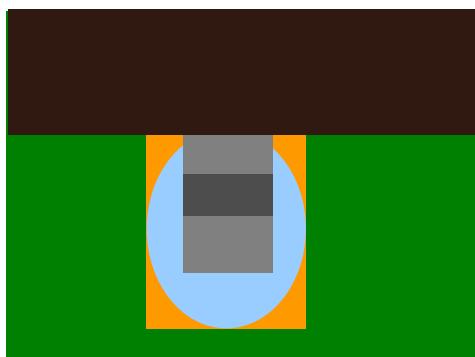
S1080  
S730  
S720A

## 7.5 Lead Offset (Oblique) - Side Overhang

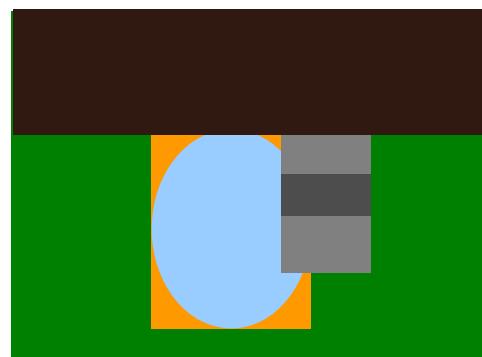
### ■ Overview

In the positions of the lead and land detected in the inspection range window, whether or not the lead is mounted in a normal position is inspected.

OK example: The lead is in a normal position



NG example: The lead is not in a normal position



### ■ Inspection Range

N/A

\*This is because the results of component extraction, lead horizontal extraction, and lead toe extraction are used.

### ■ Characteristic Parameters

N/A

\*This is because the results of component extraction, lead horizontal extraction, and lead toe extraction are used.

### ■ Inspection Criteria

The product is judged as OK if the resultant value are within the range of the set value. In addition, the range of the numerical values which can be specified on the set value is shown on the figure below.

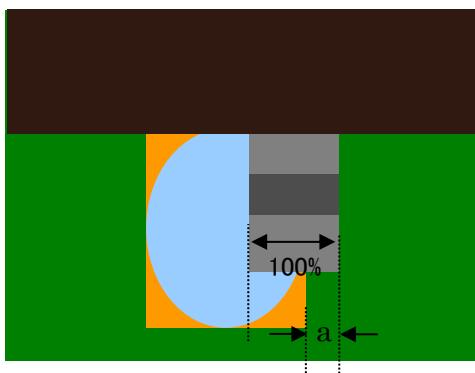
	Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Offset (Oblique)				
■ Side Overhang (Oblique) (%)	0	—	<input type="text"/>	



### ■ Process Details

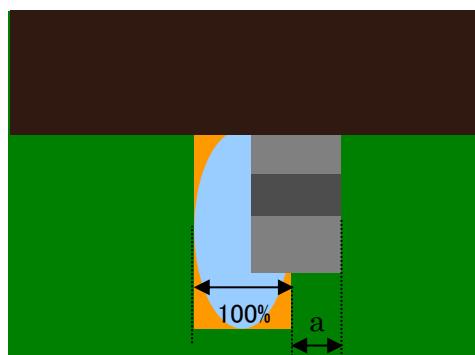
#### If the lead width is smaller than the land width:

For the lead and land detected in the inspection range window, if the distance from an end of the land to an end of the overhanging lead, distance  $a$ , is larger than the Side Overhang (Oblique) (%) value when the lead width is set to 100%, it is judged as "side overhang."



#### If the lead width is larger than the land width:

For the lead and land detected in the inspection range window, if the distance from an end of the land to an end of the overhanging lead, distance  $a$ , is larger than the Side Overhang (Oblique) (%) value when the land width is set to 100%, it is judged as "side overhang."



Fault Output : Side Overhang (Oblique)  
Fault Code : 307

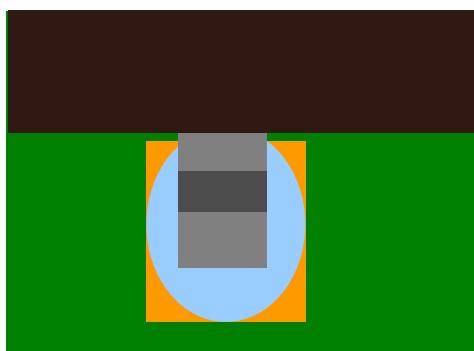
S1080  
S730 S720A

## 7.6 Lead Offset (Oblique) - End Overhang

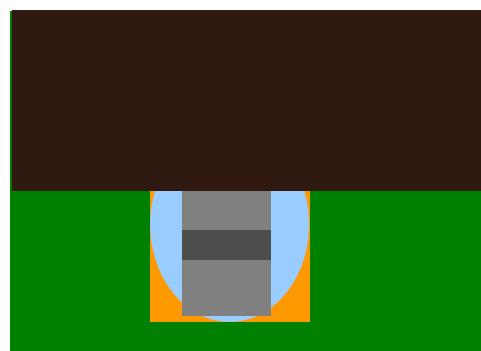
### ■ Overview

In the positions of the lead and land detected in the inspection range window, whether or not the lead is mounted in a normal position is inspected.

OK example: The lead is in a normal position



NG example: The lead is not in a normal position



### ■ Inspection Range

N/A

\*This is because the results of component extraction, lead horizontal extraction, and lead toe extraction are used.

### ■ Characteristic Parameters

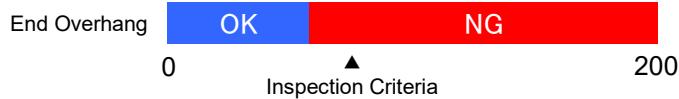
N/A

\*This is because the results of component extraction, lead horizontal extraction, and lead toe extraction are used.

### ■ Inspection Criteria

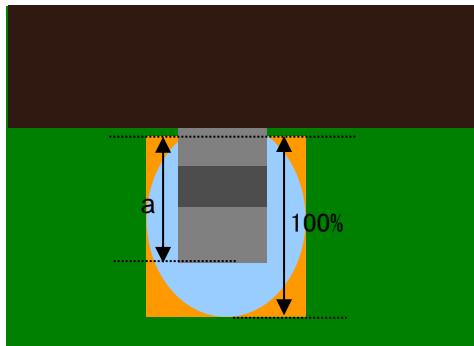
The product is judged as OK if the resultant value are within the range of the set value. In addition, the range of the numerical values which can be specified on the set value is shown on the figure below.

	Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Offset (Oblique)				
■ End Overhang (Oblique) (%)	0	—	<input type="text"/>	



■ Processing Detail

The lead and lands in the Inspection Range Window are inspected. "End Overhang" is output if the ratio of a) to the land length (100%) is larger than the "End Overhang (%)" where a) is the distance from the land inside edge to the offset lead end.



Fault Output: End Overhang (Oblique)  
Fault Code: 308

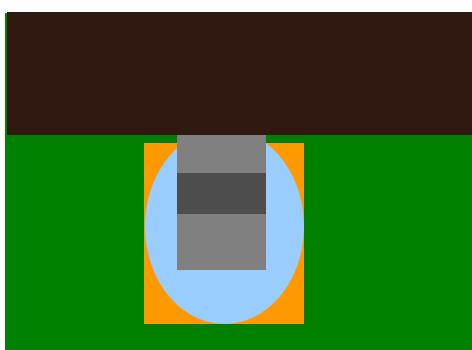
S1080  
S730  
S720A

## 7.7 Lead Offset (Oblique) - End Overlap

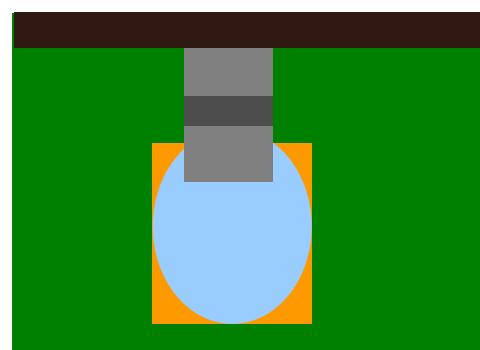
### ■ Outline

This system inspects the lead and land positions in the Inspection Range Window to judge if the lead are mounted on the right positions.

OK Example: Electrodes Mounted on the Correct Position



NG Example: Electrodes Mounted on the Wrong Position



### ■ Inspection Range

Not Specified

\* The results obtained in component extraction, lead horizontal extraction and lead end extraction are used.

### ■ Characteristic Parameter

Not Specified

\* The results obtained in component extraction, lead horizontal extraction and lead end extraction are used.

### ■ Inspection Criteria

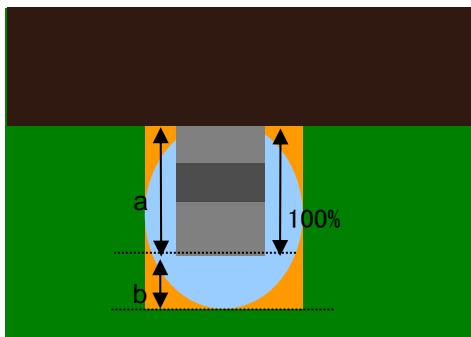
The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Offset (Oblique)				
■ End Overlap (Oblique) (%)				



■ **Processing Detail**

The lead and lands in the Inspection Range Window are inspected. "End Overlap" is output if the smaller of the ratio of a) and b) to the lead length (100%) is smaller than the "End Overlap (%)" where a) is the distance from the land inside edge to the offset lead end and b) is the distance from the land outside edge to the offset lead end.



**Fault Output: End Overlap (Oblique)**  
**Fault Code: 309**

S1080  
S730 S720A

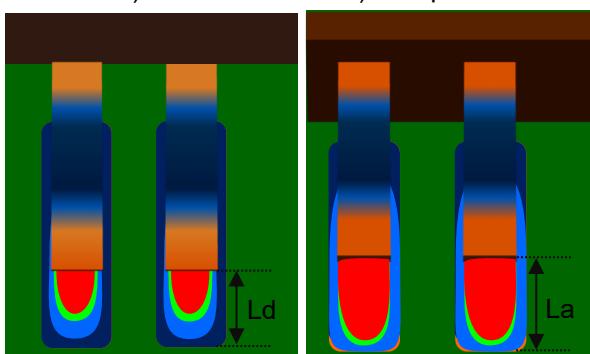
## 7.8 Lead Posture (Oblique) - Lead Height

### ■ Overview

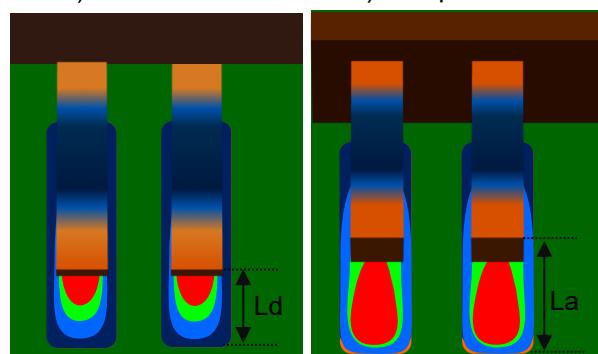
If a component and/or lead is lifted due to chip component biting or other reasons, a difference becomes larger between a distance ( $L_d$ ) between the land tip and lead toe in the direct view and a distance ( $L_a$ ) between them in the oblique view. Inspection is done for a lifted lead using the difference between distances between Land Tip and Lead Toe in the direct and oblique views.

\* This cannot be used for chip lead, castellated lead, non-lead, and insertion terminal.

OK Example: Height of lead top is low  
a) Direct View      b) Oblique View

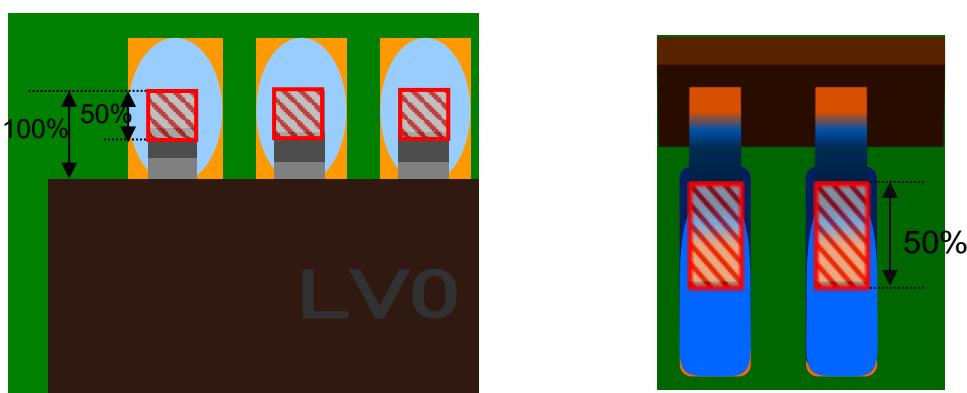


NG Example: Height of lead top is high  
a) Direct View      b) Oblique View



### ■ Inspection Range

Shaded areas below (lead size and position in the direct view are converted into those in the oblique view for setting)



### ■ Characteristic Parameter

Lead Color (Oblique)

Illumination type (available only for S1080): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The item will be evaluated as good if the value is within the configured range. The available range for configuration is shown below.

Inspection Item	Setting Value	Measurement Value	Judge
■ Lifted Lead			
Lead Height (mm)	0 - <input type="text"/>		



### ■ Process Details

1. For each lead, a search is made vertically for a pixel width extracted in an inspection area that runs continuously for "50(%)" or more against the lead window, from the component side to the land tip.
2. If the width searched in the step 1 is found, the end point of that is configured as the Lead Toe. If not, the search end position is configured as the Lead Toe.
3. Distances between the Lead Toe calculated in the step 2 and each land tip are calculated.
4. Distances between the extracted Lead Toe position in the direct view and each land tip are calculated.
5. If the Lead Height calculated based on the calculated values in the steps 3 and 4 is larger than the "Lead Height (mm)", it is judged as "Lead Height (Oblique)".

If there is more than one lifted lead, the largest of the "Lead Height (mm)" is displayed as the measured value. Note that all the measured values are provided as the inspection result.

Fault Output	: Lead Posture (Height (Oblique))
Fault Code	: 149

S1080  
S730  
S720A

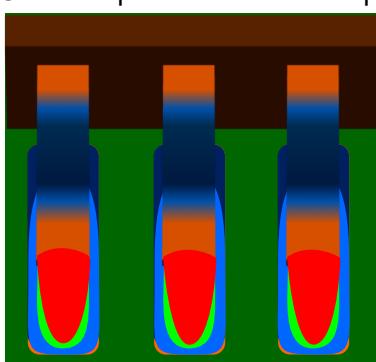
## 7.9 Lead Posture (Oblique) - Exposed Lead Toe

### ■ Overview

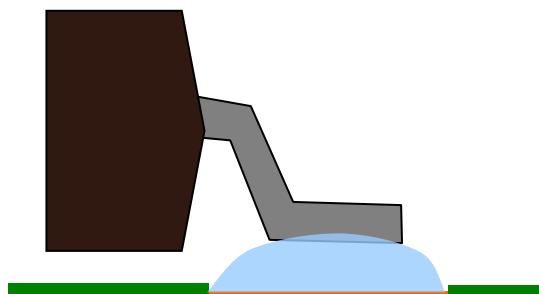
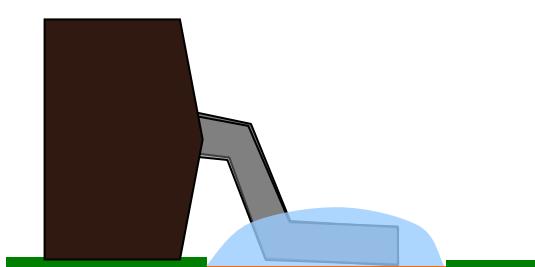
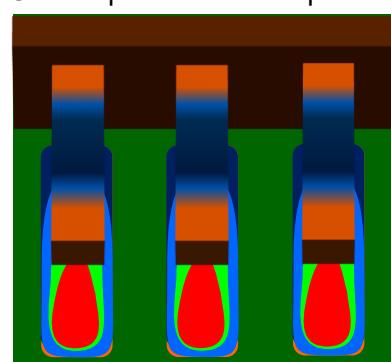
When a lead is lifted, its end will be exposed. Whether a lead is lifted or not is determined by difference of brightness on the border between the lead end appearing when lifted and the solder.

\* This cannot be used for chip lead, castellated lead, non-lead, and insertion terminal.

OK Example: Lead toe not exposed



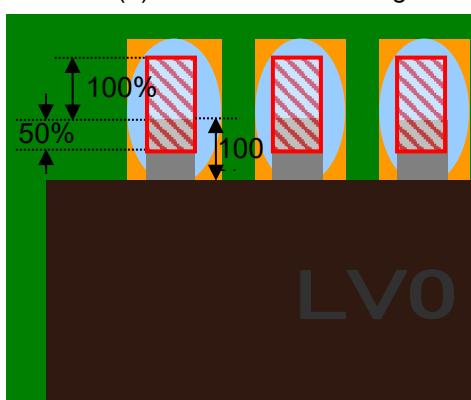
NG Example: Lead toe exposed



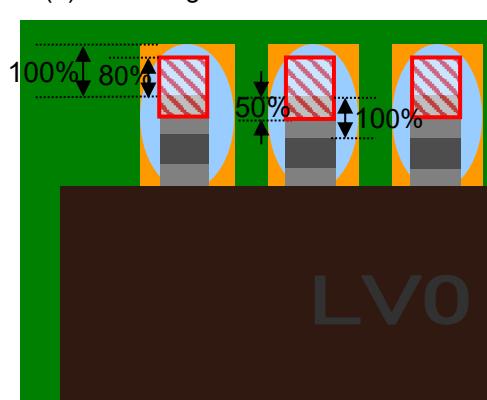
### ■ Inspection Range

Shaded area below (lead size and position in the direct view are converted into those in the oblique view for setting)

(a) Other than Gull-Wing Lead



(b) Gull-Wing Lead



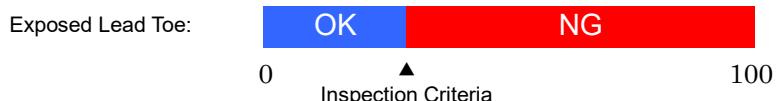
### ■ Characteristic Parameter

No configuration required.

### ■ Inspection Criteria

The item will be evaluated as good if the value is within the configured range. The available range for configuration is shown below.

Inspection Item	Setting Value	Measurement Value	Judge
■ Lifted Lead (Oblique)			
Exposed Lead Toe (%)	0 - 		



### ■ Process Details

If a degree of brightness change extracted for the characteristic parameter in the inspection area is larger than [Exposed Lead Toe (%)], it is judged as "Lead Posture (Exposed Toe (Oblique))".

If there is more than one lifted lead, the largest of the "Exposed Lead Toe (%)" will be displayed as the measured value. Note that all the measured values are provided as the inspection result.

Fault Output	: Lead Posture (Exposed Toe (Oblique))
Fault Code	: 304

S1080  
S730 S720A

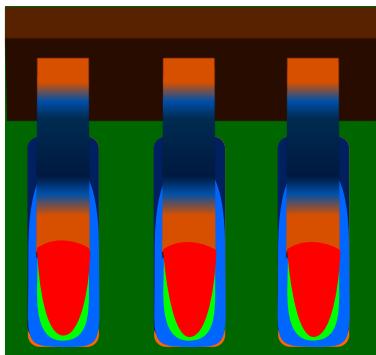
## 7.10 Lead Posture (Oblique) - Lead Dispersion

### ■ Overview

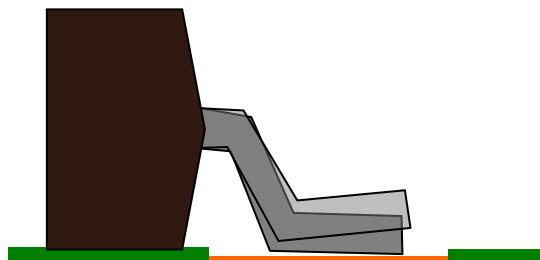
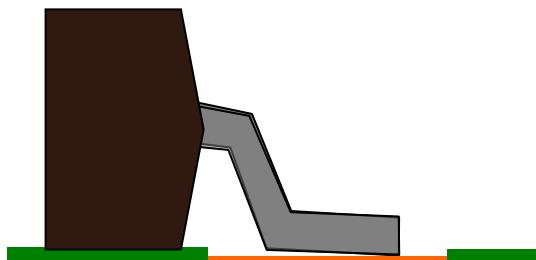
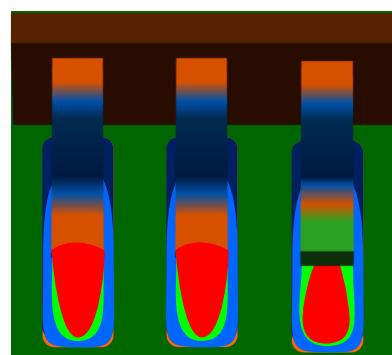
When a lead is lifted, its color changes depending on the degree of lead inclination. Whether a lead is lifted or not is inspected by comparing its color with those of the adjoining leads.

\* This cannot be used for chip lead, castellated lead, non-lead, and insertion terminal.

OK Example: Colors of the adjoining lead toes are the same



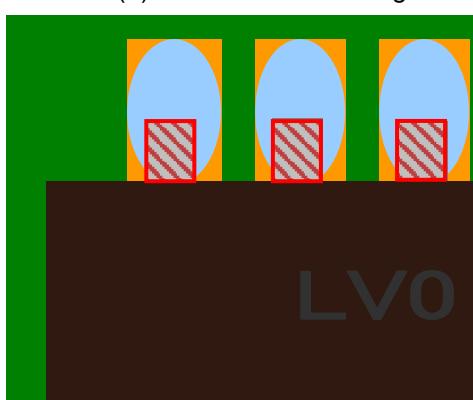
NG Example: Colors of the adjoining lead toes are different



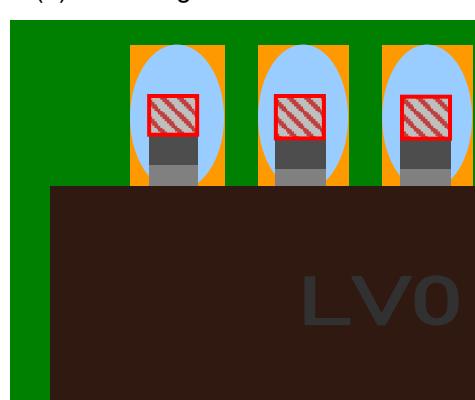
### ■ Inspection Range

Shaded area below (lead size and position in the direct view are converted into those in the oblique view for setting)

(a) Other than Gull-Wing Lead



(b) Gull-Wing Lead



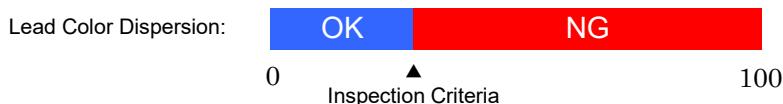
### ■ Characteristic Parameter

No configuration required.

### ■ Inspection Criteria

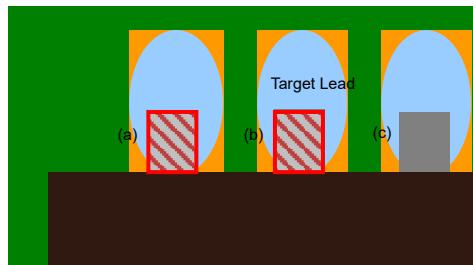
The item will be evaluated as good if the value is within the configured range. The available range for configuration is shown below.

Inspection Item	Setting Value	Measurement Value	Judge
■ Lifted Lead			
Lead Dispersion (%)	0 - <input type="text"/>		

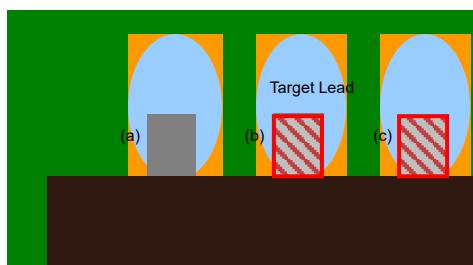


### ■ Process Details

1. The characteristic parameters are used to measure degrees of lead color dispersion in area (b) of the target lead and area (a) of the left-side lead. If no lead exists on the left of the target lead, the degree of dispersion is measured as "0".



2. In the same way, degrees of lead color dispersion in area (b) of the target lead and area (c) of the right-side lead are measured. If no lead exists on the right of the target lead, the degree of dispersion is measured as "0".



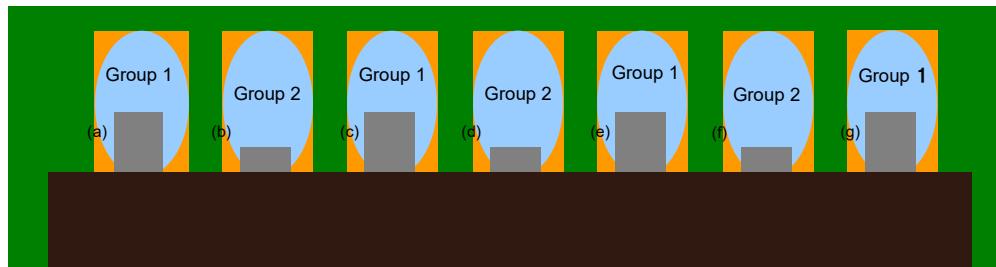
3. If either of the measured values in the steps 1 and 2 is larger than the "Lead Dispersion (%)", it is judged as "Lead Posture (Dispersion(Oblique))". If there is more than one lifted lead, the largest of the "Lead Dispersion(%)" is displayed as the measured value. Note that all the measured values are provided as the inspection result.

\* The larger the color difference, the closer the measured value to 100%.

Fault Output	: Lead Posture (Dispersion (Oblique))
Fault Code	: 305

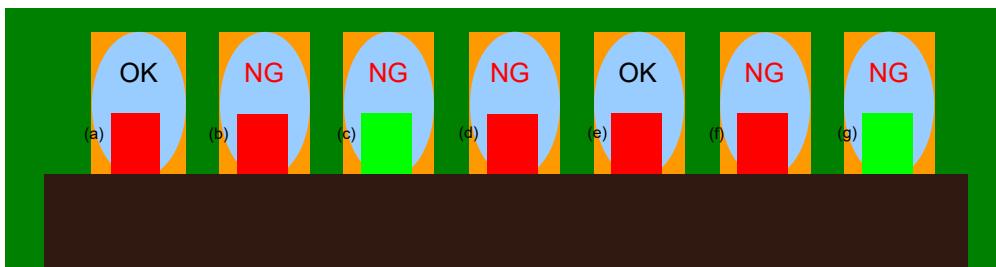
### Leads used for measurement

Measurement is performed among the lead of the same direction in the same lead group. In the group configuration like below, for example, if the target lead is (c), lead (a) and (e) are used for measurement as the left-hand and right-hand ones, respectively.



### Inspection results

This inspection judges two or more lead adjacent each other as NG simultaneously.



If the target lead is:

- (a), it is judged as OK because dispersion between it and the right-hand lead (b) is small.
- (b), it is judged as NG because dispersion between it and the right-hand lead (c) is large.
- (c), it is judged as NG because dispersion between it and the left-hand lead (b) is large.
- (d), it is judged as NG because dispersion between it and the left-hand lead (c) is large.
- (e), it is judged as OK because dispersion between it and the left-hand lead (d) is small and that between it and the right-hand lead (f) is small.
- (f), it is judged as NG because dispersion between it and the right-hand lead (g) is large.
- (g), it is judged as NG because dispersion between it and the left-hand lead (f) is large.

S1080  
S730  
S720A

## 7.11 Lead Posture (Oblique) - Lead Area

### ■ Overview

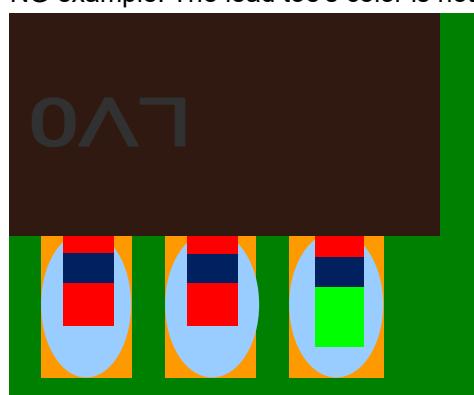
If a lead is lifted, the lead toe color changes from the flat color (red) to green or blue. Whether or not the lead is lifted is inspected according to the difference of the lead color appearing when a lead is lifted.

\*This is not usable for chip leads, castellation leads, or non-leads.

OK example: The lead toe's color is red



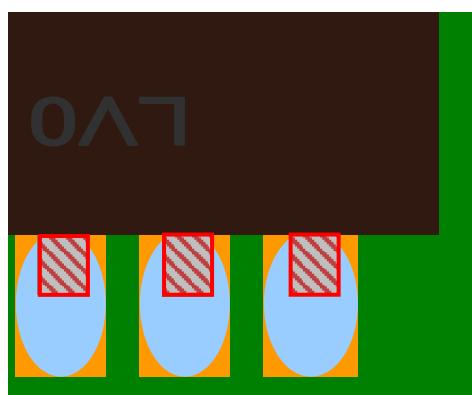
NG example: The lead toe's color is not red



### ■ Inspection Range

Hatched portion on the figure

(a) Other than gull wing lead



(b) Gull wing lead



### ■ Characteristic Parameters

Color of lifted lead

Illumination type (available only for S1080): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The product is judged as OK if the resultant value is within the range of set value. In addition, the range of the numerical values which can be specified on the set value is shown on the figure below.

	Inspection Item	Setting Value	Measurement Value	Judge
■ Lead Posture (Oblique)				
■ Lead Area (Oblique) (%)	0	-	<input type="text"/>	



■ **Process Details**

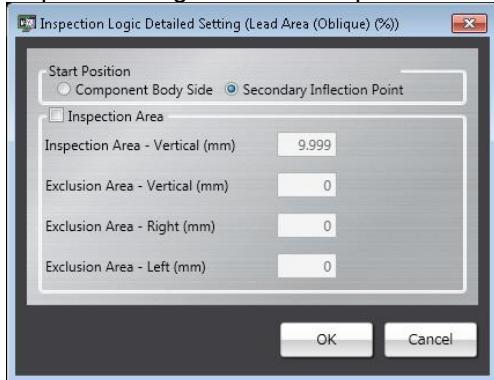
If the area of the pixels extracted by the characteristic parameters in the inspection range is larger than the Lead Area (%) to the inspection range, the pixels are judged as Lead Posture (Area).

If there are more than one lifted lead, the maximum Lead Area (%) is displayed as measurement value. However, all measurement values are output as inspection results.

<b>Fault Output</b>	: Lead Posture (Area (Oblique))
<b>Fault Code</b>	: 310

### Detailed Setting

The inspection range can be set up in detail.

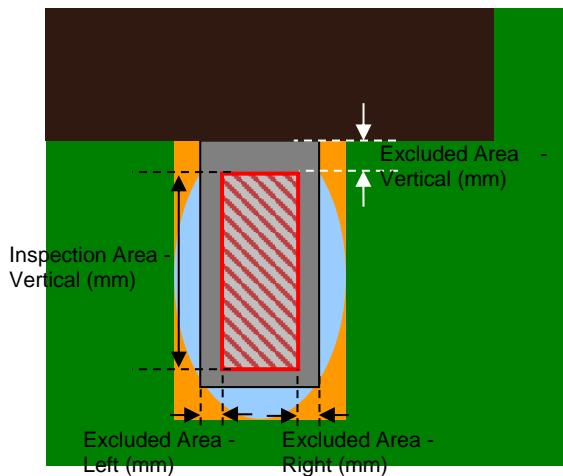


Remove "Excluded Area - Right (mm)" and "Excluded Area - Left (mm)" from the lead area.  
Remove "Excluded Area - Vertical (mm)" from the origin position. The origin position becomes as follows:

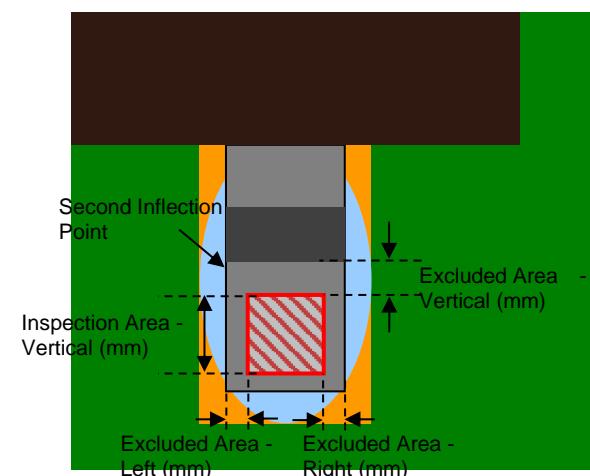
- Component Side of Start Position: The origin is on the component body.
- Second Inflection Point of Start Position: The origin is on the second inflection point of the lead.

The illustration of the inspection area setting is shown below.

(a) Inspection Area ON - Component Body Side



(b) Inspection Area ON - Second Inflection Point



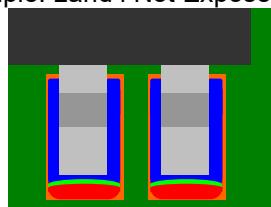
S1080  
S730 S720A

## 7.12 Exposed Land (Oblique)

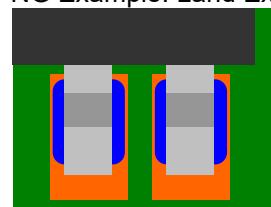
### ■ Overview

Inspection is made whether a land is exposed or not for the land color detected in the land window.

OK Example: Land I Not Exposed

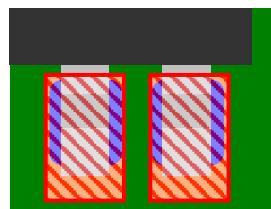


NG Example: Land Exposed



### ■ Inspection Range

Shaded area in the illustration



### ■ Characteristic Parameter

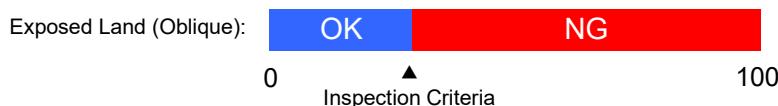
Land color

Illumination type (available only for S1080): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The item will be evaluated as good if the value is within the configured range. The available range for configuration is shown below.

Inspection Item	Setting Value	Measurement Value	Judge
■ Exposed Land (Oblique)	0 - <input type="text"/>		



### ■ Process Details

If an area of pixels extracted for the characteristic parameter in the inspection area is larger than [Exposed Land (Oblique)(%)], it is judged as "Exposed Land (Oblique)".

Fault Output	: Exposed Land (Oblique)
Fault Code	: 300

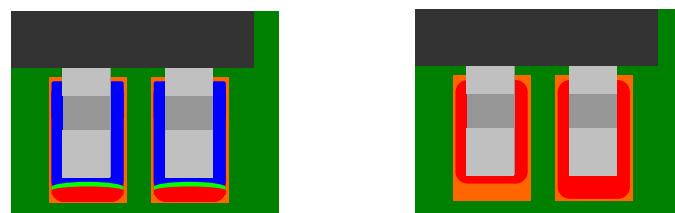
S1080  
S730  
S720A

## 7.13 Land Error (Oblique)

### ■ Overview

The abnormal color detected within the window inspects if the land has error.

OK sample: Land has no error. NG sample: Land has error.

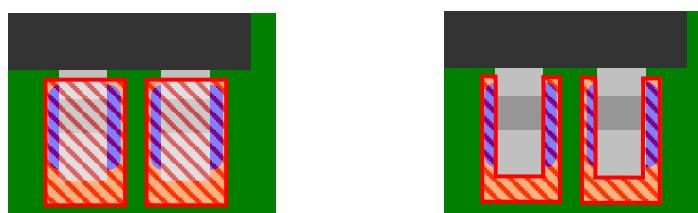


### ■ Inspection range

Oblique line portion of the chart

(a)"Except component/lead" :ON

(b)"Except component/lead" :OFF



### ■ Characteristic parameter

Land abnormal color

Land Plane Exclusion Color

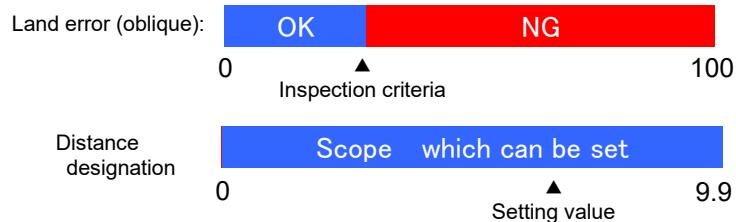
Illumination type (available only for S1080): Color highlight, enhanced white illumination

### ■ Inspection criteria

If the color of the land is within the range of setting value, it is judged to be OK. In addition, the scope of the value which can be set is indicated in the following chart.

	Inspection Item	Setting Value	Measurement Value	Judge
<b>■ Land Error (Oblique)</b>				
	■ Setting 1 (Oblique)(%)	<input type="text"/> — <input type="text"/>		
	■ FollowLeadEnd			
	■ FollowLeadSide			
	■ Specify Distance (mm)	<input type="text"/>		
	■ ExcludeForComponentAndLead			
	■ Fixed Lead Side			
	■ Land Plane Exclusion			
	Width (%)	<input type="text"/>		
	Length (mm)	<input type="text"/>		
<b>■ Setting 10 (Oblique) (%)</b>				
	■ FollowLeadEnd			
	■ FollowLeadSide			
	■ Specify Distance (mm)	<input type="text"/>		

■ ExcludeForComponentAndLead	
■ Fixed Lead Side	
■ Land Plane Exclusion	
Width (%)	<input type="text"/>
Length (mm)	<input type="text"/>



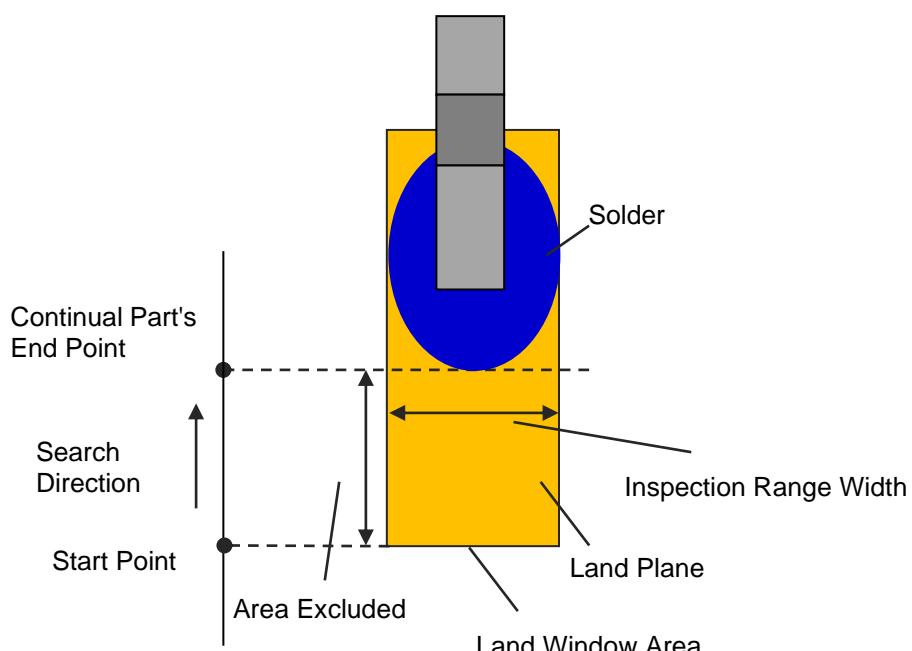
#### ■ Content of handling

If the area of pixels extracted by characteristic parameter within the inspection range is smaller than the lowest limit of "land error (%)" for the inspection range or is larger than the highest limit of "land error (%)", it is judged to be "land error." If it is judged to be "land error" for multiple inspection ranges, the one whose land error (%) is the farthest from the scope of the OK sample is indicated as the measurement value.

**Fault Output: Land error (oblique)  
Fault Code: 306**

#### Land Plane Exclusion

In the inspection area, the part where the width of the pixel extracted by the target color is equal to or larger than "Width (%)" of the inspection area width and which continues more than "Length (mm)" is determined as the land plane, and the land plane is excluded from the land window area. The excluded area is replaced with a land window area and used for subsequent inspection. If no land plane is detected, the land window range will not be changed.





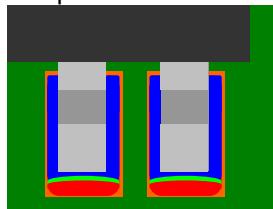
For details on settings, see "5-10 Land Error"

## 7.14 Solder Ball (Oblique)

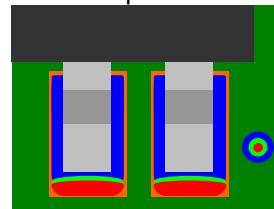
### ■ Overview

The solder ball around a component is detected for the solder color detected in the Inspection Range Window.

OK Example: No Solder Ball Exists

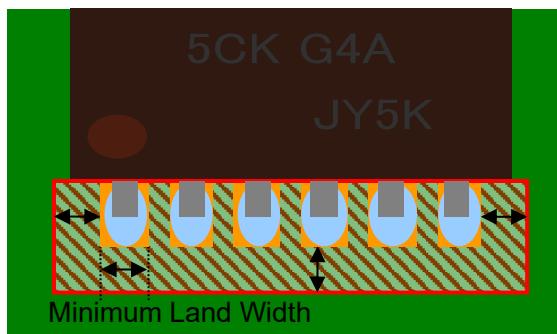


NG Example: Solder Ball Exists



### ■ Inspection Range

Inspection Area Limitation OFF: Shaded area in the illustration (area extended to tight/left/down by the minimum land width for the rectangular frame of the land (except for the land))



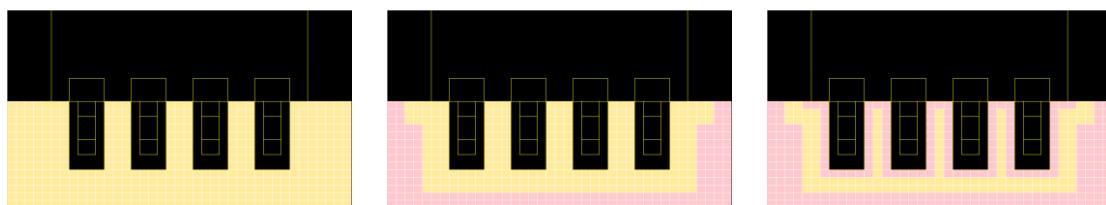
Inspection Area Limitation ON: Yellow area in the drawing (This is the area set by "inspection area limitation" in the inspection range window. (However, land, component body, and inside of the lead window are not included.))

Ex.: Specification of inspection area

0-0.99 mm

0-0.3 mm

0.1-0.3 mm



### ■ Characteristic Parameter

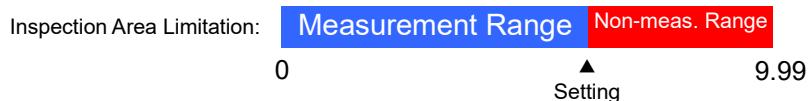
Solder ball color

Illumination type (available only for S1080): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The item will be evaluated as good if the value is within the configured range. The available range for configuration is shown below.

Inspection Item	Setting Value	Measurement Value	Judge
■ Solder Ball			
Judgment Type	<input checked="" type="radio"/> Length Diameter Ratio <input type="radio"/> Aspect Ratio		
Solder Ball Diameter (mm)	0 — <input type="text"/>		
Ratio (%)	0 — <input type="text"/>		
Area Rate (%)	0 — <input type="text"/>		
■ Inspection Area Limitation (mm)	<input type="text"/> — <input type="text"/>		



### ■ Processing Details

1. Set the range specified by “Inspection Area Limitation” as an inspection area.
2. Use feature parameters to binarize the area.
3. In the connected pixel group, if the “Rate” of the method specified by the judgment method is out of the setting range and the “Area Rate” is out of the setting range, the pixel group becomes a candidate solder ball.
4. If the short side of the pixel group which has become a candidate at step 3 is out of the setting range of “Solder Diameter (mm),” the pixel group is judged as a “Solder Ball.” If there are more than one solder ball present, the maximum solder diameter (mm) is displayed as a measured value. However, all measured values are output as inspection results.

**Fault Output: Solder Ball (Oblique)**  
**Fault Code: 301**

### Judgment Method

Long-Short Diameter Ratio and Aspect Ratio are defined as follows:

Long-Short Diameter Ratio: Ratio between the long side and short side of an approximated ellipse

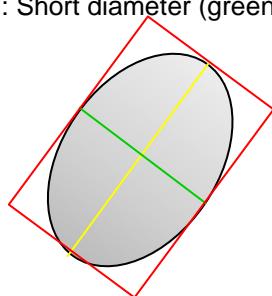
Aspect Ratio: Ratio between the long side and short side of the bounding rectangle in the inspection window coordinate system

Long-Short Diameter Ratio

S: Area rate (rate of solder color inside the red frame)

L: Long diameter (yellow line)

W: Short diameter (green line)

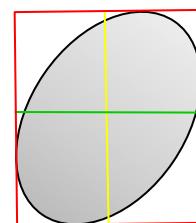


Aspect Ratio

S: Area rate (rate of solder color inside the red frame)

L: Vertical length (yellow line)

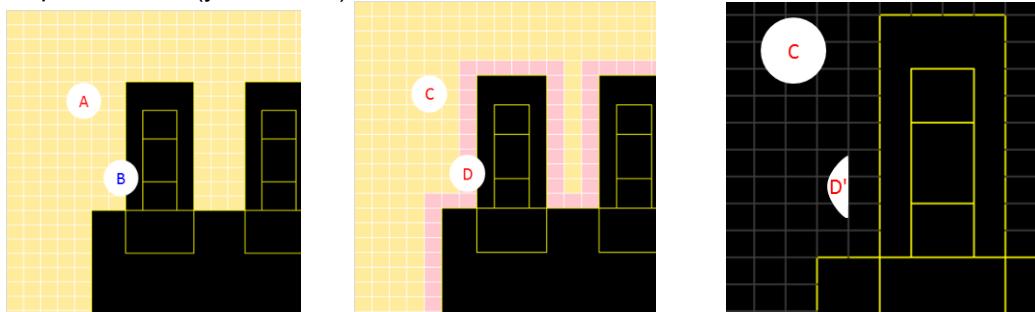
W: Horizontal length (green line)



### Inspection Area Limitation

If a pixel group applicable to a solder ball, which is binarized by solder ball color, contacts one of a land, component body, or electrode window, the pixel group does not become a candidate solder ball. So, in the drawing below, objects A and C become candidate solder ball, however, object B does not become it because this object contacts a land window and does not contact the non-inspection area.

To regard an object contacting a land like object B as a candidate solder ball, set the lower limit of the inspection area specification (red cells in the drawing below). Then, the pixel group is disconnected and does not contact a land, component body, or lead window, so that it becomes a candidate solder ball. Consequently, a portion of D which is called D' and intersects with the inspection area (yellow cells) becomes a candidate solder ball.



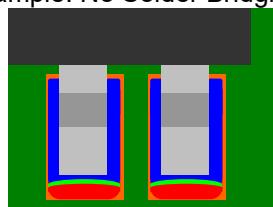
S1080  
S730 S720A

## 7.15 Solder Bridging (Oblique)

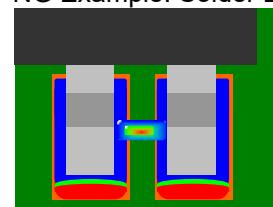
### ■ Overview

The solder bridging is detected for the solder color detected in the Inspection Range Window.

OK Example: No Solder Bridging Exists

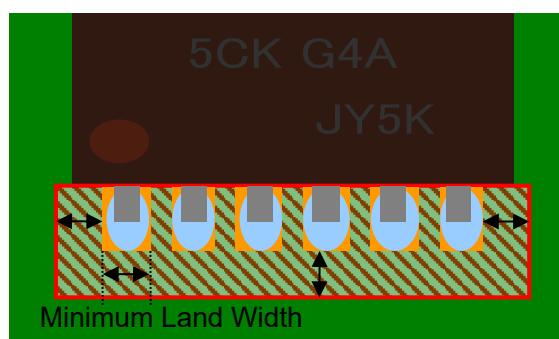


NG Example: Solder Bridging Exists



### ■ Inspection Range

Shaded area in the illustration (area extended to tight/left/down by the minimum land width for the rectangular frame of the land (except for the land))



### ■ Characteristic Parameter

Solder bridging color

Illumination type (available only for S1080): Color highlight, enhanced white illumination

### ■ Inspection Criteria

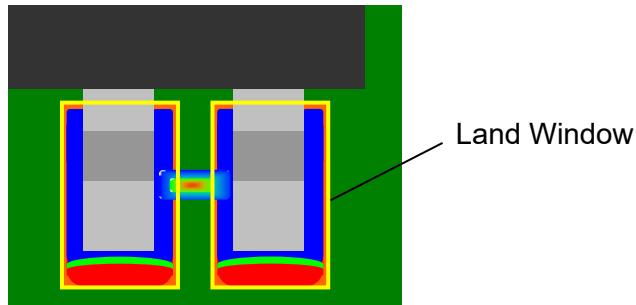
The item will be evaluated as good if the value is within the configured range. The available range for configuration is shown below.

Inspection Item	Setting Value	Measurement Value	Judge
<input checked="" type="checkbox"/> Solder Bridging (Oblique)			
Bridging Width (mm)	0	-	



■ **Process Details**

If a pixel group extracted for the characteristic parameter in the inspection area is across lands and if its average width is larger than [Bridging Width (mm)], it is judged as "Solder Bridging (Oblique)". If there is more than one solder bridging, the largest of the "Bridging Width (mm)" will be displayed as the measured value. Note that all the measured values are provided as the inspection result.



**Fault Output: Solder Bridging (Oblique)**  
**Fault Code: 302**

# 8 PCB/Component Block Unit Mark

\* The description regarding the inspection logic is as follows.

No symbol: Common for VT-S1080/S1040/Z600/S730-H/S730/S720/S530/S500,

**S1080** : S1080 **S1040** : S1040 **Z600** Z600 **S730** : S730-H/S730 **S720A** : S720A **S530** : S530 **S500** : S500

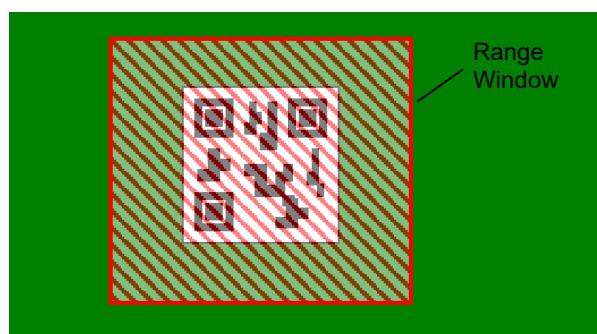
## 8.1 1D/2D Code

### ■ Outline

This system reads the 1D/2D code attached to a PCB or Component Block Unit and outputs the result as the PCB ID or Component Block Unit ID.

### ■ Inspection Range

Shaded Area Below (Inside Range Window)



### ■ Characteristic Parameter

1D/2D Cell Color (Setting is Not Required)

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

Not Specified

	Inspection Item	Setting Value	Measurement Value	Judge
■ 1D/2D Code				
Format		EAN-8 EAN-13 UPC-A .....		

### ■ Processing Detail

A 1D/2D code detected in the inspection range is read and the result is output as the PCB ID or Component Block Unit ID. "1D/2D Read Error" is output if the code cannot be read.

Fault Output: 1D/2D Read Error  
Fault Code: 20

**Compatible 2D Codes**

PDF417/Micro PDF417, Data Matrix (ECC200),QR Code, GS1 composite symbols, Micro QR Code

**Compatible 1D Codes**

EAN-8/-13,UPC-A-E,CODE39/93,CODE128/GS1-128,Codabar(NW-7),  
GS1 data bar standard/limited/extended, Pharmacode

**Option**

When the barcode standard extension option is enabled, the following standards can be further selected.

**Supported 2D code (Option, S1080/S1040/Z600 only)**

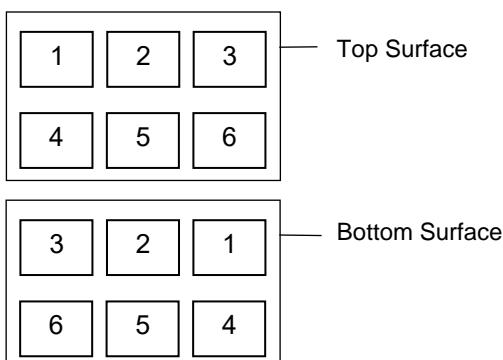
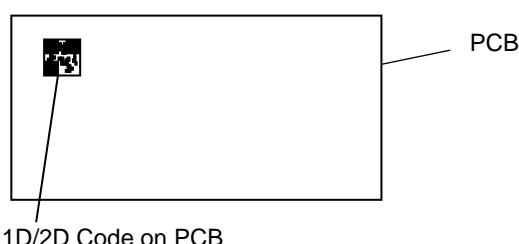
Aztec Code, DotCode, GS1 QR code/Data Matrix/Aztec Code/DotCode

**Supported 1D code (Option, S1080/S1040/Z600 only)**

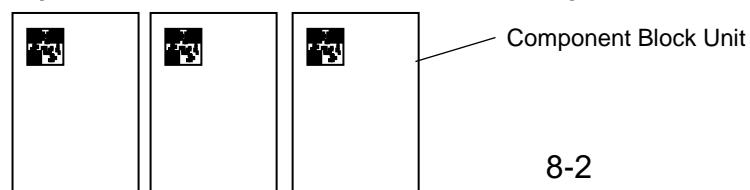
2 of 5 industrial, EAN-8 2-digit add-on/5-digit add-on, MSI, GS1 databar truncated/stacked/stacked omni-directional/expanded stacked, ITF

**Notes on 1D/2D Code Handling**

- The system may not be able to read obscure or poorly-printed 1D/2D codes (Tilt up to  $\pm 10^\circ$  of teaching).
- Unify the individual Component Block Unit numbers on the front and back sides of a PCB for Component Block Unit ID management.
- Only the first read code is output when multiple IDs are defined (other ID codes are not read).

**PCB ID: Defined on the PCB. (Multiple IDs can be defined)**

1D/2D Code on PCB

**Component Block Unit ID: Defined on the Component Block Units. (Multiple IDs can be defined)**

## 8.2 Bad Mark

### ■ Outline

When a bad mark on a component block unit is identified, inspection of the component block unit is skipped.

### ■ Inspection Range

Shaded Area Below (Inside Bad Mark Window)



### ■ Characteristic Parameter

Bad Mark Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

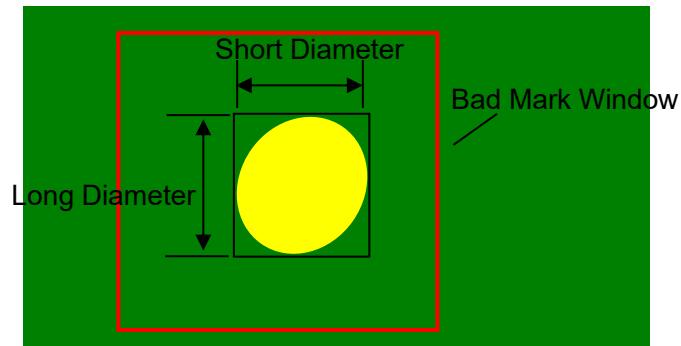
The item will be evaluated as good if the value is within the configured range. The available range for configuration is shown below.

Inspection Item	Setting Value	Measurement Value	Judge
■ Bad Mark			
Length Diameter Ratio (%)	<input type="text"/> - <input type="text"/>		
Area (mm <sup>2</sup> )	0 - <input type="text"/>		



### ■ Processing Detail

- If a length diameter ratio of a pixel group extracted for the characteristic parameter in the inspection area is smaller than the lower limit of the "Length Diameter Ratio (%)" and the pixel group area is larger than the "Area (mm<sup>2</sup>)", it is judged as "Bad Mark Detection".
- If a length diameter ratio of a pixel group extracted for the characteristic parameter in the inspection area is larger than the upper limit of the "Length Diameter Ratio (%)" and the pixel group area is larger than the "Area (mm<sup>2</sup>)", it is judged as "Bad Mark Detection".
- When a component block unit is judged as "Bad Mark Detection" in either of the above 1 or 2, inspection of the component block unit is skipped. In the inspection mode, no fault output is made, while in the teaching mode "Bad Mark Detection" is output as fault output.



**Fault Output: Bad Mark Detection  
Fault Code: 9**

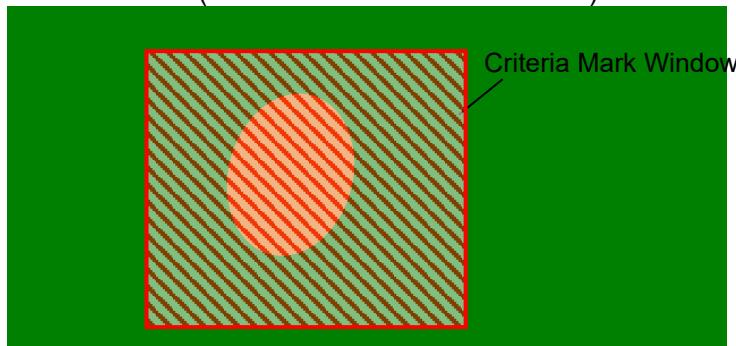
## 8.3 Criteria Mark

### ■ Outline

This system extracts the criteria mark for the distance inspection and calculates the distance and/or angle from the criteria mark.

### ■ Inspection Range

Shaded Areas Below (within the criteria mark window)



### ■ Characteristic Parameter

Criteria Mark Color

Illumination type (available only for S1080/S1040/Z600): Color highlight, enhanced white illumination

### ■ Inspection Criteria

The judgment is "OK" if the result is within the set value. The effective setting value range is shown below:

	Inspection Item	Setting Value	Measurement Value	Judge
■ Criteria Mark				
<input checked="" type="radio"/> Color	Length Diameter Ratio (%)	<input type="text"/> — <input type="text"/>		
	Area (mm <sup>2</sup> )	0 — <input type="text"/>		
<input type="radio"/> Model	Matching rate (%)	<input type="text"/> — 100		
<input type="checkbox"/> Use Height Information				

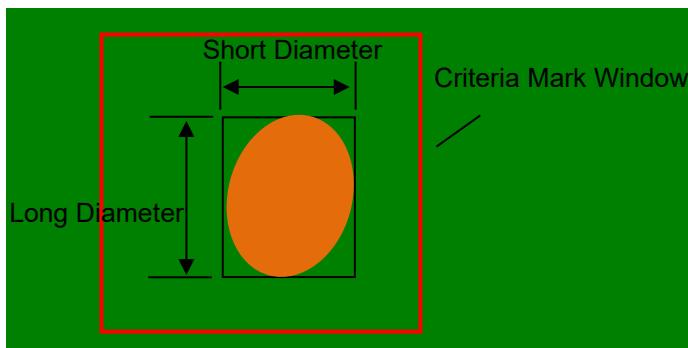


### ■ Processing Detail

#### 【If selecting a color】

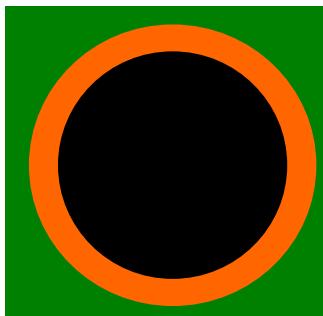
1. "Criteria Mark Detection Failure" is output if the Length Diameter Ratio of the pixel cluster extracted in the Inspection Range using the characteristic parameter is smaller than the lower limit of "Length Diameter Ratio (%)" or larger than the upper limit of "Length Diameter Ratio (%)."
2. "Criteria Mark Detection Failure" is output if the area of the pixel cluster extracted in the Inspection Range using the characteristic parameter is larger than the "Area (mm<sup>2</sup>)."

3. When the "Criteria Mark Detection Failure" is not output in Step 1 or 2, the center of circumscribed rectangle of the pixel cluster, which was extracted in the Inspection Range using the characteristic parameter, is set to the criteria mark position and the Distance Inspection is performed.

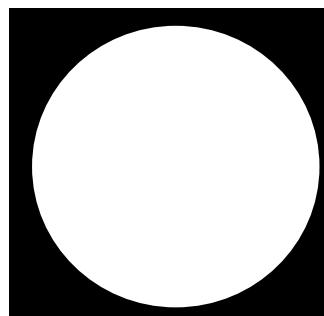


**[If selecting a model]**

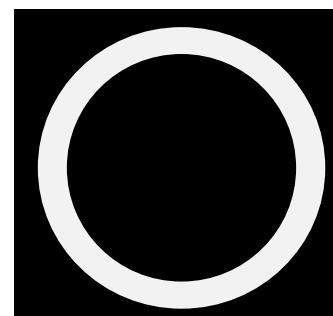
1. Within the inspection area, the feature parameters are used to create a binarized image.
2. If [Use Height Information] is selected, areas lower than the height of the PCB surface are excluded from the binarized image in step 1.



When using a PCB hole  
as a reference mark



Use Height Information: OFF



Use Height Information: ON  
(Screen display is the same  
as when OFF)

3. The image created in step 2 and the model registered beforehand are searched for the best match, and the match rate with the model is measured.
4. If the result obtained in step 3 is equal to or greater than the "Matching rate (%)", the distance inspection is performed using that position as the reference mark position. If the result obtained in step 3 is less than the "Match rate", it is judged as "reference mark detection failure".

**Fault Output: Criteria Mark Detection Failure**  
**Fault Code: 360**

## Version History

The system you have just purchased may have new features or improvements. Changes will be added to the manual as they occur. All versions have listed a version code that indicates the version history and a version history section that indicates new changes and content.

### ● About the Version Code

The manual's version code is marked in the bottom right corner of the cover following the letters "No."

No. 8600371-0 □

Version Code

### ● Version History

Version code	Dates	Revisions	
A	April 2014	-First edition	
B	May 2014	P3-3 P4-16 P5-17	Wrong Component Inspection Specification: Changed Electrode Length Inspection: Description Corrected (Inspection Criteria) Land Error Inspection: Description Corrected (Inspection Criteria)
C	August 2014	P1-3 P1-12 P1-14,15 P2-5 P2-6,7 P2-9,10 P3-1 P3-8,9 P3-11 P3-12 P3-13,14 P4-1 P4-8,9 P4-10,11 P4-12~23 P4-18~21 P5-1 P5-2 P5-17~21	Component Type and Inspection Logic List: Changed Inspection Flow: Changed Fault Code List: Changed Reference Surface Setting: Description Added Extraction Steps: Description Added Extraction Steps: Description Added Component Inspection Flow: Changed Volume Rate: Description Added Y-Axis Polarity Specification: Changed Component Height Inspection: Added Lifted Component Inspection: Added Electrode Inspection Flow: Changed Lifted Electrode Inspection: Added Coplanarity Inspection: Added Lifted Electrode: Changed to Electrode Posture Electrode Color Dispersion: Changed to Electrode Dispersion Fillet Inspection Flow: Changed Linkage Setting with Measured Component/Electrode Height Value: Description Added Land Fault Inspection Specification: Changed
D	September 2014	P4-9 P4-19 P4-25 P7-1,3,4,5	Specification change of detailed process of lifted electrode inspection Typo correction of detailed process of electrode dispersion inspection Typo correction of inspection criterion of electrode presence/absence inspection Typo correction of inspection names
E	March 2015	P1-3 P1-11 P1-13,14 P2-9 P2-11 P3-12 P4-4	Lists of component type and inspection logic: Changed Flow of inspection: Changed List of fault codes: Changed Specifications of processing of electrode side extraction: Changed Specifications of processing of electrode tip extraction: Changed Erroneous description of component height inspection: Modified Erroneous description of the inspection criteria of the end overhang inspection:

		P5-17~24	Modified Specifications of processing of land error inspection: Changed
		P7-1	Oblique inspection flow: Changed
		P7-11~12	Land error (oblique) inspection: Added
		P7-13,15	Item numbers: Changed
F	October 2015	Overall	VT-S730, VT-S720, VT-S500 are subject of this manual.
		Overall	Added icons for description of S730, S720A, S500.
		P0-6	Added icon description for how to read this manual.
		P1-3	Added machine support availability.
		P1-20	Added machine support availability.
		P2-6	Added description of reference plane division setting.
		P2-13	Added description of electrode tip extraction search range.
		P2-15	Added description of processing content Extraction method: height.
		P3-6	Corrected a wrong writing of result judgment
		P3-7	Added description of component polarity/height
		P8-2	Corrected a wrong writing of supported 2D code.
G	November 2015		Corrected the missing pages of chapter 5 in the English version.
H	February 2016	P1-19,20	Corrected the Fault Code List.
		P2-4	Added description of inspection screen position adjustment and the adjustment range.
		P2-8	Added description on the surface approximation of the reference plane.
		P2-16	Electrode end extraction method of insertion terminal: added height. Electrode end extraction method of insertion terminal: corrected wrong explanation on color and height.
		P3-6	Corrected the wrong explanation on the process of wrong polarity and height inspection.
		P3-13	Changed the specification of inspection criteria for the component height inspection.
		P3-14	Changed the specification of the inspection criteria for lifted component inspection.
		P4-26	Added the electrode height inspection.
		P8-2	Corrected the wrong explanation on 2D code to be supported.
I	August 2016	P1-21, 22	Changed the fault code list.
		P2-4, 5	Inspection screen position correction:
		P2-11 - 13	Added explanation of position correction criteria
		P2-16	Added detailed settings of extraction method
		P2-21 - 22	Added explanation of detailed setting function
		P3-6	Changed spec. of measured value display
		P3-8,9	Changed spec. of inspection area
		P3-11	Changed spec. of inspection area
		P3-13 - 15	Added Offset X (Component) and Offset Y (Component)
		P3-16 - 17	Changed spec. of measured value used to judge lower limit value
		P4-22 - 23	Added explanation of detailed setting function
		P6-2 - 5	Changed spec. of inspection criteria Changed spec. of feature parameters (separated from solder bridge)
		P6-6	Changed spec. of feature parameters

		P6-8 P7-13 - 16 P7-17	(separated from solder ball) Changed spec. together with addition of feature parameters Changed spec. of inspection criteria Changed spec. of feature parameters (separated from solder bridge) Changed spec. of feature parameters (separated from solder ball)
J	September 2016	Cover P0-5 P0-6 P1-1,2-1, 3-1,4-1 5-1,6-1 7-1,8-1	Changed the doc. name and added VT-S730-H for the target machine. Added manual description about VT-S730-H. Added VT-S730-H for description about inspection logic. Added VT-S730-H for description about inspection logic.
K	October 2016	P0-6 P1-21 P3-16 P6-12	Error in writing was corrected in the blank area The fault code list was changed. Error in writing was corrected. Description of the foreign object inspection inside view was added.
L	February 2017	Overall P3-15	VT-S530 was included as the applicable machine of this book. Error in writing on the illustration was corrected.
M	February 2017	P1-23,24 P3-22,23 P5-7 to 13	OCR was added to the fault code list. OCR inspection was added. Inspection of height specified block was added.
N	May 2017	P1-3,4 P1-11-20 P1-21, 22 P3-22, 23	Changed the list of component type and inspection logic. Changed inspection flow. Added 2D code (component) to the failure code list. Added 2D code (component) inspection.
O	September 2017	P5-2 P5-23,27	Added description on the height link Added explanation of Fixed Lead Side
P	October 2017	P3-22 P6-6 to 6-8 P6 to15	Added explanations about the regular expression Added explanations of detail setting Added explanations of height criteria
Q	April 2018	P0-4	Terms and Conditions Agreement Item 7. Disposal Added
R	June 2018	P1-3,4 P1-9 P1-21,22 P2-1 P2-3 P2-16 P2-22~24 P3-1 P3-16 P3-20 P4-1,2 P4-9~11 P4-30,31 P4-32,33 P4-34~36 P5-1 P5-31,32	Changed component type and inspection logic list Added explanations of window setting for criteria mark Added 2D code (components) to fault code list Changed position correction/position extraction flow Added explanations of contents of fiducial correction processing Error in writing was corrected in extraction range of electrolytic capacitors Added land position individual extraction Changed component body inspection flow Added explanations of result judgment of component height Added distance inspection Changed lead inspection flow Added lead X, Y, and angle shift Added lead presence-center of gravity Added lead presence-dispersion Added lead bend Changed land inspection flow Added blow hole Added solder ball

		P5-33~36 P5-37~40 P6-8 P8-5	Added solder bridging Added automatic binarization function for solder ball Added explanations of criteria mark
S	January 2019	P1-6,11,1 4 ~23 P1-24 P2-25 P3-1 P3-27,28 P5-38 P8-1,2	Changed 2D code name. Changed 2D code name on fault code list. Added explanation of electrode extraction expansion function of insertion terminal. Changed 2D code (component) name. Added explanation accompanied by addition of 1D/2D support formats. Added supplemental explanation of inspection area (inspection area of each land). Added explanation accompanied by addition of 1D/2D support formats.
T	February 2020	P1-3,4 P1-14,15, 18 P1-20 P1-24,25 P3-6 P4-20 P5-23,24 P7-1 P7-3,4 P7-5 to 8 P7-9,10 P7-11,12 P7-13,14 P7-22 to 24 P7-27	Changed component types and inspection logic list Changed inspection flow Updated inspection flow of VT-S530 Added Side Overhang (Oblique), End Overhang (Oblique), End Overlap (Oblique), Lead Area (Oblique), Projector Light Intensity Low, and Projector Light Intensity High to fault code list Changed inspection flow of component unit Added description on detailed setting function of lead area Added description on land area exclusion function Changed flow of lead oblique inspection Added Lead Horizontal Extraction (Oblique) Added Lead Toe Extraction (Oblique) Added Lead Offset (Oblique) - Side Overhang Added Lead Offset (Oblique) - End Overhang Added Lead Offset (Oblique) - End Overlap Added Lead Posture (Oblique) - Lead Area Added description on land plane exclusion function
U	June 2021	Overall P4-28	VT-S1080 was included as the applicable machine of this book. Adds selectable illumination types for each logic to characteristics parameters for S1080 Corrected writing error of processing contents of lead side bend inspection
V	June 2022	Overall P4-31 P4-37 P6-8 P6-18 P7-6 P7-15	VT-S1040/Z600 was included as the applicable machine of this book. Adds selectable illumination types for each logic to characteristics parameters for S1040/Z600 Corrected the wrong explanation on the process of Lead Presence - Area Corrected the wrong explanation on the process of Lead Bend Corrected the wrong explanation on the process of Solder Ball Added description on Full View Foreign Material Corrected the wrong explanation on the process of Lead Toe Extraction (Oblique) Corrected the wrong explanation on the process of End Overlap (Oblique)

		P8-1 P8-6	Corrected the wrong explanation on the process of 1D/2D Code Added explanations of criteria mark
W	February 2023	P0-6	Fixed warning display mark
X	May 2023	P2-25 P3-24 P3-27 P3-30 P5-3 P6-17 P8-2	Added description of automatic extraction Added description of distance measurement with 3 reference points and 2 reference points with rotation Added description of OCR engine option 1 Corrected omitted 2D code standards Added 1D/2D code option standards Added description of high-precision mode Added description of full-view foreign object inspection method and logical formula Corrected omitted 2D code standards Added 1D/2D code option standards
Y	October 2023	P4-40	Added note on lead height logic at insertion-type terminals and terminal leads.
Z	June 2024	P5-1,35 P5-1,40 P5-39,45, P6-10,14, 18 P5-44	Renamed to Inter-pin solder ball Renamed to Inter-pin solder bridge Added a note when the Component body window, electrode window, and land window overlap the inspection area. Explanation of the difference between Inter-pin solder bridges and inspection range solder bridges
AA	November 2024	P2-2,3 P2-18 P2-26-28 P3-22 P3-24,25 P3-26 P3-28 P4-8 P5-1 P5-20	Addition of processing details for template matching + shape detection Corrected illustration of maximum extraction range Addition of Supported Electrode Types and Search Range for Auto Extraction Added explanation of how to determine set values Added description of processing of angles Added description of processing of measurement center. Addition of OCR Engine Option 2. Added illustration of gull wing lead Added note on shadows and secondary reflections when they occur Added illustration of gull wing lead

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