Operating environment conditions

Item	AIP-4000M	AIP-4000L
Temperature	10-30℃	
Humidity	25 – 75%RH（no condensation）	
Altitude	1000m maximum	

Hardware specifications

Item	AIP-4000M	AIP-4000L
Model	AIP-4000M	AIP-4000L
Mass	55kg	90kg
Supply Voltage	100 – 240VAC 50/60Hz Single Phase	
Power Supply ethod	Plug Connector	
Power Consumption	300W max※1	
Products to be inpected	Printed mounting board (PCB)	

※1 Main unit only. Does not include PoE hub for PC, monitor and camera.

Imaging unit

Item	directly above camera	oblique camera
Constitution	2-camera configuration of a straight-up camera and an oblique camera	
Number of pixels	3M pixel	3M pixel
Resolution	13.8um/pixel	4.3um/pixel
Field of view	28.26 × 21.20mm※2	8.83 × 6.62mm※2 ※3

※2 When the magnification setting is "100%"
※3 When the board is placed perpendicular to the camera optical axis

PCB specification to be inspected

Item	AIP-4000M	AIP-4000L
Minimum size	50 × 50mm	
Maximum size	330 × 250mm	４６０× ４０７mm
Thickness	0.5mm-4.0mm	
Weight	Max 1.0kg	
vertical clearance (part maximum height)	Top：40mm max ※4 Bottom：40mm max ※4	
Edge clearance	Front：3.0mm Back：3.0mm	

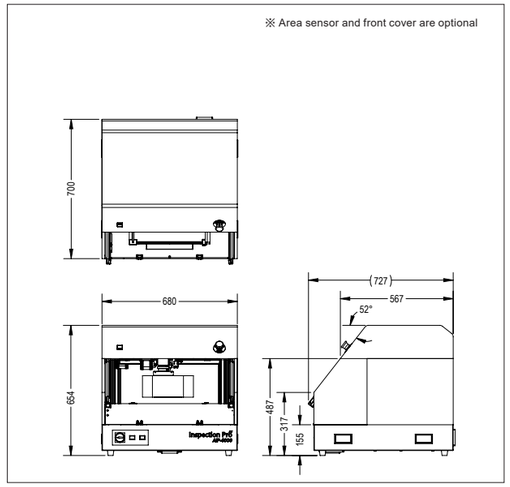
※4 If the substrate is warped, the clearance will be reduced by that amount regardless of whether it is warped upwards or downwards.

Additional options

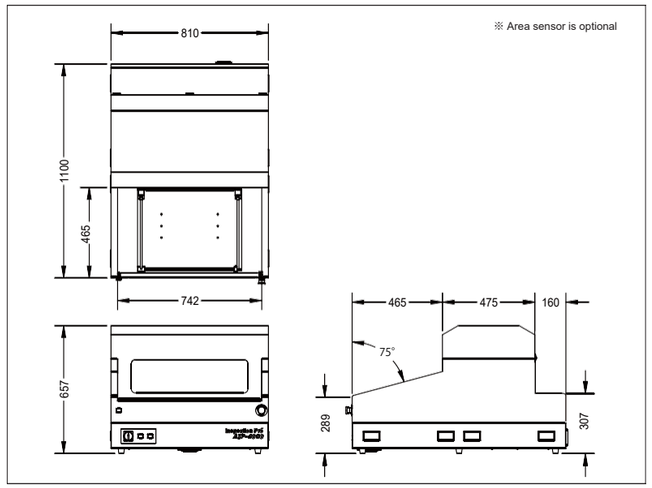
Item
AOI link software
Area Sensor with Safety Switch Front Door
78 Keys (operation box)
Work Station
Calibration Plate
White balance adjustment sheet
2D Code Reader Function

External dimensions

AIP-4000M



AIP-4000L



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The specifications and appearance of the products in this brochure are subject to change for improvement without notice.

2304-1

ZERO
「Miss O」Checking

Visual Inspection System

Inspection Pro AIP-4000

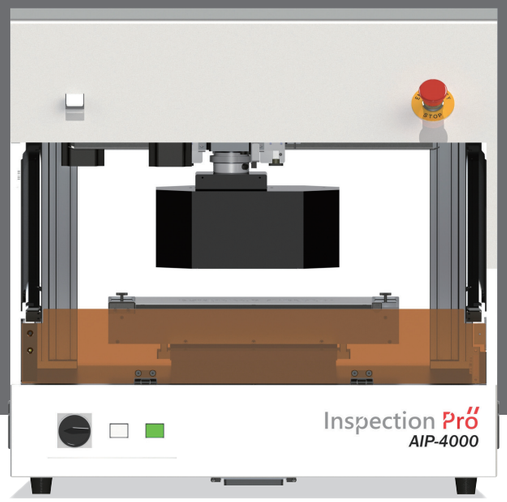
Conventional Virtual Assistance to 0 Miss Checking

Product Overview

Since the release of the "Inspection Pro" series in 2006, many customers around the world have long used the "IP-2X00" and "IP-3000" as visual support solutions for automatic visual inspection equipment.
In recent years, there have been dramatic improvements in performance of automatic visual inspection equipment, as well as circuit boards that have achieved miniaturization and high integration.
We have developed the next-generation visual inspection support device "AIP-4000" by incorporating the opinions and requests of the market.

The product name "AIP" is an abbreviation of "Automated Inspection Pro", and it is a product that carries the "WIT Dream" that can expand the automatic inspection function to the System in the near future.

In order to enable the AIP-4000 to be equipped with an automatic inspection function, we have significantly "Evolved and deepened" the performance and functions



Precision and Accuracy

Capture Images with Unparalleled Accuracy

Equipped with two cameras, directly above and diagonally, it is possible to move, rotate, and adjust the magnification of the camera and display it on the monitor screen. The operator can make a visual judgment while looking at the monitor image. The new image processing engine has realized 3D image correction with "constant magnification" and "distortion removal".

Warpage and Rotation Correction for better Camera Accuracy

Side Camera is effective for monitoring the condition of three-dimensional structures such as solder surfaces. However, it is greatly affected by board warpage. Also, camera unit that works 360°but "rotational misalignment" is a risk. Gradual reduction of misalignment can be achieved now by the AIP-4000's "board warp correction" and "camera rotation correction". Furthermore, a new function “fiducial mark correction” improved the positional accuracy by a lot.

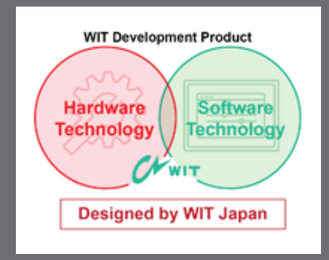
Development and New Functions

Equipped with a Lot of New Functions

We received valuable opinions and requests from field users of "IP-2X00" and "IP-3000". The AIP-4000 is the result of us, WIT, listening to its users and work with the implementation of highly convenient inspection and selection lines that is equipped with useful functions.

WIT Developed Hardware and Software

AIP-4000 is proudly developed by WIT in both hardware and software. WIT had accumulated technical know-how over the years and was poured into the development and manufacturing of the AIP-4000. Continuously pursuing high quality and reliability worthy of the “Made in Japan” name.



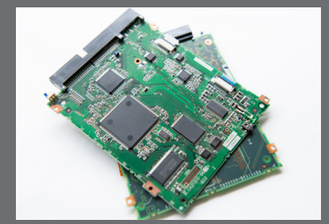
New Image Processing Engine

Built-in Image Processing Engine

Equipped with a high-performance image processing engine. "3D spatial correction" for images captured
with a high-resolution camera, recognition of feature points such as "2D code" and "position correction
mark" is now possible.

Automatic inspection as a visual assistance device

We are also developing automatic inspection functions for areas that are difficult to inspect with AOI*, such as automation of Priority Visual Inspection.
* An automated optical inspection, an inspection method used in board manufacturing and board mounting.



New Features

AIP-4000 Work Flow

"AIP-4000" first registers various information of the board in "board registration mode",Inspection is performed in two “visual inspection modes”.

PCB Registration Mode

PCB thickness, PCB brightness, origin offset, whole PCB image capturing, fiducial mark registration, 2D code registration (optional), priority visual inspection program creation, etc.

Visual Inspection Mode（Stand Alone）

Visual inspection is performed according to the priority visual inspection program created in board registration mode.

Visual Inspection Mode（AOI Link）

The defect information of AOI is acquired using the board ID and visual inspection of the defective part is performed. Various functions can be used by registering the board in advance.

High-Definition Shot

This is possible with a new image processing engine, working with "fiducial mark recognition", "automatic machine calibration", and "automatic warp correction" functions. Z-axis is also added to remove the need for height adjustment jigs.

AIP Server

This is for storing inspection results to make it easier to share inspection data with good security.

Stand Alone Mode

A visual inspection program called "key visual inspection program" can be made. The visual inspection will be in accordance with the prepared program. A “reference image” is captured when creating a key visual inspection program.

Innovative New Features from the Image Processing Engine

AOI Link Mode (Optional)

A mode in which the camera automatically moves to the location judged to be "defective" by the AOI, and visually determines whether it is really defective. By linking with AOI, the coordinates, angle, part size, defect name, etc. of the defect location can be obtained in advance, displayed on the monitor, and can be visually inspected. It is also possible to additionally register the "Key Visual Inspection Program”.

Product Shooting Mode

The X-axis, Y-axis, rotation axis, and Z-axis can be moved freely to display any part of the board on the monitor. Inspection results can be captured and saved.

Visual inspection Result Mode

"Visual inspection mode" allows you to check the results of the visual inspection. You can check the corresponding image on the same screen along with the inspection memo such as pass/fail results at the time of judgment.

Inspection Pro
AIP-4000

INDEX

SEEING IS BELIEVING

Pursuing Clear Images that are Easy for People to See

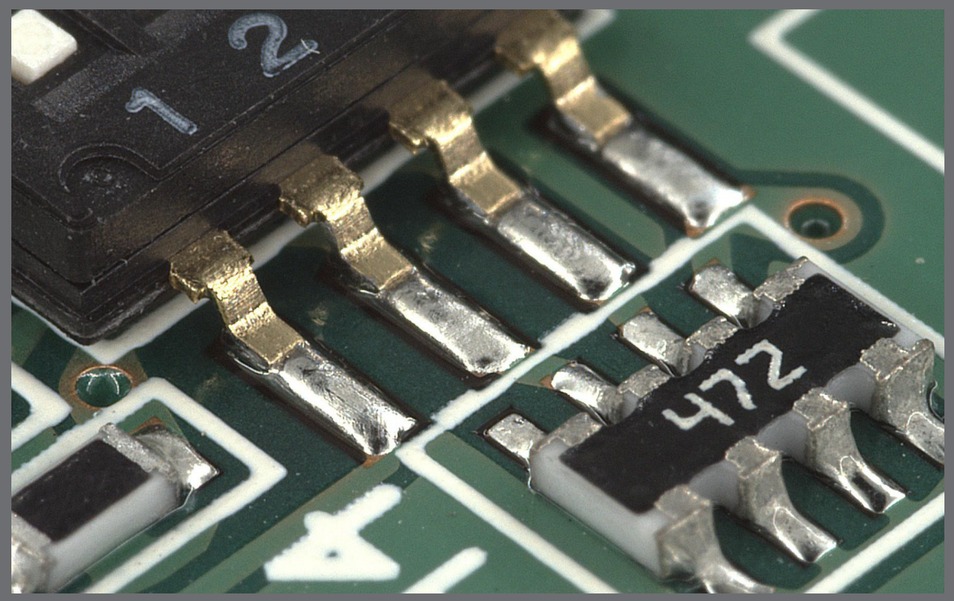
WIT had devised ways to provide the best lighting condition for the “TOP” and “SIDES” of the parts to be inspected.
Define easily the solder bridges, insufficient solder, ideal solder fillet conditions and other manufacturing defects.
It can be seen with the AIP-4000 as bright as the day.
With the "stabilization function" when moving the camera, "lens distortion elimination" and "constant magnification", a high-quality images of soldering and chips is obtained..

Inspection Pro
AIP-4000

1 Image Stabilizatio
“Global Camera Shutter”
This eliminates image distortion when two cameras are moved vertically, horizontally or diagonally.

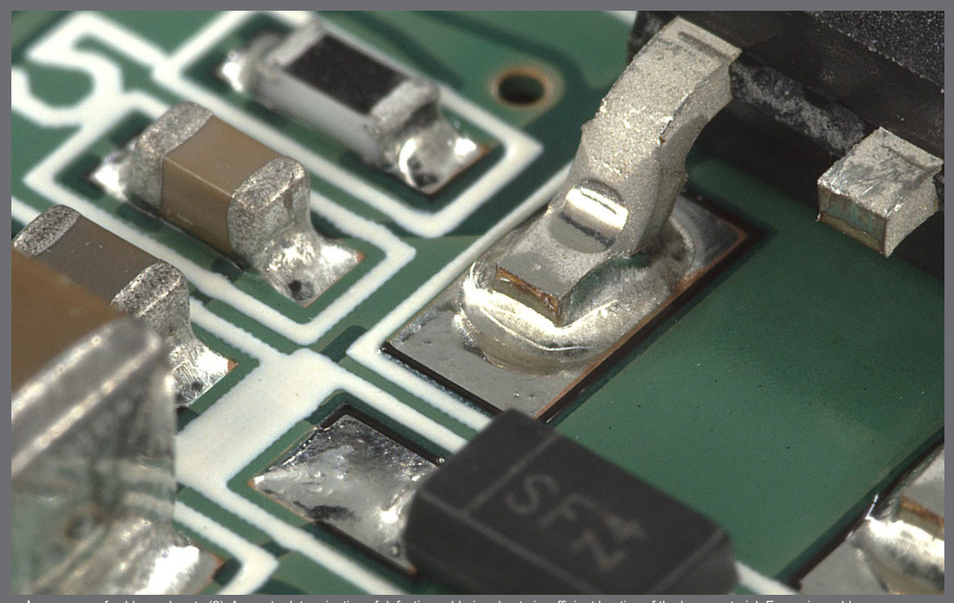
2 Lens Distortion Removal
Equipped with a "lens for macro photography" to minimize lens distortion. "Distortion" has been corrected and removed in software.

3 Magnification Stabilization
The image processing engine has achieved a constant monitor display magnification.



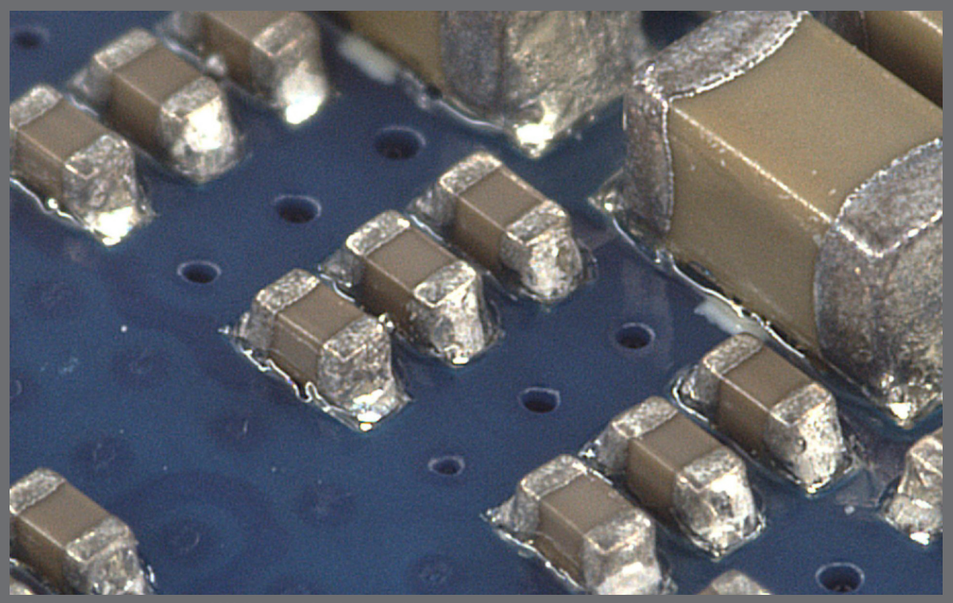
Appearance of solder and components (1). It is possible to instantly determine the soldering condition of IC package legs (sockets and pins) and misalignment.

Thanks to the Z-axis, characters on the upper surface of high parts can be clearly confirmed without blurring.
Images with a deep depth of field make it easy to detect human errors such as wrong parts.



Appearance of solder and parts (2). Accurate determination of defective soldering due to insufficient heating of the base material. Excessive solder,

insufficient wetting, horns, pattern peeling, etc. are obvious at a glance.



Displayed chip component size 0603 (0.6mm x 0.3mm). It is possible to clearly check even miniaturized chips with a size of about 1 mm or less and soldering conditions.conditions.

In-pursuit of “Correct Position”

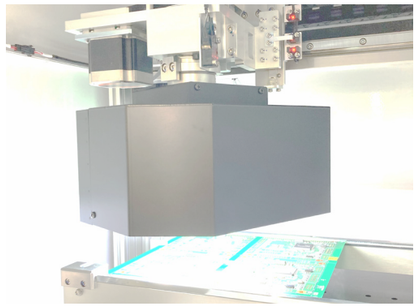
Realizing the highest image quality through cooperation between hardware and software

The "AIP-4000" captures the image of the board to be observed accurately and easily by reviewing the hardware mechanism and enhancing the software functions.
"(1) Camera height adjustment", "(2) Automatic board warp recognition", "(3) Position correction mark", "(4) Hardware correction", and "(5) Timing belt/pulley improvement" enabling good focus, alignment and hardware calibration. Image captured at the "correct position" has been achieved.

1 Automatic Height Adjustment

Equipped with a "Z-axis mechanism" that moves up and down in the height direction, the Z-axis automatically moves up and down according to the board thickness, and the Z-axis moves up and down according to the warp model. Even with tall IC chips and modules, visual inspection is now possible while in focus. Accurate spatial recognition is possible, securing the optimal shooting position and taking pictures that are easier to see while maintaining the ratio of the actual size.

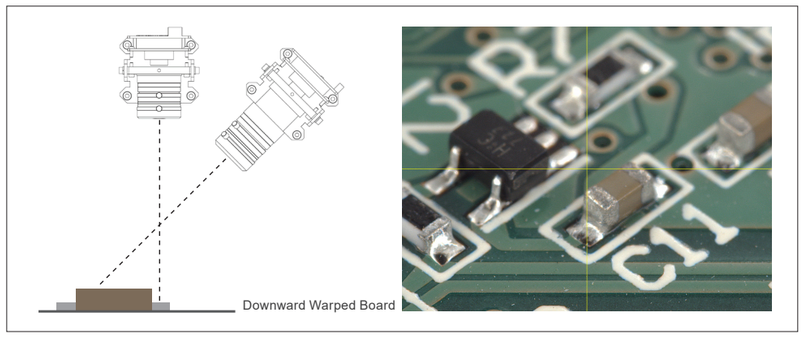
* No height adjustment jig is required. Maximum height about 20mm



Camera unit mounted on AIP-4000

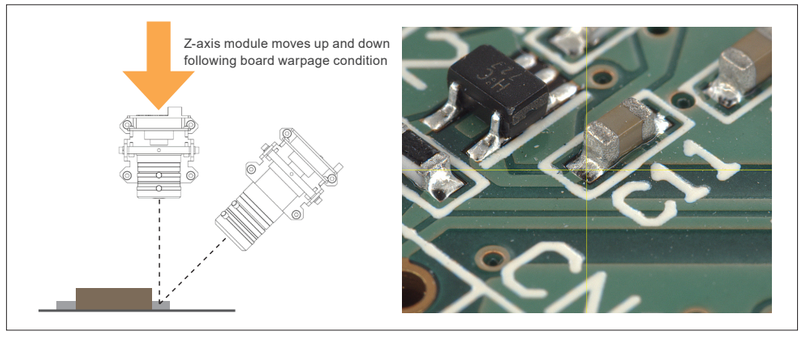
2 Register Warpage to Minimize View Offset

"Oblique camera" is directly affected by "warping of board".
On the other hand, measuring the warpage of all boards one by one greatly affects the visual inspection time.
Therefore, in the "board registration mode", which is the pre-inspection stage, the warpage at a specific position is automatically measured and a "warp model" is generated.
By reflecting this model during visual inspection, A significant reduction in the effect of warpage without affecting the inspection time was achieved.



Conventional model camera position
(Z axis is fixed)

- ☒ Cursor is off Center
- ☒ Out of Focus

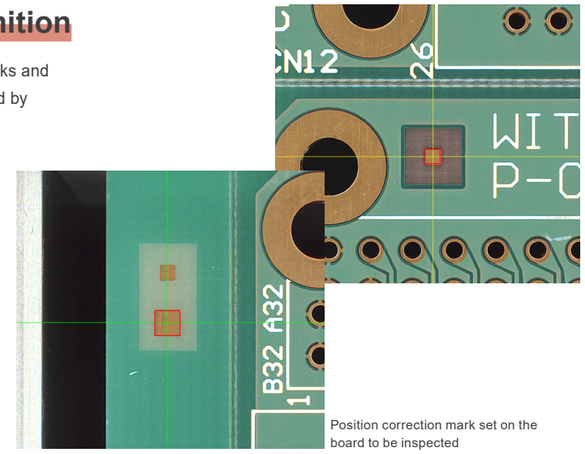


AIP-4000 camera
(equipped with Z-axis vertical mechanism)

- ◯ Cursor stays centered
- ◯ In Focus

3 Position Correction Mark Recognition

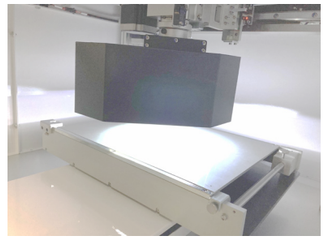
It is possible to read the pre-registered position correction marks and correct the X-Y-θ coordinates of the board. Imaging of the board by camera work can be realized.

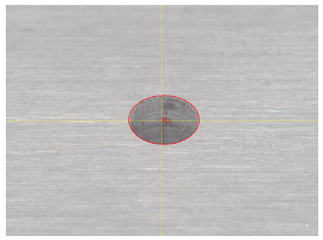


Position correction mark set on the board to be inspected

4 Correction Function

What was done manually in the past,
the AIP-4000 is Now equipped with an automatic hardware correction.





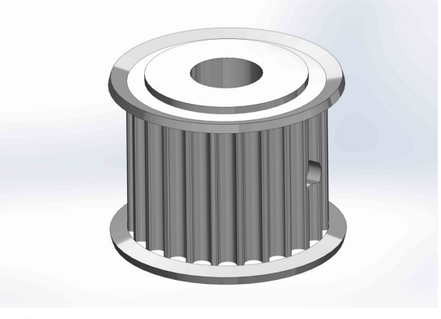
Device Calibration	XY Hard Correction	Corrects the inclination of the PCB pallet to the Y-axis rail and the orthogonality of the X-axis rail to the Y-axis rail by Affine conversion.
	Z Hard Correction	Performs elliptic paraboloid correction for height direction (Zdirection) error due to XY position.
	θ rotation correction	Ellipse correction for XY position error due to rotation.

white balance justment	—	Adjust camera RGB and brightness (Optional item "white balance adjustment sheet" is required.)

Learn more about device calibration and white balance adjustment

5 Timing Belt and Pulley Effects

In consideration of safety, the AIP-4000 uses a "timing belt" mechanism.
In cooperation with the "backlash less pulley”, this results to precise movement of the camera with smoother and higher positional accuracy.



The backlash-less pulley is highly effective in suppressing reverse rotation and belt slippage.

Made Convenient and Easier

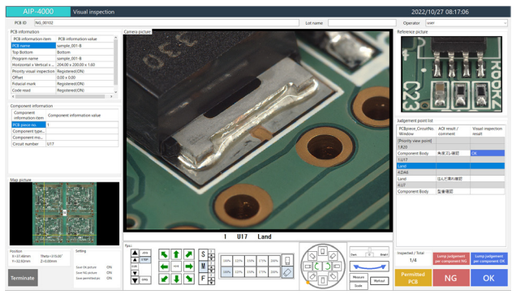
Convenient Functions for Users

The AIP-4000 received a number of convenient functions that are based on IP-2X00 and IP-3000 feedbacks.
We paid close attention to details from the "on-site user's point of view", such as functions that support visual inspection and functions that minimize human error.

1 Automatic Magnification

AOI Link

As a "pre-learning" function, the old models were able to set the "default" of the camera magnification in advance according to the defective items of the AOI.
However, It did not follow the size of the component, and there were cases where the appropriate magnification was not obtained.
AIP-4000 is equipped with "automatic magnification (AOI link)" function that automatically sets the magnification according to the component size.
* No height adjustment jig is required.

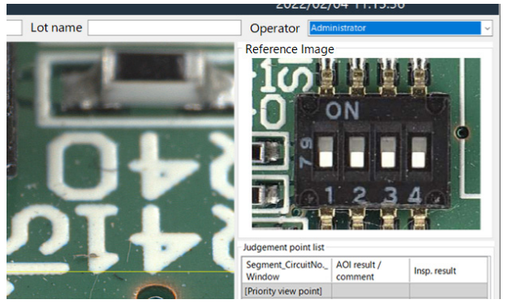


Automatically sets the optimal magnification for judgment

2 Convenient Reference Image

AOI Link

In the previous model "IP-3000", there were "MAP extraction reference image" and "AOI reference image" as reference images for visual inspection, but both were displayed by pressing the "reference image" button on the operation box.
With the AIP-4000, you can select whether to display the reference image according to the AOI defect item.
When "Display" is selected, the reference image is automatically displayed on the upper right of the visual inspection screen.



Sample image for Visual Inspection Screen

3 Improved Versatility of Inspection Results

The file output function for visual inspection results has also been greatly enhanced. Equipped with a database called "AIP server" to store and manage visual inspection results.
Data management software "AIP-Stats" currently under development.

- **Output by board type**
- **Output board IDs individually**
- **Output in CSV format**
- **Output inspection results with images**

The above outputs will be possible according to the customer's individual use, greatly improving the convenience of inspection results..

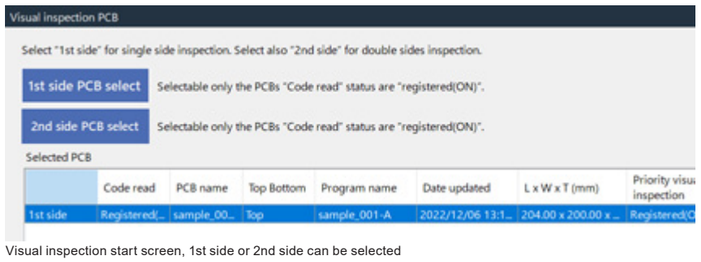
4 Board ID Flexibility and Inspection

In order to respond to diversifying board ID operations,

- **Single-sided board or double-sided board without board ID**
- **Single-sided board with board ID**
- **Double-sided boards with different board IDs on each side**
- **Double-sided board with common board ID on both sides**
- **Double-sided board in the order of "front → back" and "back → front".**

It is now possible to set inspection conditions such as addition of support adding priority visual programs to each of the front and back for "AOI link ".

Solves the problem of different board ID operation methods and inspection procedures for each customer.



Visual inspection start screen, 1st side or 2nd side can be selected

5 Judgement Button Details

"Judge parts all at once" in judgment by visual inspection
In order to respond to requests such as "Keeping a history", in addition to ", OK" and "NG" judgments,
Added "Acceptable items", "Batch OK", and "Batch NG".
In addition, a new function that allows you to change the order of judgment buttons has been added.

You can change the order of judgment buttons

6 Visual Inspection Completion

Equipped with a function to display “summary of judgment” when visual inspection is completed.
In addition, a “return to inspection” button (function to return to the judgment screen) has improved usability.
In response to requests such as "Safety regarding the class 2 laser that the old model use", The response is to add a new "visual judgment completion screen".

"Map image" can be used to identify the approximate location of the problem,
The detailed position is displayed in the "map enlargement" area, and the NG point can be identified.

You can specify the approximate location on the map image and specify the detailed location by zooming in on the map.
You can also refer to the image at the time of judgment.

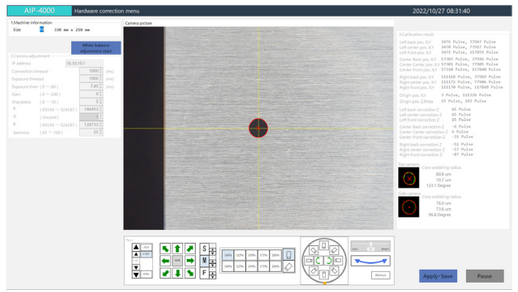
Easier and Convenient to Operate

Full of convenient functions from the user's point of view

A new "image processing engine" is installed to make full use of the performance of the cameras arranged directly above and diagonally. It fully draws out the imaging performance of the camera, realizing high-performance and stable imaging.
Pursuing operability and convenience from the user's point of view, it is equipped with a hardware calibration function and a measure reading function.

❶ Automatic Machine alibration

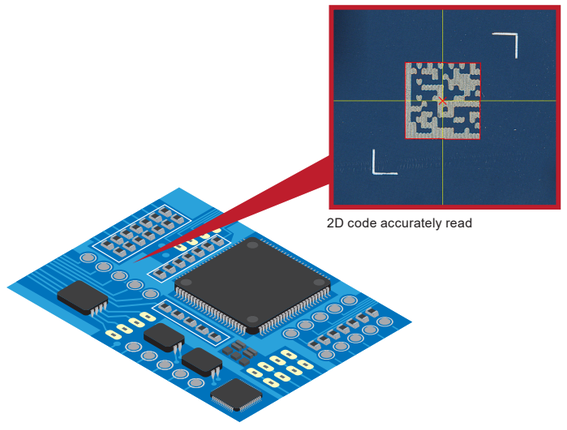
Various hardware corrections can be automatically performed simply by setting the "machine calibration plate (optional)" and clicking the "Start" button.



Automatic searching reference hole on the calibration plate

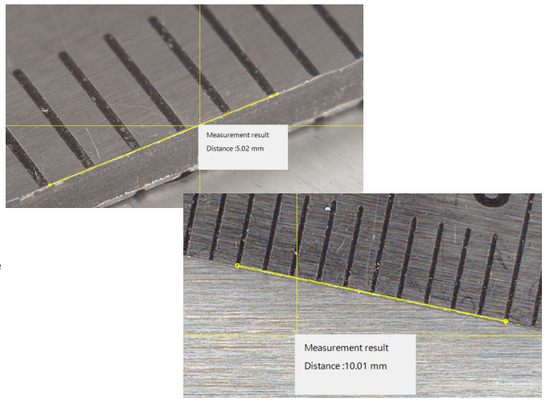
❷ 2D Code Reading

"2D code (board ID)" printed on the board with the top viewing camera can be recognized.
A high-resolution imaging sensor and image processing engine accurately read minute code patterns.


2D code accurately read

❸ Measure function and Fiducial marks

By capturing the camera image in 3D, not only Top Camera but also Side Camera, XY plane distance between the two points can be measured.
In addition, the "fiducial mark" on the PCB is registered in advance, and when the visual inspection starts, automatic reading and position correction are performed, resulting in a precise and accurate inspection.



Achieving “0 miss” with Automatic

In-Progress

Automatic Inspection Expansion Technology “AIP”

"AIP" is a software technology that adds an "automatic inspection function" to the visual inspection function developed in-house by WIT.
Since the image processing engine of "AIP-4000" is equipped with a corresponding visual inspection function, it is possible to add an "automatic inspection function" with a software update provided by our company.
As a result, "automatic visual inspection" can be realized, and overlooked mistakes due to human error can be prevented.

※ Automated Inspection Proの略

Automated visual inspection of boards that are becoming more complex with advanced mounting technology

There may be a surprising number of areas that are difficult to inspect with AOI, such as intricate inspection areas hidden behind parts and inspection areas hidden by overhangs.
Although it can be registered as a "priority visual inspection program", "automatic visual inspection" can greatly reduce

AIP
Automated Inspection Pro
under development

STEP 1

Create an automatic inspection program

Firstly, creates an automatic inspection program similar to AOI. However, in the case of the AIP-4000, this can be done in an extremely short time, such as pattern matching and OCR inspection for pre-registered non-defective images.

STEP 2

Display NG probability and perform visual inspection of all parts.

Visual inspection is always performed after automatic inspection by the automatic inspection program in STEP1. The result of automatic inspection is expressed as a numerical value called "NG probability", this is to gauge the reliability of how accurate the automatic inspection is. In addition, since visual inspection is always carried out, there will be “0 (zero) miss”. In addition, the monitor will display to call attention to inspection points with a high "NG probability", and the importance of visual inspection points can be differentiated.

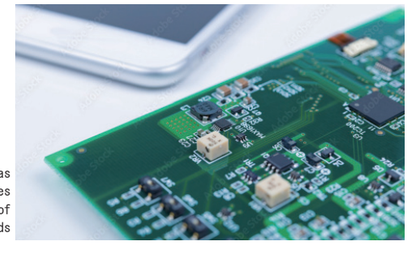
STEP 3

Create an automatic inspection program

In STEP 2, switch to automatic inspection for all parts that can be automatically inspected with high reliability, and use another automatic inspection method for parts with low reliability, or stop automatic inspection and switch to full visual inspection.

Automated visual inspection of boards that are becoming more complex with advanced mounting technology

Intricate inspection points hidden behind parts, inspection points hidden in overhanging parts, etc.
There may be a surprising number of areas that are difficult to inspect with AOI.
It can be registered as an "emphasis visual program", but if it is "automatic visual observation"
You can greatly reduce the time and effort required for judgment.


High density of small devices such as smartphones
Ideal for automatic visual inspection of mounting boards