Flying probe tester APT-9411 series

Vision System

TOS-5/TOS-4/TOS-41 Operator's Guide

TAKAYA

Preface

Vision System TOS-5/TOS-4/TOS-41, one of exclusive options for Takaya Fixtureless Tester APT-9411CE/CJ, enables to display a crosshair (Target marker) on the camera monitor that plays an important role in inputting or modifying X,Y coordinates of the probe contact position, and offer Auto. Coordinates Alignment Function in order to have the accurate probes contact on the board under test.
In addition, the TOS-5 is provided with the ability to recognize the barcode labels that can manage the serial number input via a CCD camera.

Also, this option offers Simple Vision Test for such component that is not detected by electrical test.

Please read this manual before using this option. Then keep this manual handy for answers to any questions you may have.

If you have any question or thoughts you would like to share with us - we would like to hear from you.

(NOTE)

1) This User's guide is written about System version [V1.0-7] for the APT-9411CE/CJ. As for further new system version, refer to our "Version up news" issued later on needed.
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4) The design of the product is under constant review and whilst every effort is made to keep this User's guide up to date, the rights is reserved to change specifications and equipment at any time without prior notice.

Introduction

Operation keys and SW

(1) All operation keys on the keyboard are enclosed by [ ] mark such like [**Enter**] key, [**SP**] key.

(2) All SWs on the operation panel are also displayed like [**TEST START**] .

(3) If some plural keys need to be depressed in order, they are combined with " **>** ".
For example, in case of [**A**] **>** [**3**] key, first depress [**A**] key then [**3**] key.

(4) If some plural keys need to be depressed at a time, they are combined with " **+** ".
For example, in case of [**Ctrl**] **+** [**Y**] key, depress [**Ctrl**] key and [**Y**] key at a time.

""

Safety symbols

Symbol	Explanation
	Calls attention to a procedure, practice, or condition that could possibly cause serious accident or death.
	Calls attention to a procedure, practice, or condition that could possibly cause bodily injury or damage to the product.
	Calls attention to a procedure, practice, or condition that could possibly damage to the product.
	Calls attention to general instruction. Failing to follow this could loss of data stored on disks, cause possibly misjudge the unit under test, or damage to the product.
	Calls attention to "One-point advice" which should be useful when you are at a loss to operate the products.

General

Vision System TOS-5/TOS-4/TOS-41 is one of exclusive options for Takaya APT-9411CE/CJ.

Using this Vision system, the APT-9411CE/CJ (hereafter “Tester”) ensures high accurate probing on the PC boards under test that tend to shift in X-Y direction, slant and expandable otherwise contract inconsistently, by aligning their XY coordinates with Board Reference Point and Auxiliary Reference Point(s) automatically. This Auto. Coordinates Alignment Function is also applicable per assigned components and test groups.

Followings are simple optical test available on this Vision system.

1. Presence check
2. Polarity check (Electrolytic capacitors, Tantalum capacitors, etc.)
3. Orientation check (ICs, CNs, etc.)

In addition to above, the TOS-5 is able to recognize the barcode labels (Datamatrix, QR code) that can manage the serial number input via a CCD camera.

	1. The reference object has no limitation in its shape, but the image processing area must be set larger than the object size so as the background of the object is included there. As for the details, refer to Page 11.
	2. Occasionally your objects may not recognized depending on their kind, color, size, shape, color of polarity mark or letter, and so on.
	3. By reason of the camera focus, any tall component may not detected.

Specifications

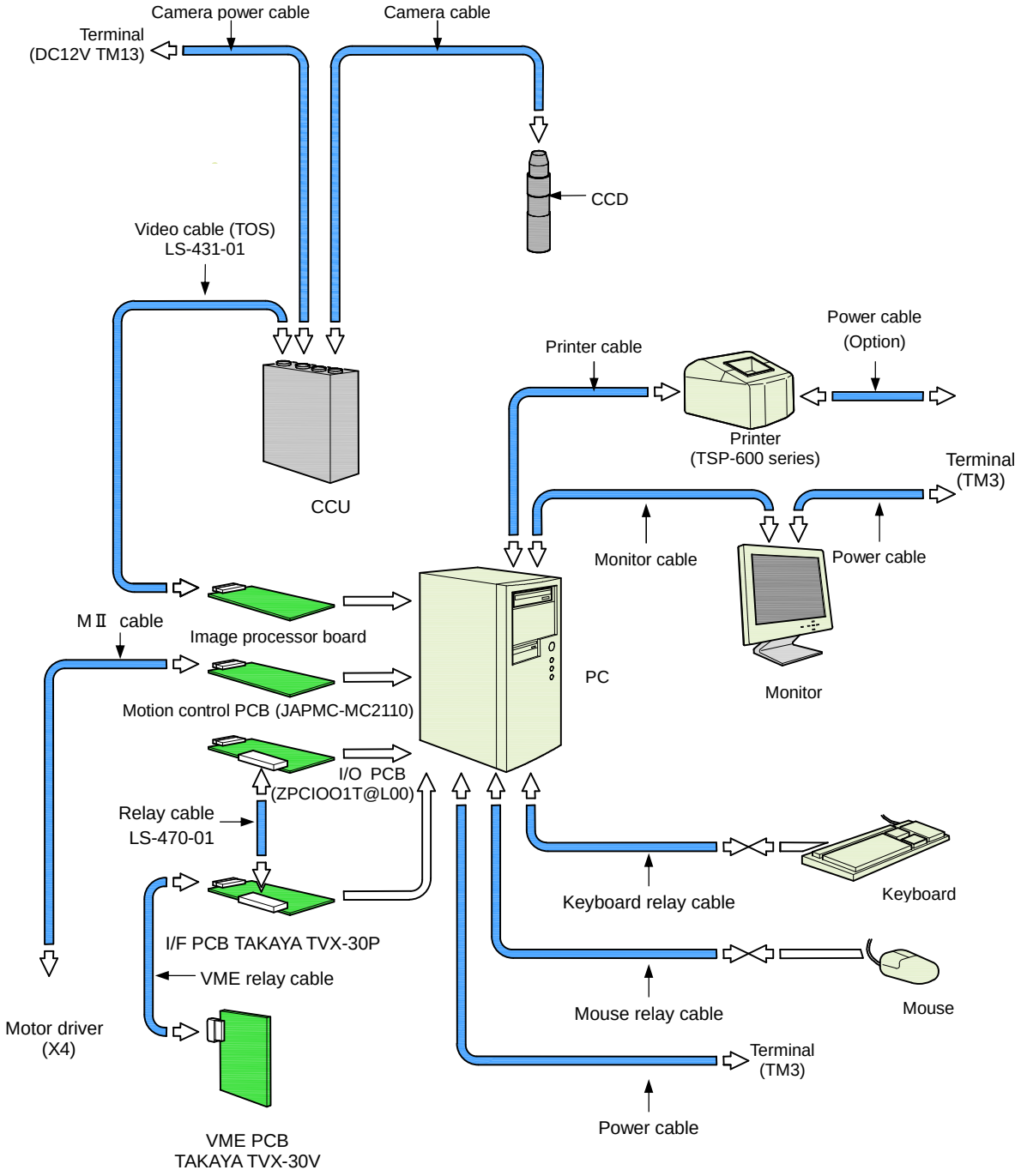
Search method	:	Gray-scale pattern matching Geometric pattern matching (for TOS-5/TOS-4)
Measuring resolution	:	Approx. 2μm (Image processor unit) Approx. 2.5μm (while Tester works for position alignment)
Measuring repeatable accuracy	:	±2μm (Image processor unit) ±50μm (while Tester works for position alignment)
Pass/Fail judgment	:	By comparing the object image to the reference image learned from a known PCB, it judges pass when its correlation value was over 20% - 100%.
Max. Scene number	:	500
Barcode labels (TOS-5 only)	:	Reading of DataMatrix, QR code

& Gray-scale pattern matching is analyzing pixel-grid values, a process known correlation. This method locates objects by comparing a gray-level model (or reference image) of the object to the image. The X-Y position at which the model best matches the image is calculated and, from this, the object's location is determined.

& Geometric pattern matching looks at the geometric features of the object, to accurately locate an object despite changes in the object's angle, size, or appearance.

Installation

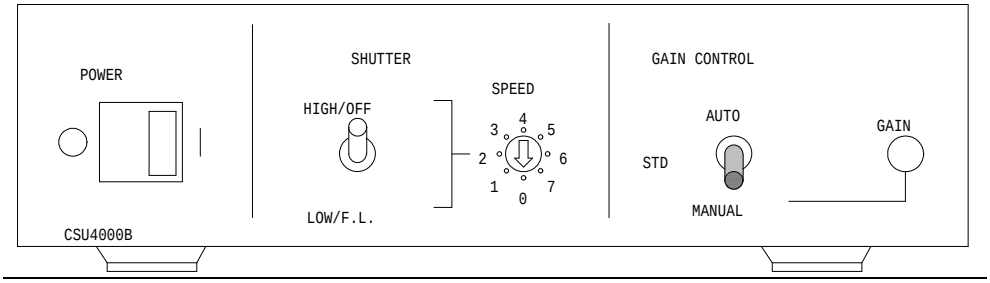
Connect the Camera Control Unit (CCU) to the Image processor board (TOS-5/TOS-4/TOS-41) that is slot-in the PC, using a dedicated video cable TAKAYA LS-431-01. (Refer to Fig.1)



[Fig. 1] System connection diagram

WARNING	Make sure that the tester is unplugged and the power switch is turned off before installing this option into the tester. Otherwise it could possibly cause bodily injury or mechanical trouble.

CCU (Front panel)



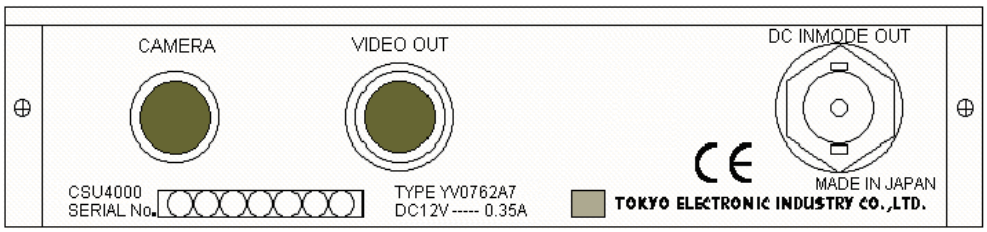
[Fig. 2] Set position

(1) **POWER** **I**
(2) **SHUTTER** **HIGH/OFF**
(3) **SPEED** **0**
(4) **GAIN CONTROL** **MANUAL**…… Rotary SW (GAIN) should be fine adjusted carefully.
(Refer to APT-9411 Service manual)

	Be sure to set up the CCU as indicated above. Otherwise the image is not displayed correctly.

	When power is turned on, the pilot lamp on the power switch will light.

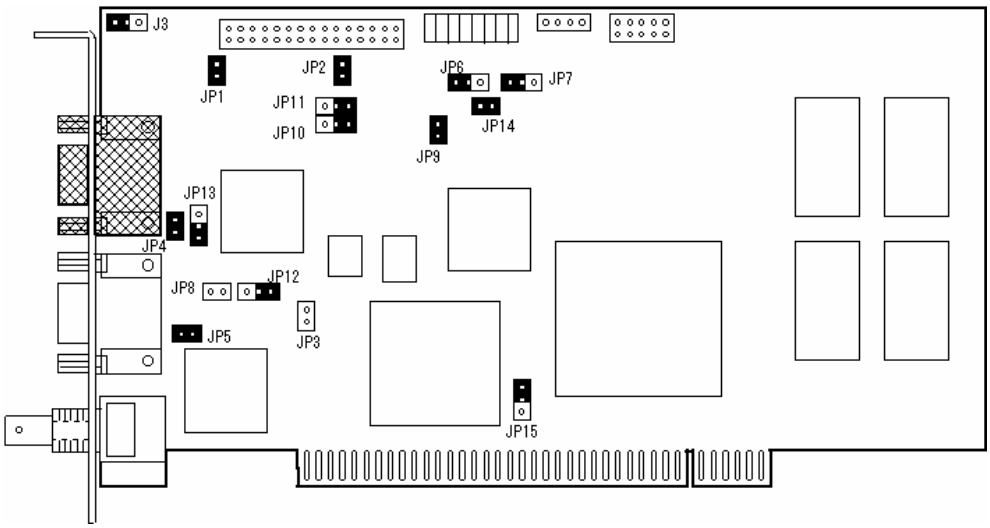
CCU (Rear panel)



[Fig. 3] Rear panel

(1) **CAMERA** …… connected to the camera head with the camera cable.
(2) **VIDEO OUT** …… connected to the Image processor board (TOS-4/41).
(3) **DC IN/VIDEO OUT** …… connected to the power supply (DC12V).

Image processor board



[Fig. 4] Image processor board (TOS-5/TOS-4/TOS-41)

	The connector drawn by shilling mark in Fig. 4 is connected to the Image processor board (TOS-5/TOS-4/TOS-41). But the other connectors should not connect to anything else.
	The Image processor board (TOS-5/TOS-4/TOS-41) is equipped with various jumpers. If they were set incorrectly, the image is not displayed correctly.

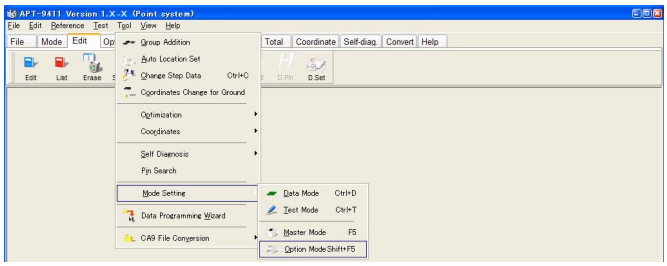
	In Fig. 4, the black-out terminals mean “short”, and the others mean “open”.

Option Mode Set

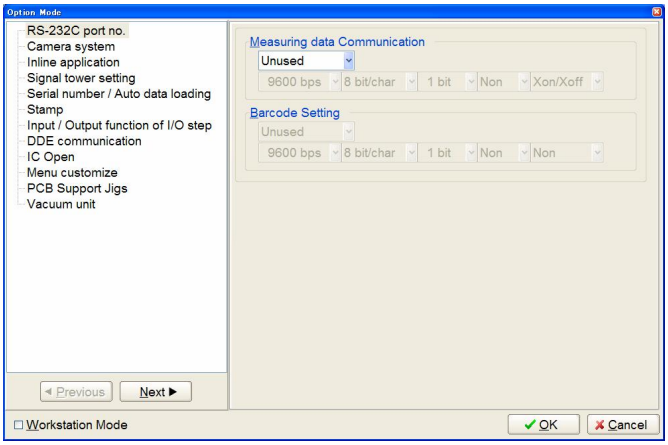
In case that Vision system TOS-5/TOS-4/TOS-41 is first used with the tester, it is necessary to set up the system software (Option Mode) correctly. This setting is conserved into Master mode file in the system directory.

[Operation steps]

(1) Click [Tool] on Menu bar, then select [Mode Setting] then [Option Mode] in order. After these operations, Option mode menu (Refer to Sample display-2) appears on the display.

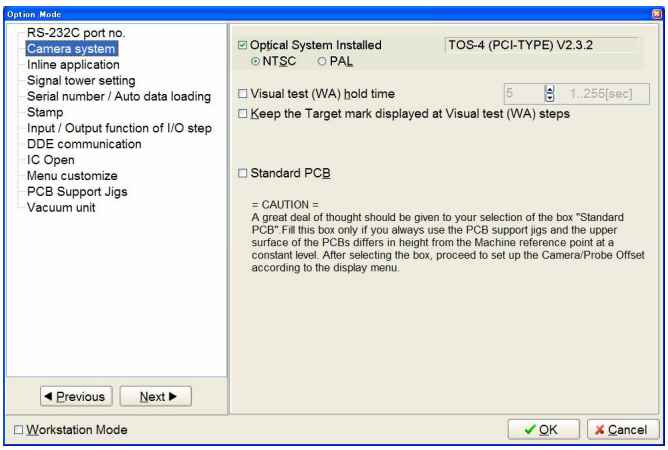


[Sample display-1]



[Sample display-2] Option Mode menu

(2) Click on [Camera System], then fill “Optical System Installed” checkbox.



[Sample display-3] Camera System menu

(3) Set up [Add recognition errors to the failure counter], [Visual test (WA) hold time (1-255sec)] and [Standard PCB] as you like. As for their details, refer to the next section.

(4) After then, click on [OK] button to close Option Mode menu.

Option Mode set for Camera

Optical System Installed

In case that Vision system TOS-5/TOS-4/TOS-41 is built-in the tester, fill “Optical System Installed” checkbox. Then specify either NTSC or PAL as your Color system.

Add recognition errors to the failure counter

In case that “Add recognition errors to the failure counter” checkbox was filled, when some recognition error for fiducial marks happened, the board is also counted as test fail number.
Unless that checkbox was filled, such error is not regarded as test fail number.

Visual test (WA) hold time (1-255sec)

In case that “Visual test (WA) hold time (1-255sec)” checkbox was filled, it is possible to preset the time to suspend the camera movement at Visual test step from 1 - 255 sec.
Unless that checkbox was filled, the camera does not move to the next step until any operation panel SWs ([ENTER] SW, [PROBE DOWN] SW, Left-arrow key) is depressed by the operator.

HINT	When the camera is suspended at Visual test step, pressing [ENTER] SW on the operation panel judges the step as PASS. And, pressing [PROBE DOWN] SW judges the step as FAIL. If Left-arrow key was depressed, it returns back to the former Visual step.

Standard PCB

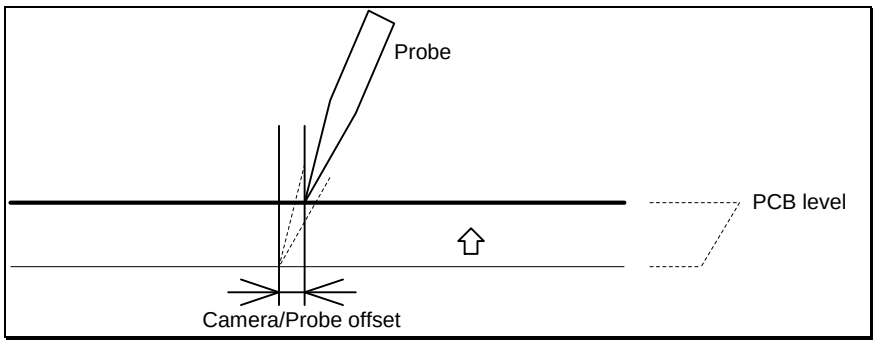
In case that “Standard PCB” checkbox was filled, Camera/Probe Offset value can be conserved in Option Mode.
Unless that checkbox was filled, Camera/Probe Offset value is conserved in Data Mode and needs to be managed in each test program.

HINT	While “Standard PCB” checkbox is filled, Camera/Probe Offset menu does not appear on Data Mode.

About Camera / Probe Offset

To ensure minimum probe pitch, all moving probes are installed on Z-axis mechanism scantly. If the contact level on the board under test changes when PCB Extension Support Kit (option) is used, as a matter of fact, any probe does not contact the position where the camera read out, as shown in Fig. 5 below.

Whenever the contact level on every board is the same and unchanged, it is recommended that “Standard PCB” checkbox in Option Mode menu is filled in advance.



[Fig. 5]

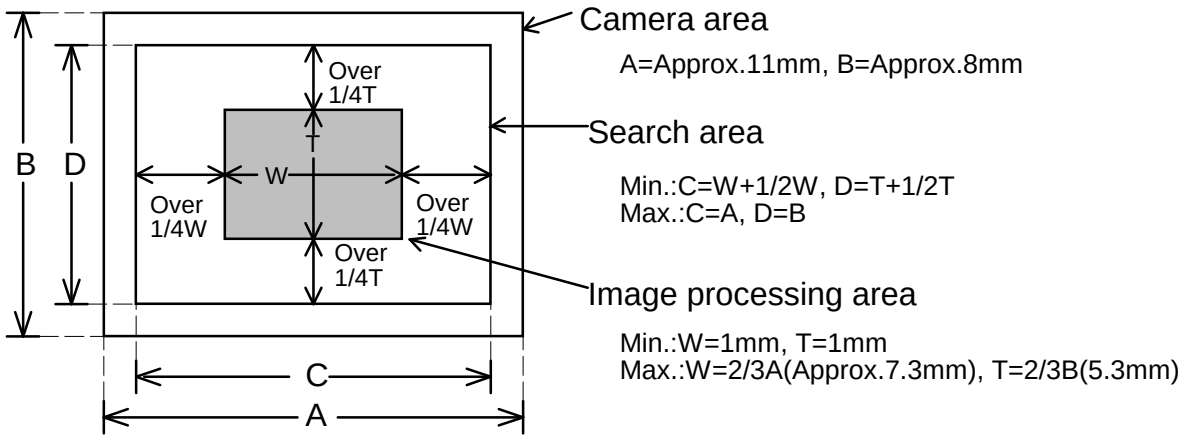
!	In case that Camera/Probe Offset value was input incorrectly, any probe may not contact the position where the camera read out.

Test Target

Fig. 6 below indicates each size of Camera area, Search area and Image processing area.

Please be assured that both Board reference point and Aux. Reference point for revising X-Y coordinates should be adequate size that is smaller than Image processing area shown in Fig. 6.

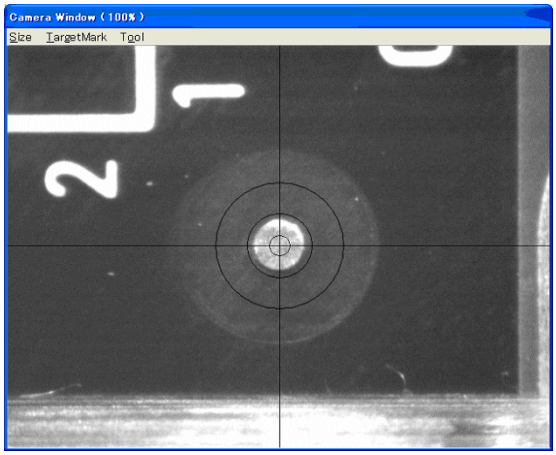
Also, in case of programming the step data for Presence check and Polarity check, please be assured that they should be adequate size that is smaller than Image processing area and Search area.



[Fig. 6] Area size

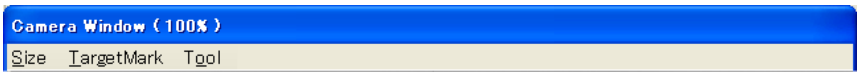
Camera Image Window

If Vision system TOS-5/TOS-4/TOS-41 was included in the tester, Camera window (Refer to Sample display-4 below) is displayed when the test program is created (X-Y coordinates input) and/or when the fiducial marks are adjusted.



[Sample display-4] Camera window

While the Camera window is displayed, the dedicated menubar (Refer to Sample display-5 below) appears.



[Sample display-5] Camera window menubar

Size

With this menubar, the image's magnification is changeable optionally in answer to the image size.

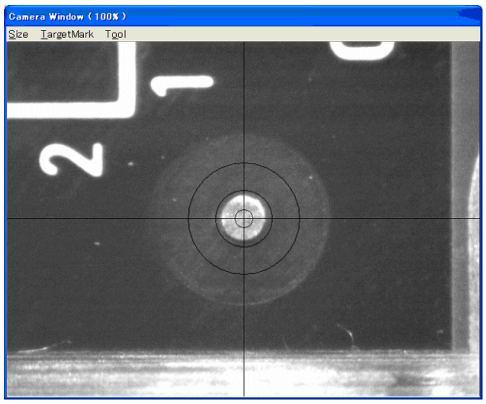
Menu	Explanation
400%	The image is magnified to 400% on the display.
200%	The image is magnified to 200% on the display.
100%	The image is magnified to 100% on the display.
50%	The image is demagnified to 50% on the display.

400% The image is magnified to 400% on the display. Use this magnification when the image size is so small that it is not possible read out X-Y coordinates accurately.

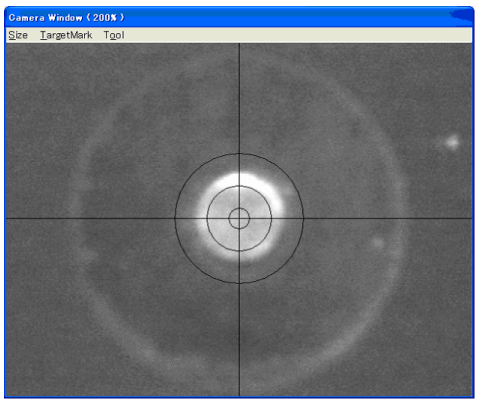
200% The image is magnified to 200% on the display. Use this magnification when the image size is so small that it is not possible read out X-Y coordinates accurately.

100% The image is magnified to 100% on the display. As normal, this magnification is used to read our X-Y coordinates.

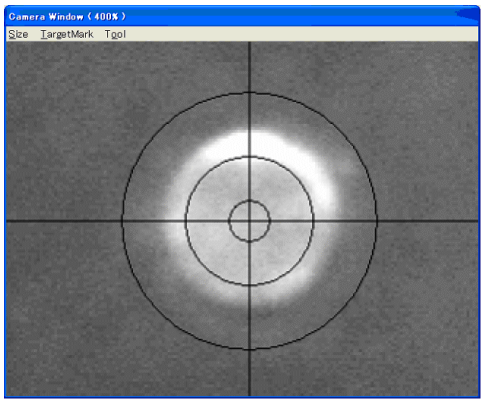
50% The image is demagnified to 50% on the display.



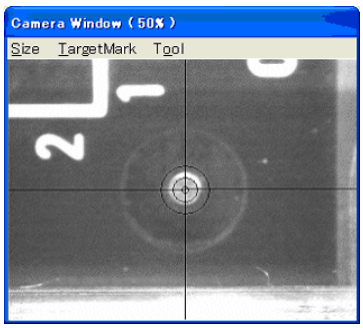
100%



200%



400%



50%

[Sample display-6] Magnification size (100%, 200%, 400%, 50% from the lefthand)

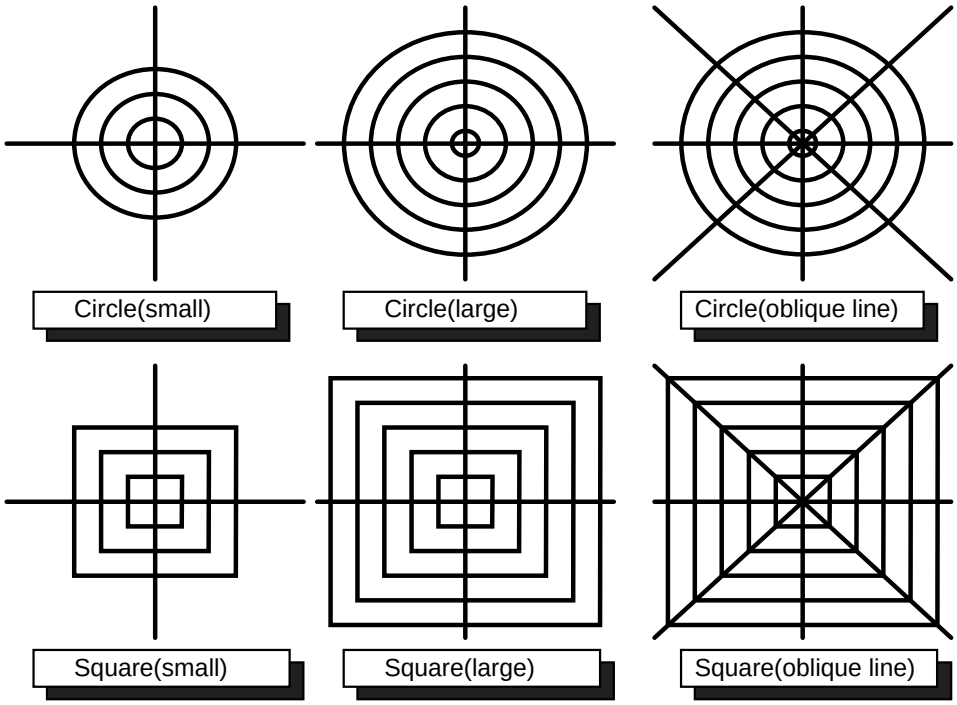
HINT	Any magnification change is conserved until the reference image input or test is executed. After these operation, it turns back to default (100%).

Target Mark

With this menubar, the target marker is changeable optionally in answer to the image color and/or shape.

Menu	Explanation
ON	Target marker is overlayed on the camera image. (Normal = ON)
OFF	Target marker is removed from the camera image.
Circle (small)	Target marker is changed to “Circle (small)” type.
Square (small)	Target marker is changed to “Square (small)” type.
Circle (large)	Target marker is changed to “Circle (large)” type.
Square (large)	Target marker is changed to “Square (large)” type.
Circle (oblique line)	Target marker is changed to “Circle (oblique line)” type.
Square (oblique line)	Target marker is changed to “Square (oblique line)” type.

Sample display-7 shows all available Target markers. Please choose the most desirable type in answer to the object shape on your PC board.



[Sample display-7] Target marker

This setting is managed by Data Mode and saved in the disk together with each test program.

Tool

This menubar includes two menus, “Mode 1 ~ Mode 4” and "Property”.

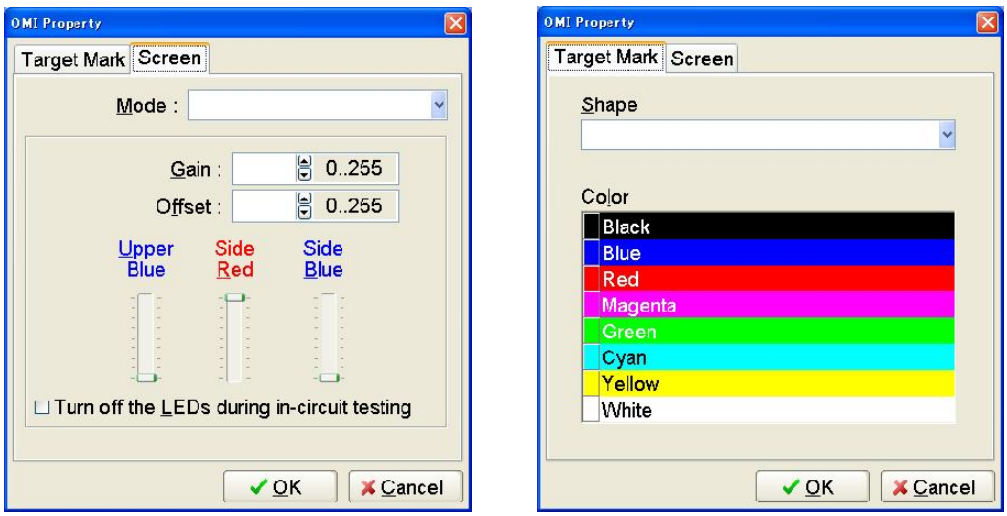
Menu	Explanation
Mode 1 – Mode 4	You can choose the most desirable Mode (Mode 1 ~ Mode4), in which Target marker, Camera image and LED illumination was already reserved.
Property	Type of Target marker, Camera image and LED illumination can be allocated in each Mode (Mode 1 ~ Mode 4) in advance.

Mode 1 - Mode 4

You can choose the most desirable Mode to use, in which Target marker (Shape, Color), Camera image (Gain, Offset) and LED illumination (Upper Blue, Side Red, Side Blue) was already reserved on Property menu.

Property

Your desirable Target marker (Shape, Color), Camera image (Gain, Offset) and LED illumination (Upper Blue, Side Red, Side Blue) can be allocated in each Mode 1 ~ Mode 4.



[Sample display-8] Screen tab (left), Target Mark tab (right)

If choose [Tool] > [Property] in order, both Screen tab and Target Mark tab above appear.

Screen tab (Sample display-8)

This tab allows to set up Camera property (such as Gain, Offset) and LED illumination separately for Mode 1- 4.

(1) **Mode**	Mode where your designated Camera property (such as Gain, Offset) and LED illumination are conserved.
(2) **Gain**	If Gain was adjusted to so smaller that the brightness level exceeds the range of 256 gradations, occasionally the image edge cannot be distinguishable. In this case, it is recommendable to make Offset bigger so as the gradation of the whole image becomes dark and the image edge is distinguishable.
(3) **Offset**	If Gain was adjusted to so smaller that the brightness level exceeds the range of 256 gradations, occasionally the image edge cannot be distinguishable. In this case, it is recommendable to make Offset bigger so as the gradation of the whole image becomes dark and the image edge is distinguishable.
(4) **Upper Blue**	Blue LED illumination installed at the top of the image is adjustable.
(5) **Side Red**	Red LED illumination installed at the sides of the image is adjustable.
(6) Side Blue	Blue LED illumination installed at the sides of the image is adjustable.
(7) **Turn off the LEDs during in-circuit testing**	If this checkbox is filled, all LED illuminations turns off, with the exception of when Board reference point/Auxiliary reference point is automatically align and when simple vision test is executed.

Target Mark tab (Sample display-8)

This tab allows you to set up Target marker (Shape, Color) as desired.

(1) **Shape**	Please choose the most desirable type in answer to the object shape on your PC board. (Refer to Fig. 13)
(2) **Color**	Please choose the most desirable color from Black, Blue, Red, Magenta, Green, Cyan, Yellow and White.

Differently from Screen tab, all setting in Target Mark tab applies equally to every Mode (Mode 1 - 4).

This setting is managed by Data Mode and saved in the disk together with each test program.

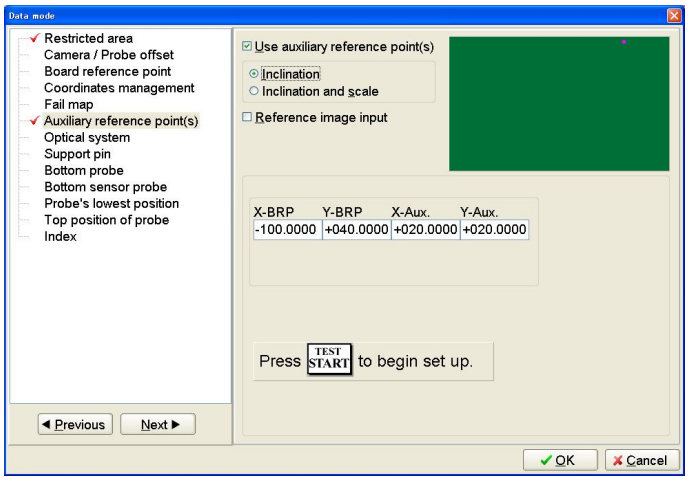
Inclination/Scale Alignment Function

The tester equipped with Vision system TOS-5/TOS-4/TOS-41 (option) can align any possible inclination and/or scale of PC boards each time before tested, by automatically detecting the center point of plural fiducial marks provided on the PC boards through the CCD camera.
In this section, we hereunder introduce a sample operation how to input image reference data usable for aligning “Inclination” or “Inclination & scale” of the PC boards under test.

Inclination alignment set at new test programming

(1) First set up “Conveyor Set Up”, “Camera/Probe Offset”, “Board Reference Point”, “Coordinates Management” and “Fail Map” in Data Mode menu properly.

(2) Fill "use Auxiliary Reference Point(s)” checkbox in Auxiliary Reference Point(s).



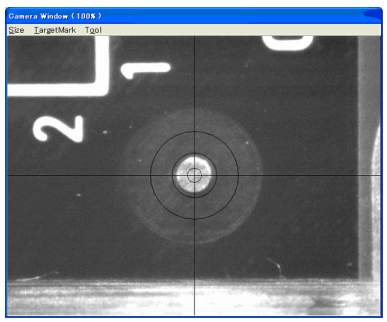
[Sample display-9] Coordinates Management (Data mode)

HINT	X-BRP/Y-BRP shown on Sample display-9 is for X-Y coordinates for Board Reference Point. And X-Aux/Y-Aux. is X-Y coordinates for Auxiliary Reference Point.

(3) Fill “Inclination” radio-button (Sample display-9)

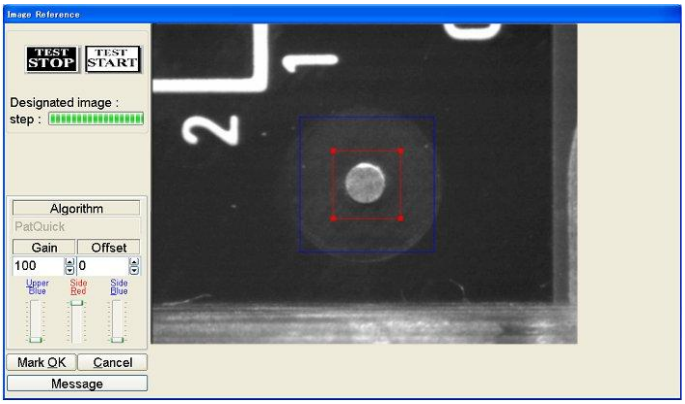
(4) Fill “Reference image input” checkbox, then press [TEST START]SW on the operation panel. (Sample display-9)

(5) After “Camera Window” appeared on the display, center the Target marker on the Board reference point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.



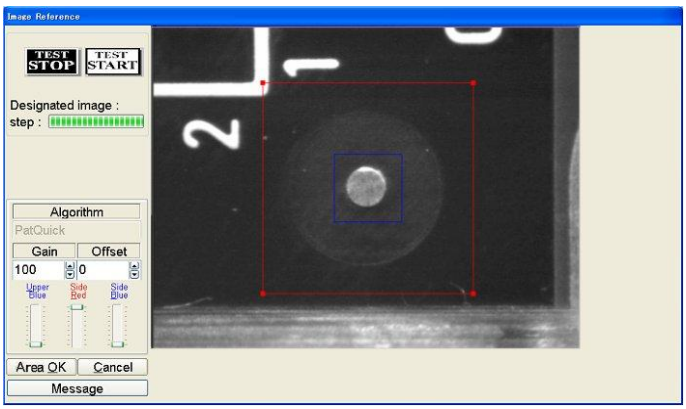
[Sample display-10] Camera Window

(6) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area. Enclose the Board reference point with Image processing area shown by a red box, then click on “Mark OK” button.



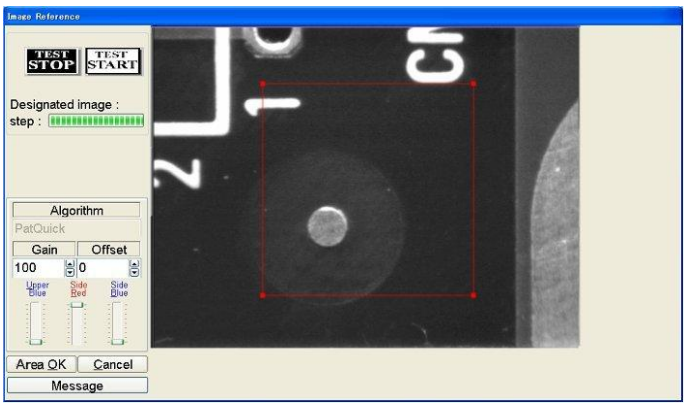
[Sample display-11] Image processing area set

(7) The Image processing area box changes from red to blue, and Search area is shown by a red box. Specify your Search area with the red box, and then click on “Area OK” button.



[Sample display-12] Search area set

(8) The camera shifts 1mm toward the right-top side automatically. (Sample display-13)
Shift your Search area (the red box) so as it encloses the Board reference point, and then click on “Area OK” button.



[Sample display-13] Reference image input

(9) With the above operation, the reference image is input.

(10) Center the Target marker on the auxiliary reference point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates. (Sample display-10)

(11) Enclose the Auxiliary reference point with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-11)

(12) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-12)
Specify your Search area with the red box, and then click on “Area OK” button.
With the above operation, the reference image is input.

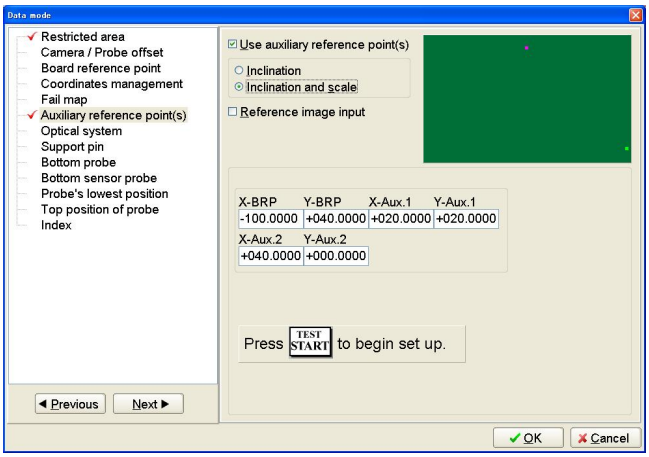
(13) When all process to setup and input the Board reference point and the Auxiliary reference point finished, it returns back to Data Mode menu. (Sample display-9)

	To align possible inclination of PC boards, it is enough to use two fiducial marks, Board reference point and Auxiliary reference point. But in case of aligning their inclination and/or scale, it must use three fiducial marks, Board reference point, Auxiliary reference point-1 and Auxiliary reference point-2.

Inclination & scale alignment set at new test programming

(1) First set up “Conveyor Set Up”, “Camera/Probe Offset”, “Board Reference Point”, “Coordinates Management” and “Fail Map” in Data Mode menu properly.

(2) Fill "use Auxiliary Reference Point(s)” checkbox in Auxiliary Reference Point(s).



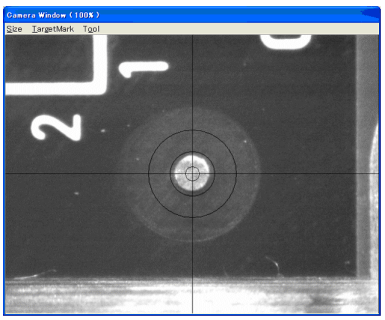
[Sample display-14] Coordinates Management (Data mode)

HINT	X-BRP/Y-BRP shown on Sample display-14 is for X-Y coordinates for Board Reference Point. X-Aux.1/Y-Aux.1 is X-Y coordinates for Auxiliary Reference Point-1 and X-Aux.2/Y-Aux.2 is X-Y coordinates for Auxiliary Reference Point-2

(3) Fill “Inclination” radio button (Sample display-14)

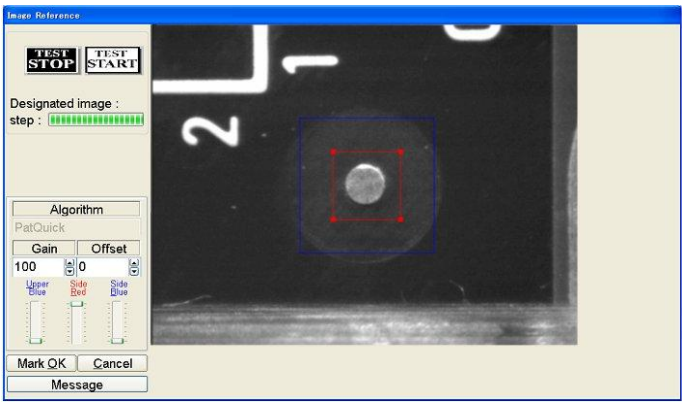
(4) Fill “Reference image input” checkbox, then press [TEST START] SW on the operation panel. (Sample display-14)

(5) After “Camera Window” appeared on the display, center the Target marker on the Board reference point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.



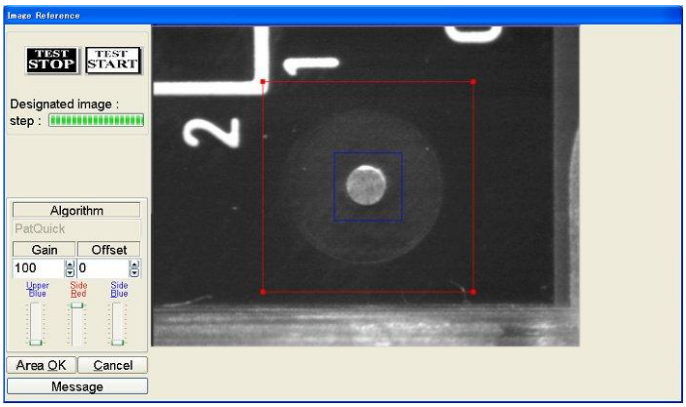
[Sample display-15] Camera Window

(6) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area. Enclose the Board reference point with Image processing area shown by a red box, then click on “Mark OK” button.



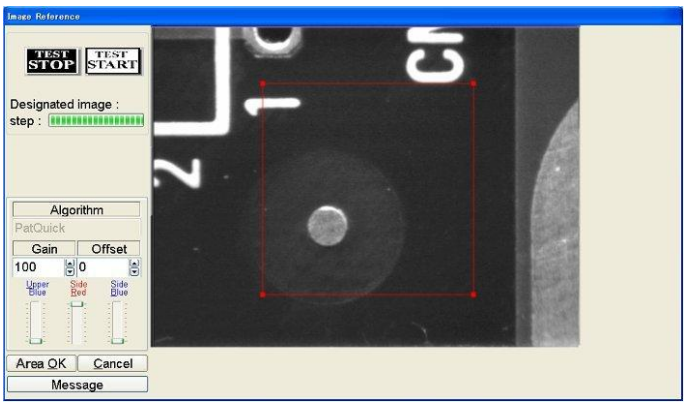
[Sample display-16] Image processing area set

(7) The Image processing area box changes from red to blue, and Search area is shown by a red box. Specify your Search area with the red box, and then click on “Area OK” button.



[Sample display-17] Search area set

(8) The camera shifts 1mm toward the right-top side automatically. (Sample display-18)
Shift your Search area (the red box) so as it encloses the Board reference point, and then click on “Area OK” button.



[Sample display-18] Reference image input

(9) With the above operation, the reference image is input.

(10) Enclose the Auxiliary reference point-1 with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-15)

(11) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-17)
Specify your Search area with the red box, then click on “Area OK” button.
With the above operation, the reference image is input.

(12) Enclose the Auxiliary reference point-2 with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-15)

(13) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-17)
Specify your Search area with the red box, then click on “Area OK” button.
With the above operation, the reference image is input.

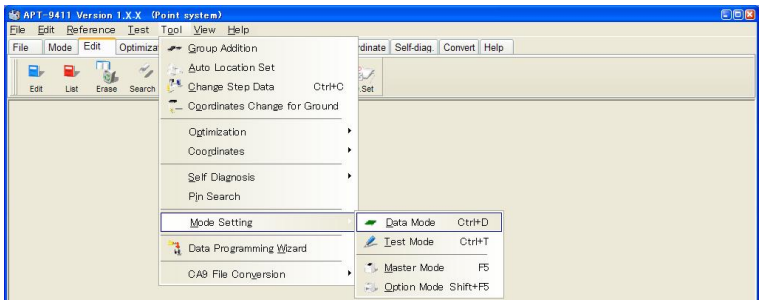
(14) When all process to setup and input the Board reference point and the Auxiliary reference point-1, 2 finished, it returns back to Data Mode menu. (Sample display-14)

HINT	To align possible inclination and/or scale of PC boards, it must use three fiducial marks, Board reference point, Auxiliary reference point-1 and Auxiliary reference point-2. But in case of aligning their inclination only, it is enough to use two fiducial marks, Board reference point and Auxiliary reference point.

Inclination alignment set to an existing test program

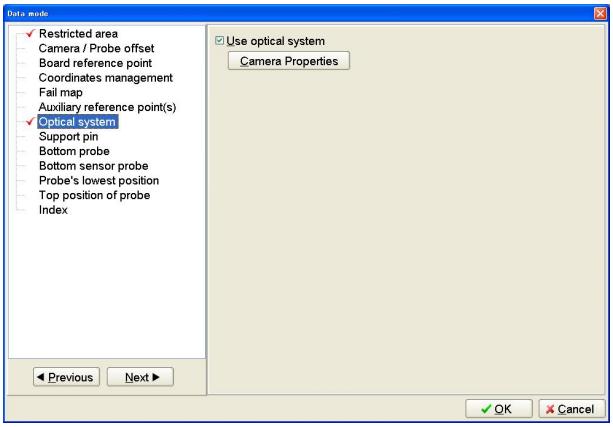
(1) After loaded an objective test program, first set up “Conveyor Set Up”, “Camera/Probe Offset” and “Board Reference Point” in Data Mode menu properly.

(2) Open Data mode menu (Tool > Mode Setting > Data Mode).



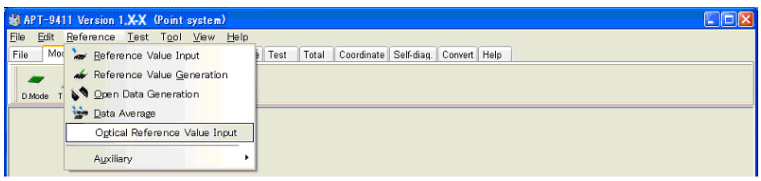
[Sample display-19] Menu bar (Data Mode)

(3) Open Optical System menu, then fill the “Use optical system” checkbox.
Also set up Camera Properties, if necessary (Refer to Page 14)



[Sample display-20] Data Mode menu

(4) Open Image data input menu (Reference > Optical Reference Value Input), where you can input the image data for both Board reference point and Auxiliary reference point.

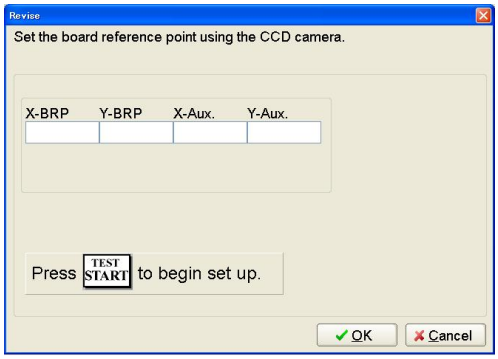


[Sample display-21] Menu bar (Image data input menu)

(5) Press [TEST START] SW on the operation panel.

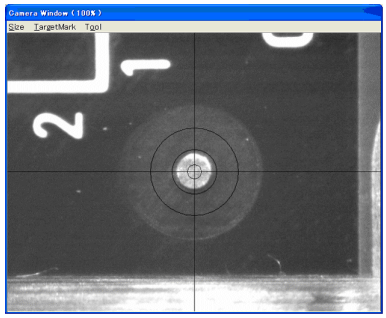
(6) It shows “Use board ref.point and aux.ref.point for alignment?” on the display. So click on [YES] button, then [TEST START] SW on the operation panel.

(7) It shows “Set the board reference point using the CCD camera” on the display.
Then press [TEST START] SW on the display.



[Sample display-22] Board reference point set message

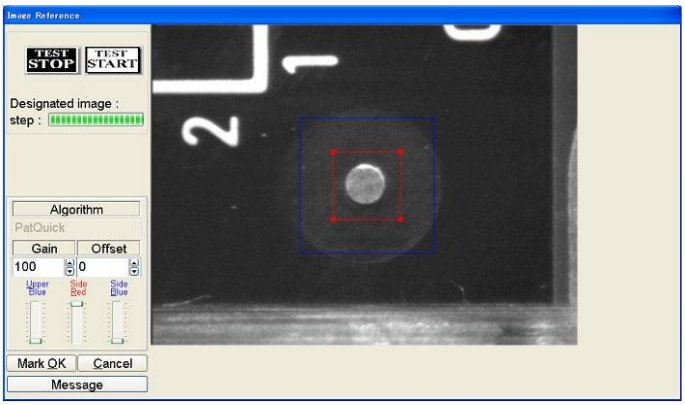
(8) After “Camera Window” appeared on the display, center the Target marker on the Board reference point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.



[Sample display-23] Camera Window

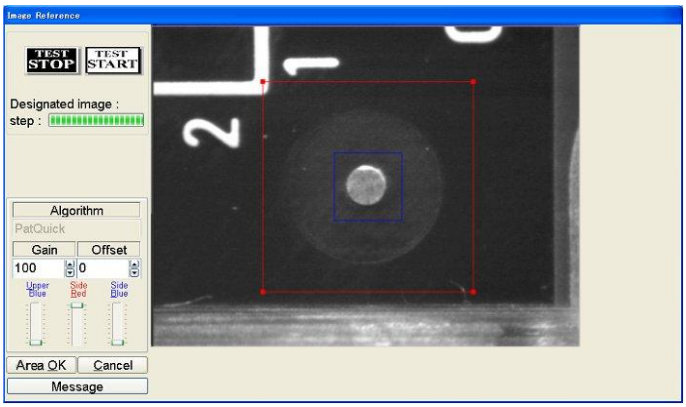
(9) Next, center the Target marker on the Auxiliary reference point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates. (Sample display-23)

(10) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area. Enclose the Board reference point with Image processing area shown by a red box, then click on “Mark OK” button.



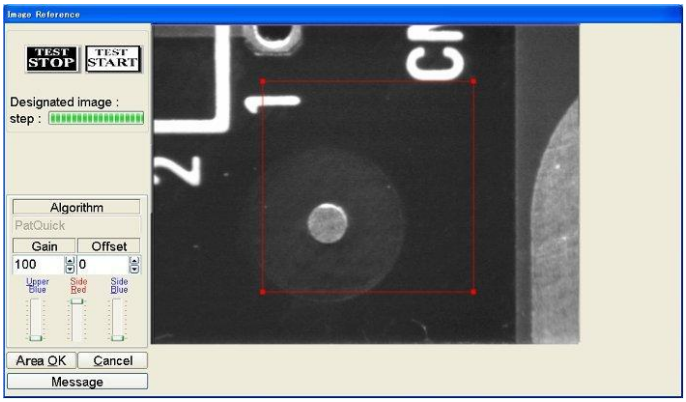
[Sample display-24] Image processing area set

(11) The Image processing area box changes from red to blue, and Search area is shown by a red box. Specify your Search area with the red box, and then click on “Area OK” button.



[Sample display-25] Search area set

(12) The camera shifts 1mm toward the right-top side automatically.
Shift your Search area (the red box) so as it encloses the Board reference point, and then click on “Area OK” button.



[Sample display-26] Reference image input

(14) With the above operation, the reference image is input.

(15) Enclose the Auxiliary reference point with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-24)

(16) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-25)
Specify your Search area with the red box, and then click on “Area OK” button.
With the above operation, the reference image is input.

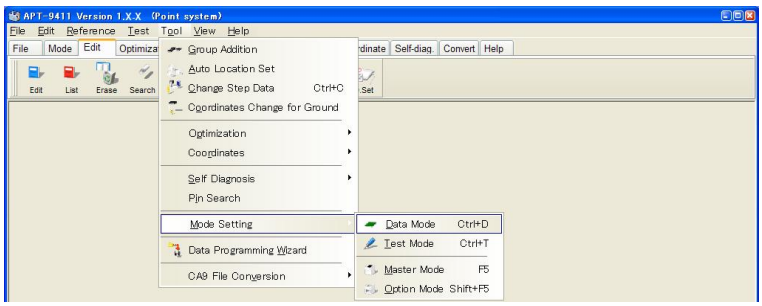
(17) When “Image Reference” window was closed, your operation of inputting the image data for Board reference point and Auxiliary reference point is finished.

HINT	To align possible inclination of PC boards, it is enough to use two fiducial marks, Board reference point and Auxiliary reference point. But in case of aligning their inclination and/or scale, it must use three fiducial marks, Board reference point, Auxiliary reference point-1 and Auxiliary reference point-2.

Inclination & scale alignment set to an existing test program

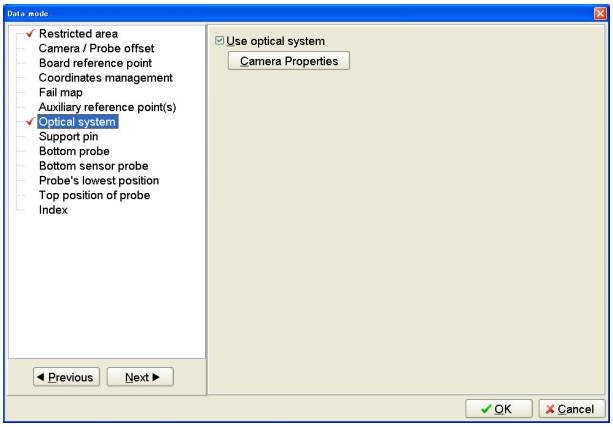
(1) After loaded an objective test program, first set up “Conveyor Set Up”, “Camera/Probe Offset” and “Board Reference Point” in Data Mode menu properly.

(2) Open Data mode menu (Tool > Mode Setting > Data Mode).



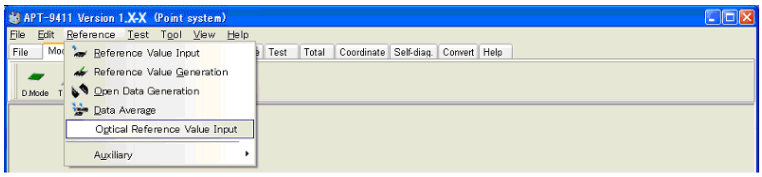
[Sample display-27] Menu bar (Data Mode)

(3) Open Optical System menu, then fill the “Use optical system” checkbox.
Also set up Camera Properties, if necessary (Refer to Page 14)



[Sample display-28] Data Mode menu

(4) Open Image data input menu (Reference > Optical Reference Value Input), where you can input the image data for both Board reference point and Auxiliary reference point-1, 2.

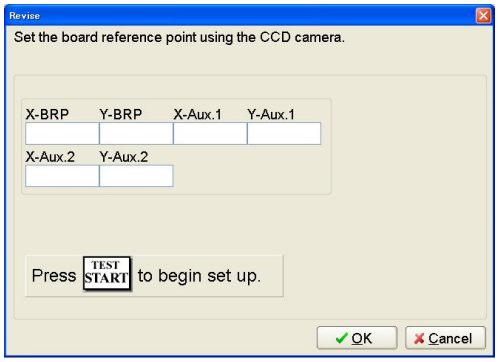


[Sample display-29] (Image data input menu)

(5) Press [TEST START] SW on the operation panel.

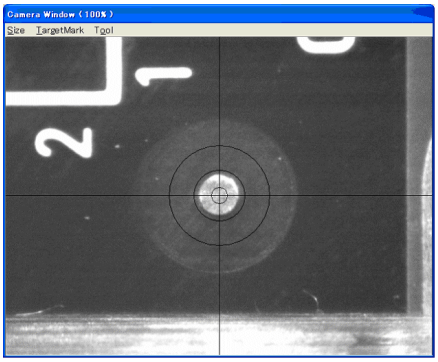
(6) It shows “Use board ref.point and aux.ref.point for alignment?” on the display. So click on [YES] button, then [TEST START] SW on the operation panel.

(7) It shows “Set the board reference point using the CCD camera” on the display.
Then press [TEST START] SW on the display.



[Sample display-30] Board reference point set message

(8) After “Camera Window” appeared on the display, center the Target marker on the Board reference point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

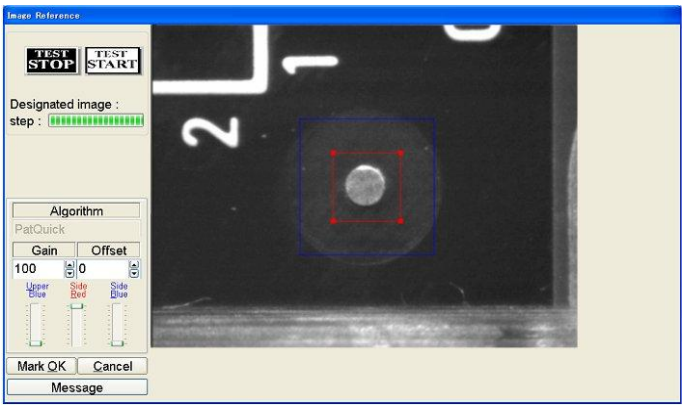


[Sample display-31] Camera Window

(9) Center the Target marker on the Auxiliary reference point-1 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates. (Sample display-31)

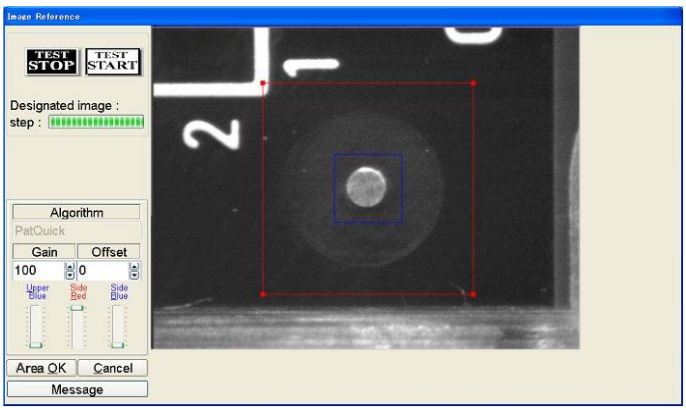
(10) Center the Target marker on the Auxiliary reference point-2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates. (Sample display-31)

(11) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area. (Sample display-32)
Enclose the Board reference point with Image processing area shown by a red box, then click on “Mark OK” button.



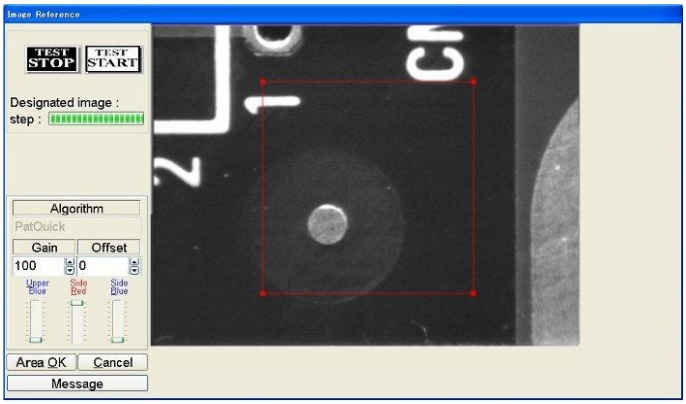
[Sample display-32] Image processing area set

(12) The Image processing area box changes from red to blue, and Search area is shown by a red box. Specify your Search area with the red box, and then click on “Area OK” button.



[Sample display-33] Search area set

(13) The camera shifts 1mm toward the right-top side automatically.
Shift your Search area (the red box) so as it encloses the Board reference point, and then click on “Area OK” button.



[Sample display-34] Reference image input

(14) With the above operation, the reference image is input.

(15) Enclose the Auxiliary reference point-1 with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-32)

(16) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-33) Specify your Search area with the red box, and then click on “Area OK” button. With the above operation, the reference image is input.

(17) Enclose the Auxiliary reference point-2 with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-32)

(18) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-33) Specify your Search area with the red box, and then click on “Area OK” button. With the above operation, the reference image is input.

(19) When “Image Reference” window was closed, your operation of inputting the image data for Board reference point and Auxiliary reference point-1, 2 is finished.

HINT	To align possible inclination and/or scale of PC boards, it must use three fiducial marks, Board reference point, Auxiliary reference point-1 and Auxiliary reference point-2. But in case of aligning their inclination only, it is enough to use two fiducial marks, Board reference point and Auxiliary reference point.

Conditional Alignment Function

Auto. Coordinates Alignment Function is also applicable conditionally while specifying some part of area in your test program;

- *** It revises after this step**
- *** It revises in only this group**
- *** It revises step data using this parts name**

In this section, each revision function is explained based on their concrete operating procedures.

It revises after this step

Specifying “It revises after this step” function, the X,Y coordinates in all steps following this assignment step are aligned automatically. If this assignment was made, “After-correct” is substituted in the Comment column.

Followings are your operating procedures to set up “It revises after this step” function.
(Ex.) X,Y coordinates after Test step #3 are aligned for possible incline & scale.

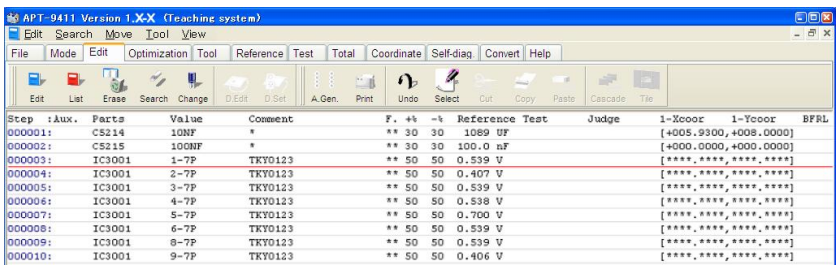
HINT	To align X,Y coordinates in some part of area against possible inclination and/or scale, it must use three fiducial marks. On the other hand, in case of the inclination only, it is enough to use two fiducial marks. (Above excludes both Board reference point and Auxiliary reference point(s))

(1) Open Step Edit menu (Edit > Step Edit) or Step List menu (Edit > Step List).

(2) It shows “Enter step number” on the dialog box.
Then specify the top step number to be revised from the keyboard and click on [OK] button.

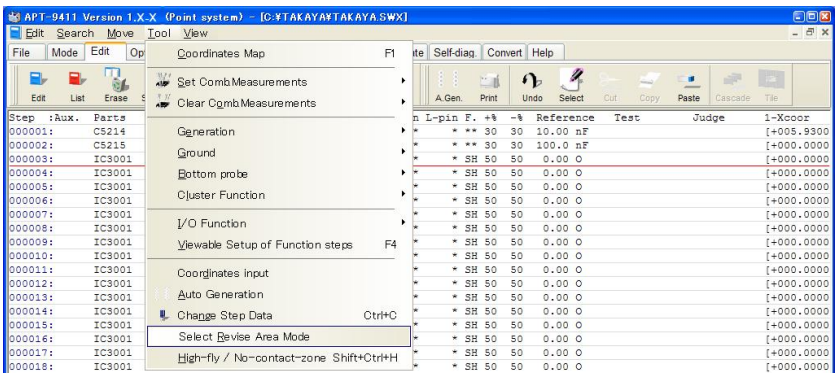
[Sample display-35] Step number input

(3) The step data list appears while showing the cursor on the specified step number (Test step #3).



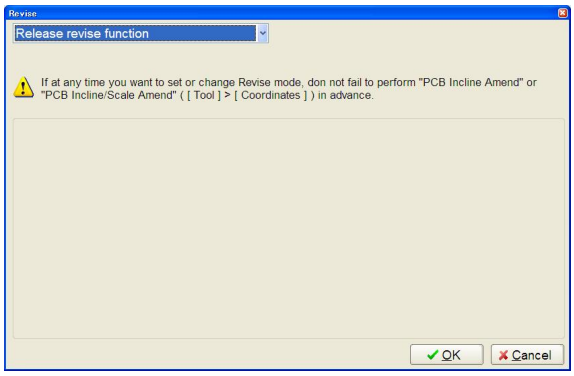
[Sample display-36] Step data list (Step No.3)

(4) Click on Tool to select Select Revise Area Mode.



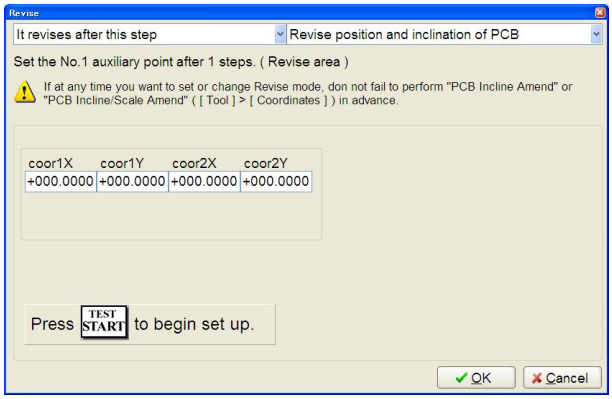
[Sample display-37] Select Revise Area Mode (Menu bar)

(5) It shows “Revision mode set” combobox. (Refer to Sample display-38)



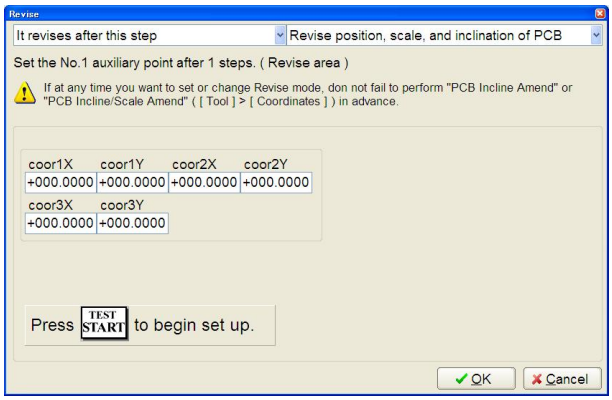
[Sample display-38] Revision mode set

(6) Select “It revises after this step” from Revision mode set combobox.



[Sample display-39] Revision area set

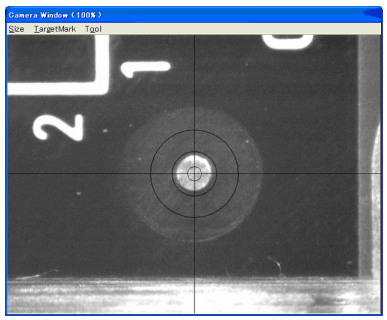
(7) Select “Revise position, scale, and inclination of PCB” from Revision area set combobox.



[Sample display-40]

(8) Press [TEST START] SW on the operation panel.

(9) After “Camera Window” appeared on the display, center the Target marker on the auxiliary point-1 for your assigned area using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.



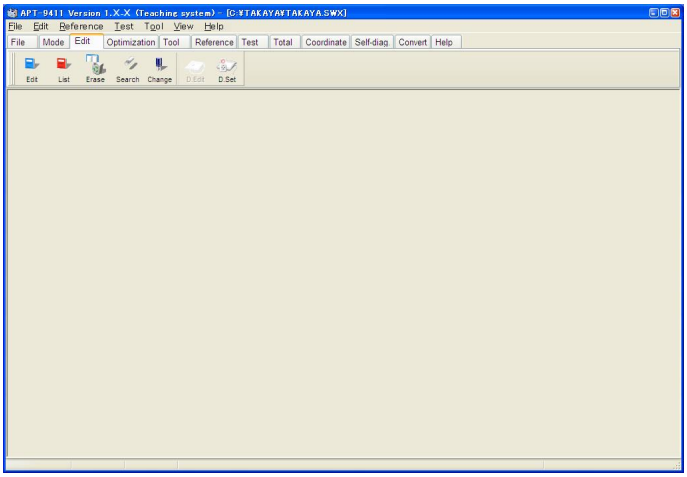
[Sample display-41] Camera Window

(10) Center the Target marker on the auxiliary point-2 for your assigned area using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates. (Sample display-41)

(11) Center the Target marker on the auxiliary point-3 for your assigned area using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates. (Sample display-41)

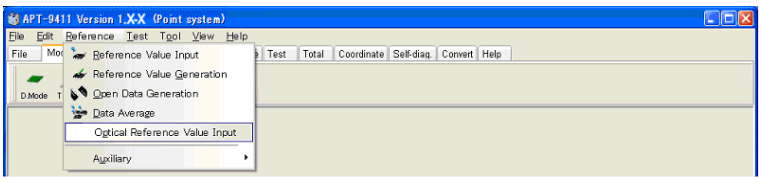
(12) After all auxiliary points were set, the menu returns back to the step data list, where “After-correct” is substituted in the Comment column.

(13) Press [Esc]key on the keyboard to close the step data list.



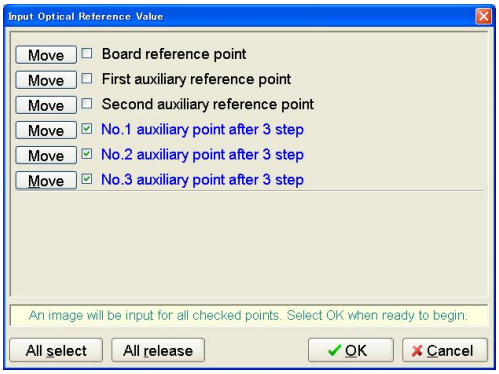
[Sample display-42] Main Window

(14) Open Optical Reference Value Input menu. (Reference > Optical Reference Value Input)



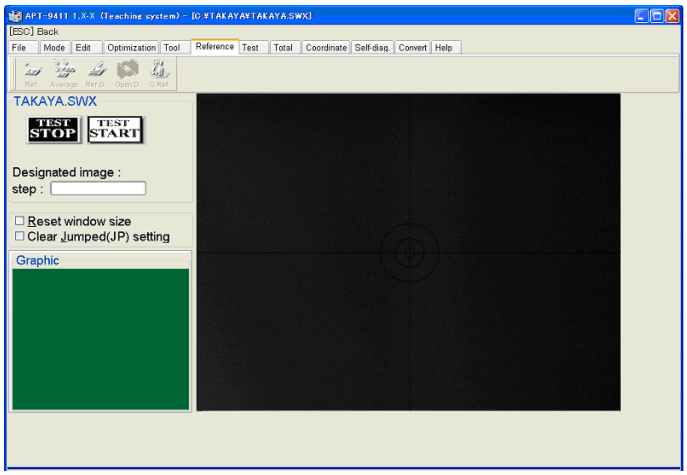
[Sample display-43] Menu bar (Optical Reference Value Input)

(15) Input Optical Reference Value window appears to show you all optical steps.
The steps in black have already input the optical data, but the steps in blue has not yet input. Thus, please fill the checkbox which optical data should be input.



[Sample display-44] Optical Reference Value Input window

(16) Optical data input condition window appears. (Sample display-45)



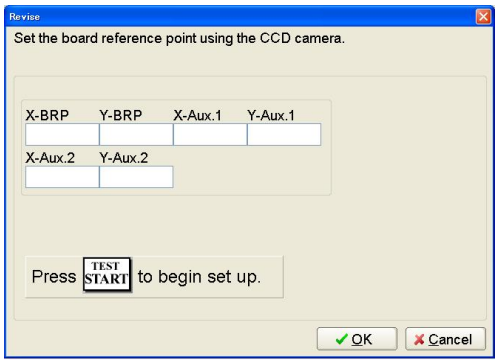
[Sample display-45] Optical data input condition window

HINT	Unless “Reset window size” checkbox displayed on Optical data input condition window was filled, Image processing area and Search are same as the ones used at your last operation. Be sure to fill the checkbox whenever the optical data is newly input.
	If “Clear Jumped (JP) setting” checkbox displayed on Optical data input condition window was filled, the measuring function in the optical step where has been preset to JUMP(JP) is initialized to “BLANK(**)”.

(17) Press [TEST START] SW on the operation panel.

(18) After a message “Use board ref. point and aux. ref. point for alignment?” appeared, click on [Yes] button then press [TEST START] SW on the operation panel.

(19) After a message “Set board reference point using the CCD camera” appeared, press [TEST START] SW on the operation panel.



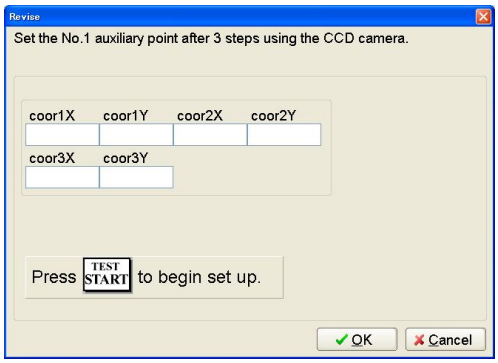
[Sample display-46] Board reference point set

(20) After “Camera Window” appeared on the display, center the Target marker on the Board reference point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(21) Center the Target marker on the Auxiliary reference point-1 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(22) Center the Target marker on the Auxiliary reference point-2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(23) It shows “Set the No.1 auxiliary point after 3 steps using the CCD camera.” Then press [TEST START] SW on the operation panel.



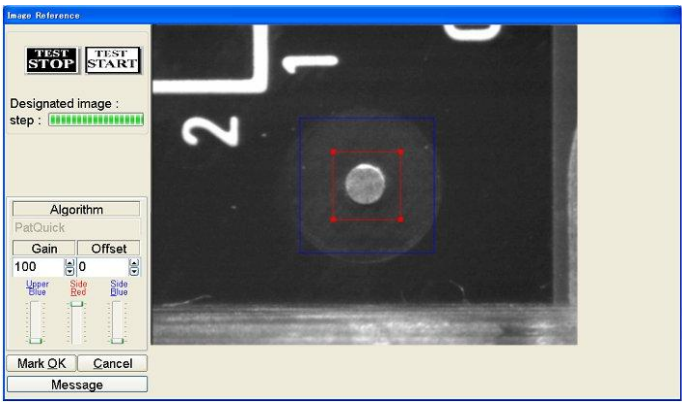
[Sample display-47] Auxiliary point set

(24) After “Camera Window” appeared on the display, center the Target marker on the auxiliary point-1 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(25) Center the Target marker on the auxiliary point-2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

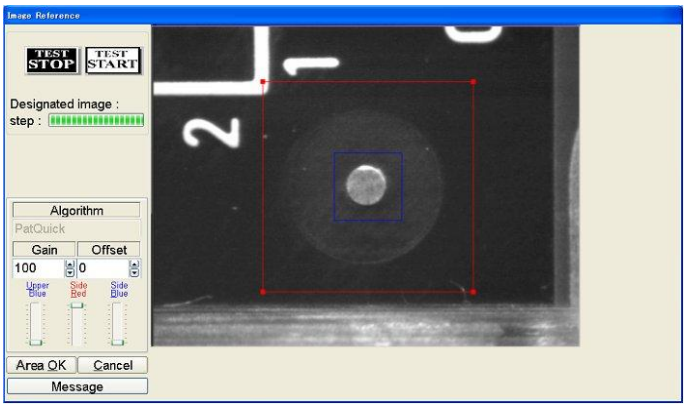
(26) Center the Target marker on the auxiliary point-3 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(27) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area. Enclose the auxiliary point-1 with Image processing area shown by a red box, then click on “Mark OK” button.



[Sample display-48] Image processing area set

(28) The Image processing area box changes from red to blue, and Search area is shown by a red box. Specify your Search area with the red box, and then click on “Area OK” button.



[Sample display-49] Search area set

(29) Enclose the auxiliary point-2 with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-48)

(30) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-49)
Specify your Search area with the red box, then click on “Area OK” button.

(31) Enclose the auxiliary point-3 with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-48)

(32) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-49)
Specify your Search area with the red box, and then click on “Area OK” button.

(33) When “Image Reference” window was closed, your operation of inputting the image data from auxiliary point1 to 3 is finished.

It revises in only this group

Specifying “It revises in only this group” function, the X,Y coordinates in this specified test group are aligned automatically. If this assignment was made, “Group-correct” is substituted in the Comment column.

Followings are your operating procedures to set up “It revises in only this group” function.
(Ex.) X,Y coordinates in Group #2 are aligned for possible incline & scale.

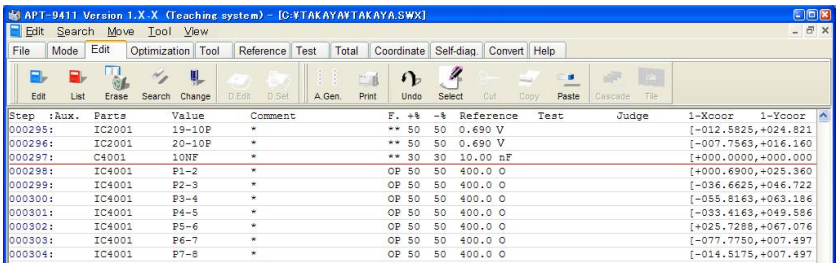
HINT	To align X,Y coordinates in some part of area against possible inclination and/or scale, it must use three fiducial marks. On the other hand, in case of the inclination only, it is enough to use two fiducial marks. (Above excludes both Board reference point and Auxiliary reference point(s))

(1) Open Step Edit menu (Edit > Step Edit) or Step List menu (Edit > Step List).

(2) It shows “Enter step number” on the dialog box.
Then specify the top step number (in Group #2) to be aligned from the keyboard and click on [OK] button.

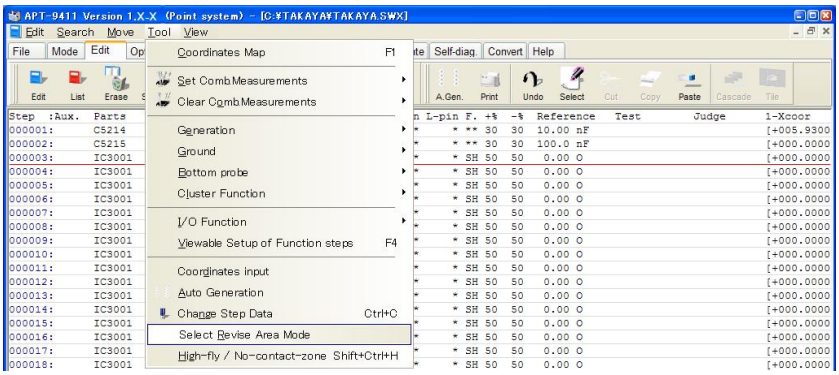
[Sample display-50] Step number input

(3) The step data list appears while showing the cursor on the specified step number.



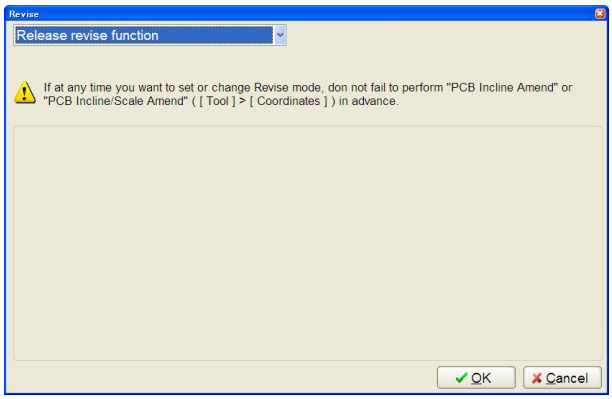
[Sample display-51] Step data list (Step No. 418)

(4) Click on Tool to select Select Revise Area Mode.



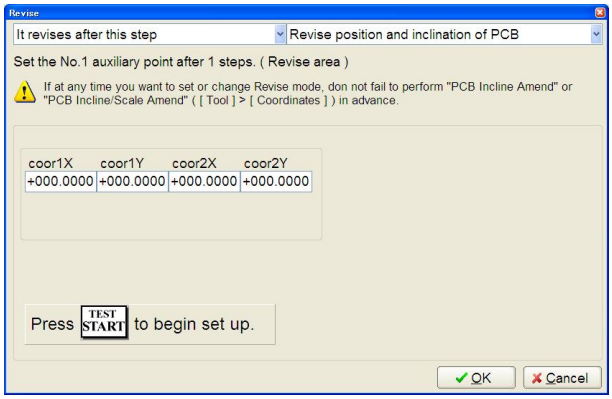
[Sample display-52] Select Revise Area Mode (Menu bar)

(5) It shows “Revision mode set” combobox.



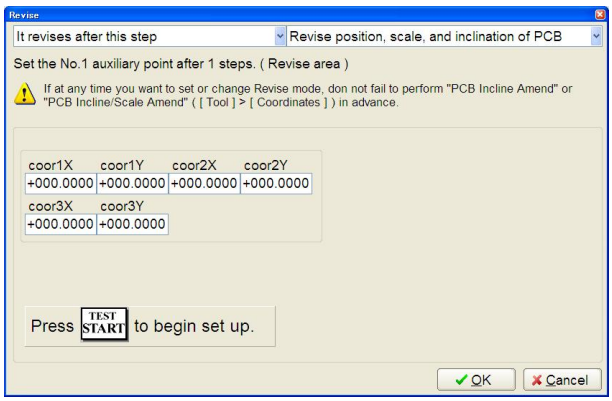
[Sample display-53] Revision mode set

(6) Select “It revises in only this group” from Revision mode set combobox.



[Sample display-54] Revision area set

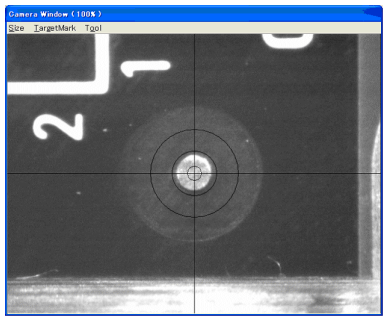
(7) Select “Revise position, scale, and inclination of PCB” from Revision area set combobox.



[Sample display-55]

(8) Press [TEST START] SW on the operation panel.

(9) After “Camera Window” appeared on the display, center the Target marker on the auxiliary point-1 in Group #2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.



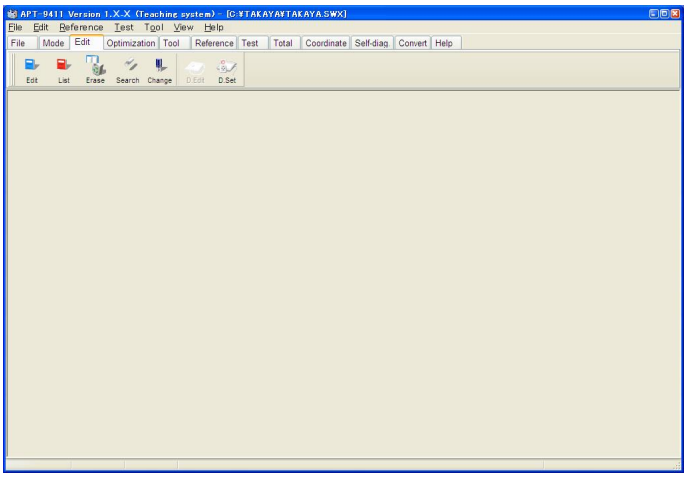
[Sample display-56] Camera Window

(10) Center the Target marker on the auxiliary point-2 in Group #2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates. (Sample display-56)

(11) Center the Target marker on the auxiliary point-3 in Group #2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates. (Sample display-56)

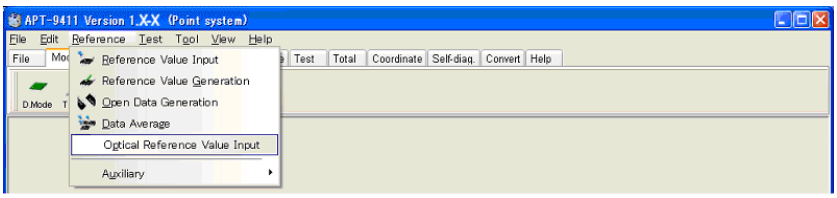
(12) After all auxiliary points in Group #2 were set, the menu returns back to the step data list, where “Group-correct” is substituted in the Comment column.

(13) Press [Esc]key on the keyboard to close the step data list.



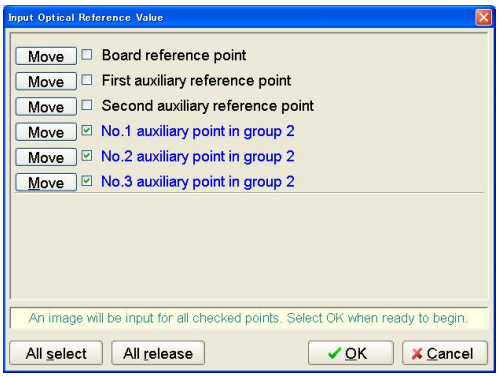
[Sample display-57] Main Window

(14) Open Optical Reference Value Input menu. (Reference > Optical Reference Value Input)



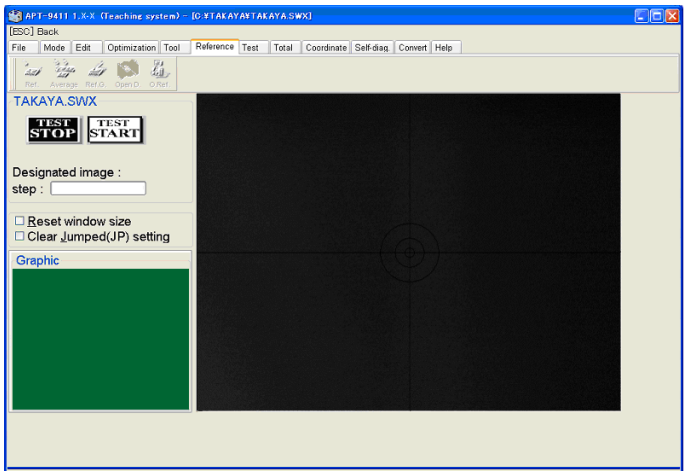
[Sample display-58] Menu bar (Optical Reference Value Input)

(15) Input Optical Reference Value window appears to show all optical steps.
The steps in black have already input the optical data, but the steps in blue have not yet input. Thus, please fill the checkbox which optical data should be input.



[Sample display-59] Optical Reference Value Input window

(16) Optical data input condition window appears. (Sample display-60)



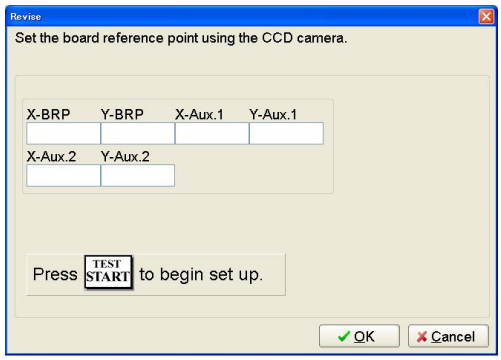
[Sample display-60] Optical data input condition window

HINT	Unless “Reset window size” checkbox displayed on Optical data input condition window was filled, Image processing area and Search are same as the ones used at your last operation. Be sure to fill the checkbox whenever the optical data is newly input.
	If “Clear Jumped (JP) setting” checkbox displayed on Optical data input condition window was filled, the measuring function in the optical step where has been preset to JUMP(JP) is initialized to “BLANK(**)”.

(17) Press [TEST START] SW on the operation panel.

(18) After a message “Use board ref. point and aux. ref. point for alignment?” appeared, click on [Yes] button then press [TEST START] SW on the operation panel.

(19) After a message “Set board reference point using the CCD camera” appeared, press [TEST START] SW on the operation panel.



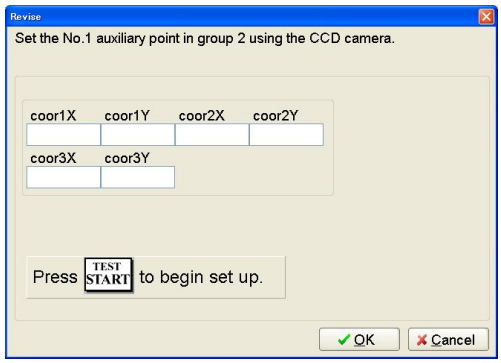
[Sample display-61] Board reference point set

(20) After “Camera Window” appeared on the display, center the Target marker on the Board reference point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(21) Center the Target marker on the Auxiliary reference point-1 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(22) Center the Target marker on the Auxiliary reference point-2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(23) It shows “Set the No.1 auxiliary point in group 2 using the CCD camera.”
Then press [TEST START] SW on the operation panel.



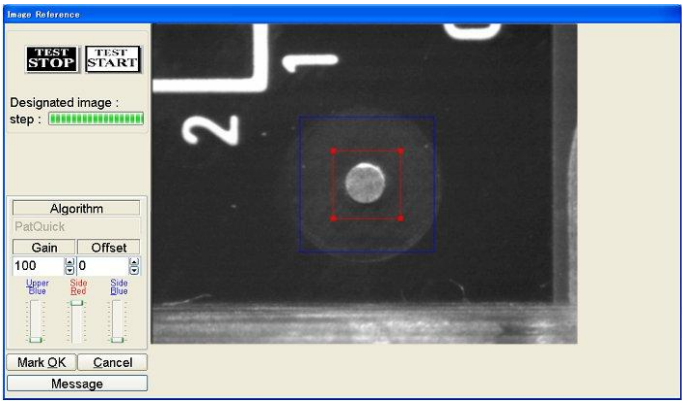
[Sample display-62] Auxiliary point set

(24) After “Camera Window” appeared on the display, center the Target marker on the auxiliary point-1 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(25) Center the Target marker on the auxiliary point-2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

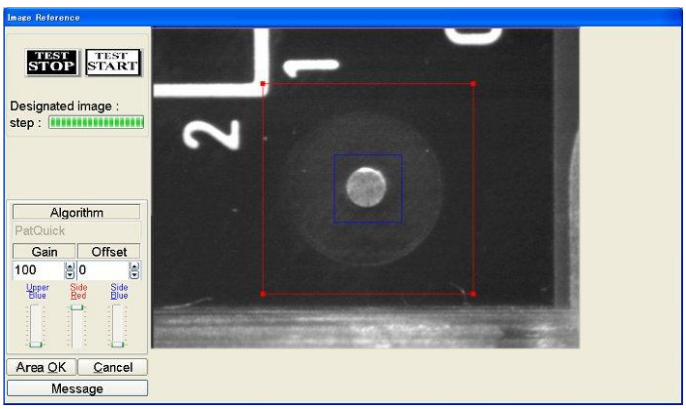
(26) Center the Target marker on the auxiliary point-3 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(27) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area. (Sample display-63)
Enclose the auxiliary point-1 with Image processing area shown by a red box, then click on “Mark OK” button.



[Sample display-63] Image processing area set

(28) The Image processing area box changes from red to blue, and Search area is shown by a red box.
Specify your Search area with the red box, and then click on “Area OK” button.



[Sample display-64] Search area set

(29) Enclose the auxiliary point-2 with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-63)

(30) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-64)
Specify your Search area with the red box, and then click on “Area OK” button.

(31) Enclose the auxiliary point-3 with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-63)

(32) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-64)
Specify your Search area with the red box, and then click on “Area OK” button.

(33) When “Image Reference” window was closed, your operation of inputting the image data from auxiliary point 1 to 3 is finished.

It revises step data using this parts name

Specifying “It revises step data using this parts name” function, the X,Y coordinates in all steps with assigned parts name are aligned automatically. If this assignment was made, “Parts-correct” is substituted in the Comment column.

Followings are your operating procedures to set up “It revises step data using this parts name” function.
(Ex.) X,Y coordinates of the step data which parts name is “IC5403” are aligned for possible incline & scale.

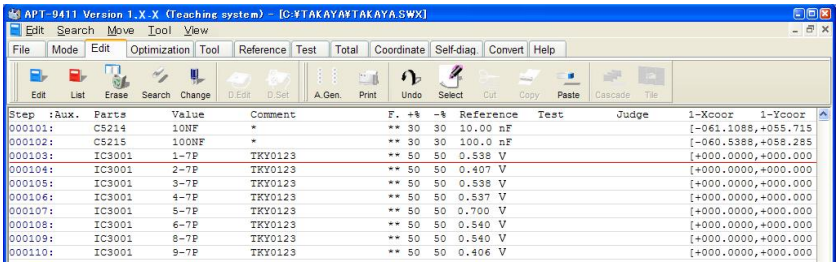
HINT	To align X,Y coordinates in some part of area against possible inclination and/or scale, it must use three fiducial marks. On the other hand, in case of the inclination only, it is enough to use two fiducial marks. (Above excludes both Board reference point and Auxiliary reference point(s))

(1) Open Step Edit menu (Edit > Step Edit) or Step List menu (Edit > Step List).

(2) It shows “Enter step number” on the dialog box.
Then specify the top step number to be aligned from the keyboard and click on [OK] button.

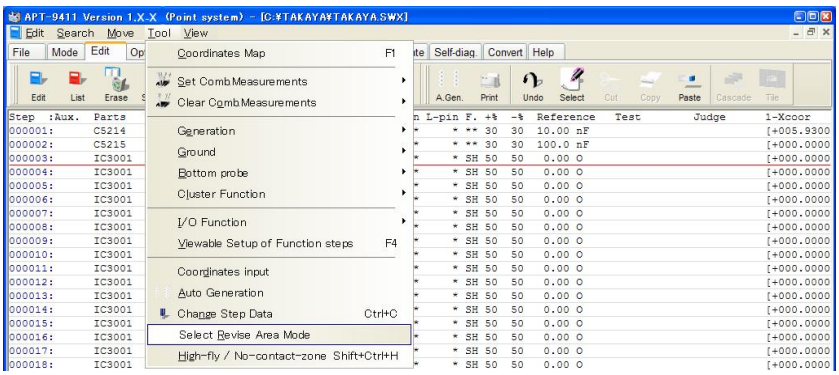
[Sample display-65] Step number input

(3) The step data list appears while showing the cursor on the specified step number.



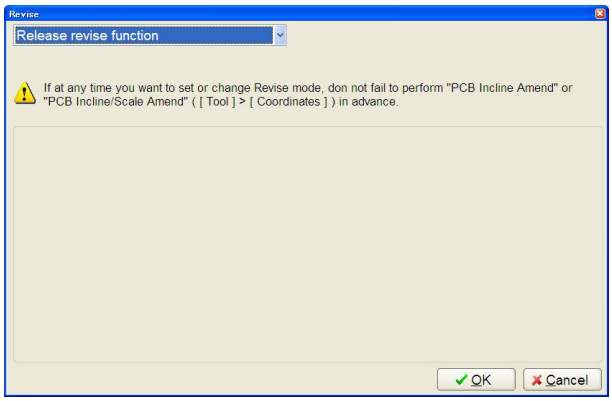
[Sample display-66] Step data list (Step No.103)

(4) Click on Tool to select Select Revise Area Mode.



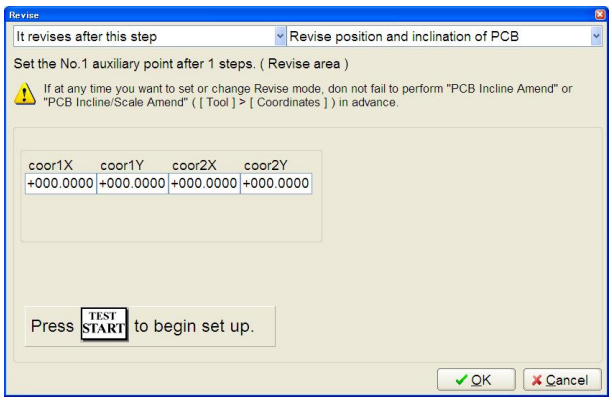
[Sample display-67] Select Revise Area Mode (Menu bar)

(5) It shows “Revision mode set” combobox. (Refer to Sample display-68)



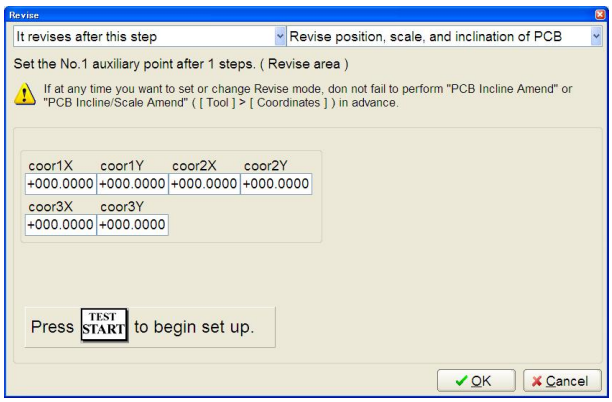
[Sample display-68] Revision mode set

(6) Select “It revises step data using this parts name” from Revision mode set combobox.



[Sample display-69] Revision area set

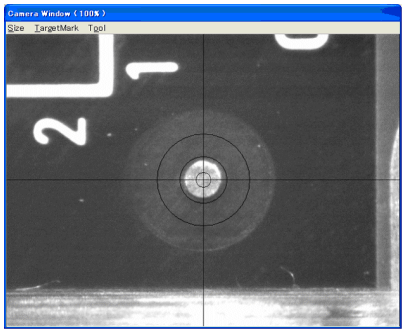
(7) Select “Revise position, scale, and inclination of PCB” from Revision area set combobox.



[Sample display-70]

(8) Press [TEST START] SW on the operation panel.

(9) After “Camera Window” appeared on the display, center the Target marker on the auxiliary point-1 for your assigned area using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.



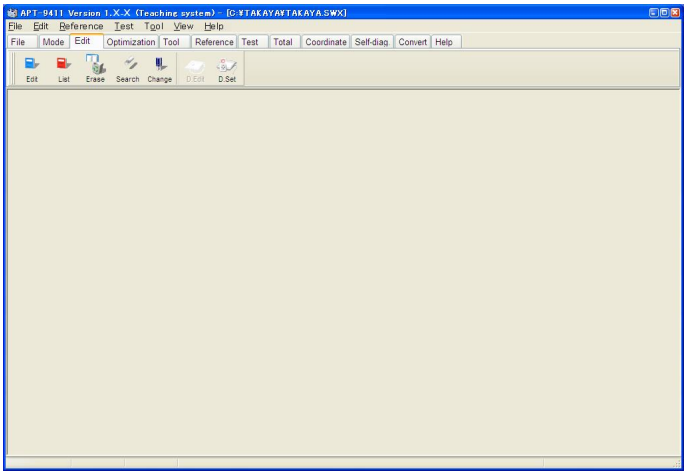
[Sample display-71] Camera Window

(10) Center the Target marker on the auxiliary point-2 for your assigned area using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates. (Sample display-71)

(11) Center the Target marker on the auxiliary point-3 for your assigned area using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates. (Sample display-71)

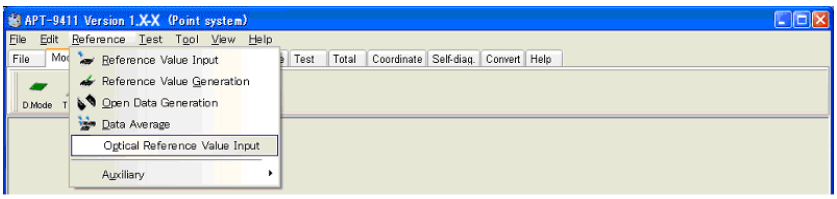
(12) After all auxiliary points were set, the menu returns back to the step data list, where “Parts-correct” is substituted in the Comment column.

(13) Press [Esc]key on the keyboard to close the step data list.



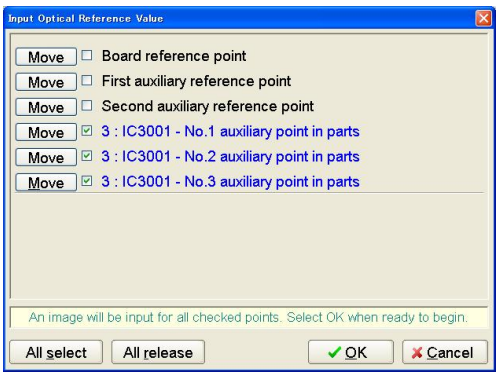
[Sample display-72] Main Window

(14) Open Optical Reference Value Input menu. (Reference > Optical Reference Value Input)



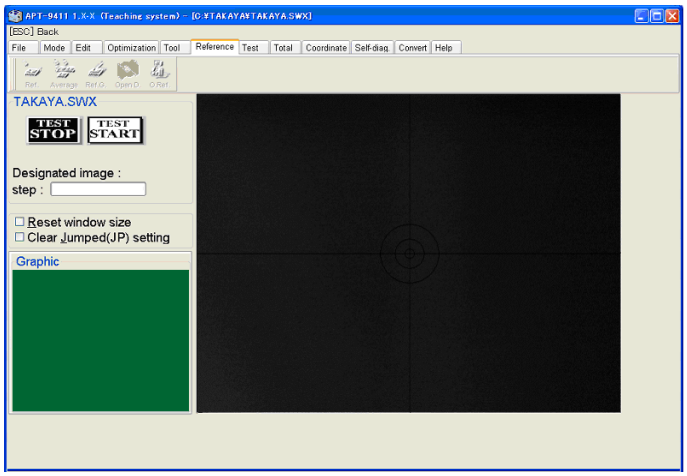
[Sample display-73] Menu bar (Optical Reference Value Input)

(15) Input Optical Reference Value window appears to show all optical steps.
The steps in black have already input the optical data, but the steps in blue have not yet input. Thus, please fill the checkbox which optical data should be input.



[Sample display-74] Optical Reference Value Input window

(16) Optical data input condition window appears. (Sample display-75)



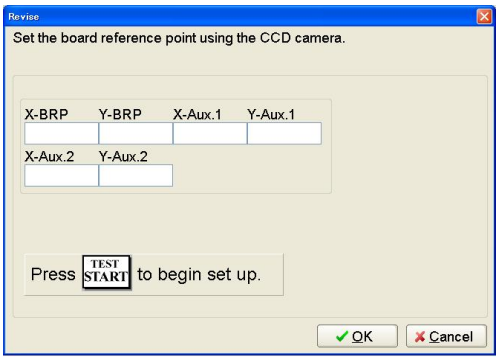
[Sample display-75] Optical data input condition window

HINT	Unless “Reset window size” checkbox displayed on Optical data input condition window was filled, Image processing area and Search are same as the ones used at your last operation. Be sure to fill the checkbox whenever the optical data is newly input.
	If “Clear Jumped (JP) setting” checkbox displayed on Optical data input condition window was filled, the measuring function in the optical step where has been preset to JUMP(JP) is initialized to “BLANK(**)”.

(17) Press [TEST START] SW on the operation panel.

(18) After a message “Use board ref. point and aux. ref. point for alignment?” appeared, click on [Yes] button then press [TEST START] SW on the operation panel.

(19) After a message “Set board reference point using the CCD camera” appeared, press [TEST START] SW on the operation panel.



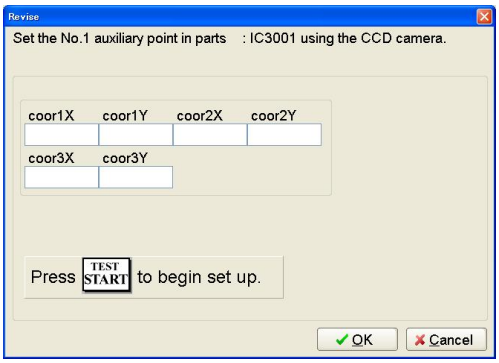
[Sample display-76] Board reference point set

(20) After “Camera Window” appeared on the display, center the Target marker on the Board reference point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(21) Center the Target marker on the Auxiliary reference point-1 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(22) Center the Target marker on the Auxiliary reference point-2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(23) It shows “Set the No.1 auxiliary point in parts 103: IC5403 using the CCD camera.” Then press [TEST START] SW on the operation panel.



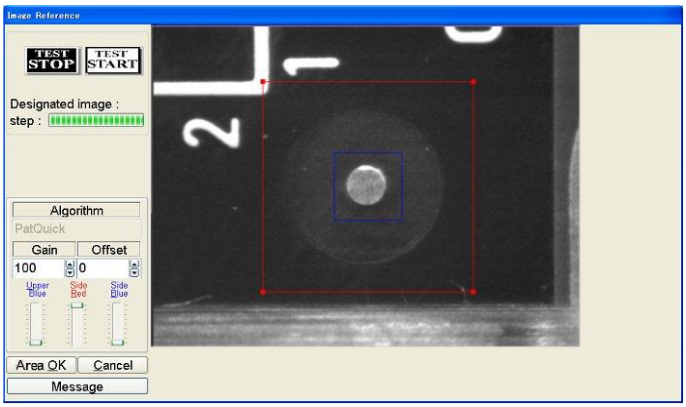
[Sample display-77] Auxiliary point set

(24) After “Camera Window” appeared on the display, center the Target marker on the auxiliary point-1 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(25) Center the Target marker on the auxiliary point-2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

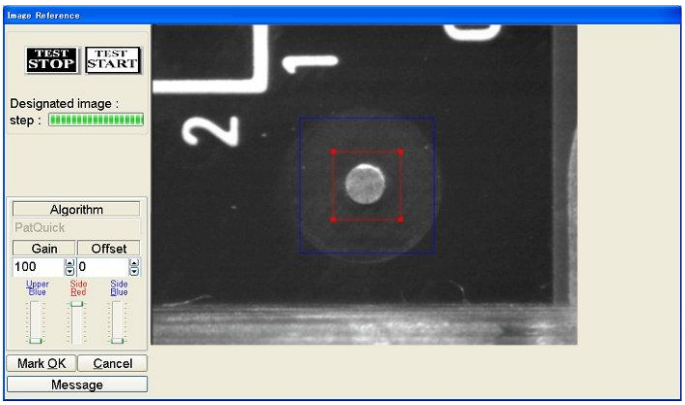
(26) Center the Target marker on the auxiliary point-3 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(27) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area. Enclose the auxiliary point-1 with Image processing area shown by a red box, then click on “Mark OK” button.



[Sample display-78] Image processing area set

(28) The Image processing area box changes from red to blue, and Search area is shown by a red box. Specify your Search area with the red box, and then click on “Area OK” button.



[Sample display-79] Search area set

(29) Enclose the auxiliary point-2 with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-78)

(30) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-79)
Specify your Search area with the red box, and then click on “Area OK” button.

(31) Enclose the auxiliary point-3 with Image processing area shown by a red box, then click on “Mark OK” button. (Sample display-78)

(32) The Image processing area box changes from red to blue, and Search area is shown by a red box. (Sample display-79)
Specify your Search area with the red box, and then click on “Area OK” button.

(33) When “Image Reference” window was closed, your operation of inputting the image data from auxiliary point1 to 3 is finished.

Simple Vision Test Function

Using Simple Vision Test Function available in Vision System TOS-5/TOS-4/TOS-41, you can detect such component failure as omission, mis-placement, and mis-orientation, which could not be checked electrically. Undermentioned is their general applications.

Polarity check of Electrolytic capacitors (TOS-5/TOS-4: Gray Search, TOS-41)

This is used for testing Electrolytic capacitors (orientation, presence, position), and their test step are discriminable by “E.Capa.-Image.” in Comment column and also “IM-E.” in Aux. column.

Polarity check of Tantalum capacitors (TOS-5/TOS-4: Gray Search, TOS-41)

This is used for testing Tantalum capacitors (orientation, presence, position), and their test step are discriminable by “T.Capa.-Image.” in Comment column and also “IM-T.” in Aux. column.

Polarity check of Connectors (TOS-5/TOS-4: Gray Search, TOS-41)

This is used for testing Connectors (presence, position), and their test step are discriminable by “Connec.-Image.” in Comment column and also “IM-Co.” in Aux. column.

Letter recognition check (TOS-5/TOS-4: Gray Search, TOS-41)

This is used for testing printed letter on the devices, and their test step are discriminable by “Charac.-Image.” in Comment column and also “IM-Ch” in Aux. column.

Presence check (TOS-5, TOS-4, TOS-41)

This is used for some other components, like Resistance (SMT), Capacitance (SMT) so on. Their test steps are discriminable by “Parts-Image.” in Comment column and also “IM-Pa” in Aux. column.

Polarity check (TOS-5/TOS-4: PatQuick Algorithm only)

This is used for testing Electrolytic capacitors (orientation, presence, position) and Tantalum capacitors (orientation, presence, position). Their test steps are discriminable by “Pol.-image” in Comment column and also “IM-Po” in Aux. column.

DATA PROGRAMMING PROCESS

1. Polarity check of Tantalum capacitors

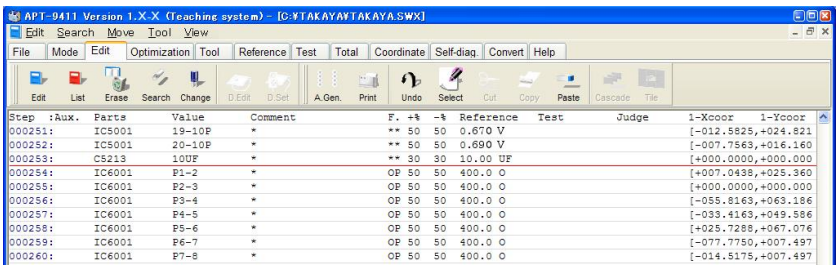
(Ex.) C5213 (10uF) at 518step

(1) Open Step Edit menu (Edit > Step Edit) or Step List menu (Edit > Step List).

(2) It shows “Enter step number” on the dialog box.
Then input “518” from the keyboard and click on [OK] button.

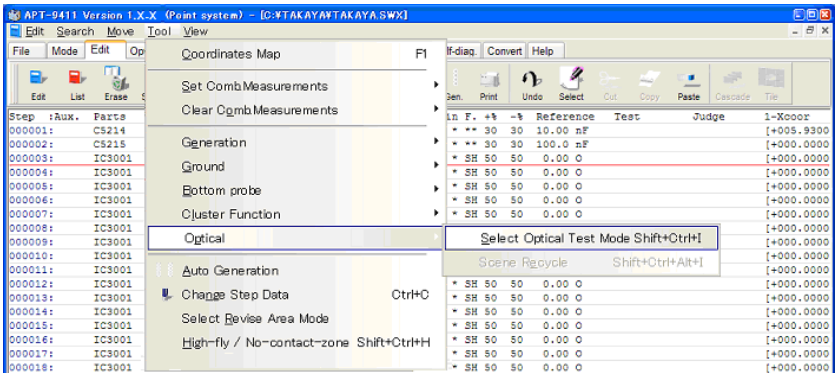
[Sample display-80] Step number input

(3) The step data list appears while showing the cursor on the specified step number.



[Sample display-81] Step data list (Step No.518)

(4) Open Select Optical Test Mode menu. (Tool > Optical > Select Optical Test Mode)

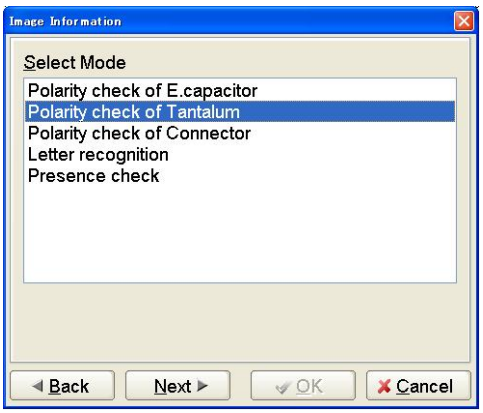


[Sample display-82] (Tool > Optical > Select Optical Test Mode)

(5) After a message “Use board ref. point and aux. ref. point for alignment?” appeared, click on [Yes] button then press [TEST START] SW on the operation panel.

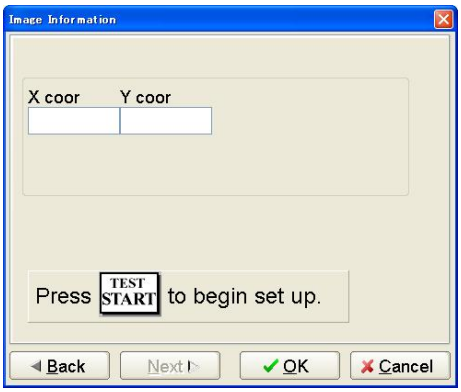
(6) The camera moves to the Board reference point, then to the Auxiliary reference point(s) to align inclination and/or scale of the board automatically.

(7) It shows “Select Mode” menu.
After selected “Polarity check of Tantalum”, click on [Next] button.



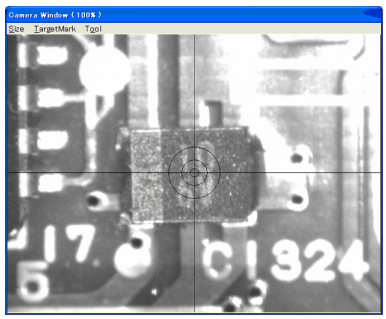
[Sample display-83] Select Mode menu

(8) It shows Sample display-84 below.
Press [TEST START] SW on the operation panel.



[Sample display-84]

(9) After “Camera Window” appeared on the display, center the Target marker on the objective device (C5213) using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

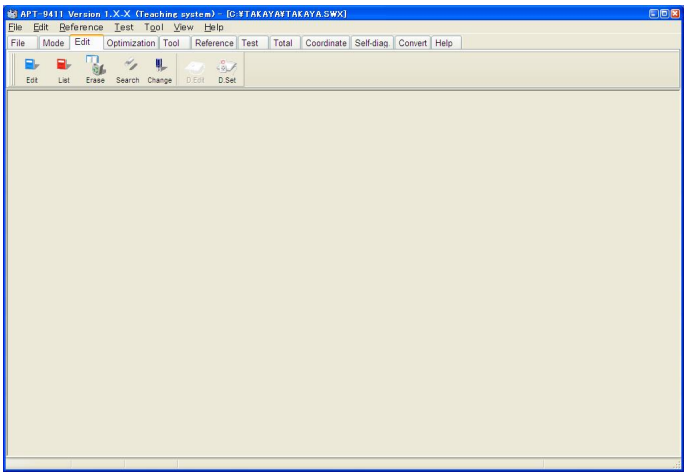


[Sample display-85] Camera Window

(10) Camera Window is closed and it shows Sample display-84 again.
Click on [OK] button to fix your assignment in “Select Mode” menu.

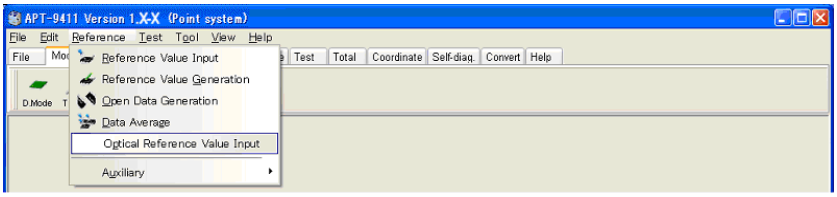
(11) The menu returns back to the step data list. On your assigned test step (518 step), you see “T.Capa.-Image.” is already substituted in Comment column and also “IM-T.” in Aux. column.

(12) Press [Esc] key on the keyboard to close the step data list. (Sample display-86)



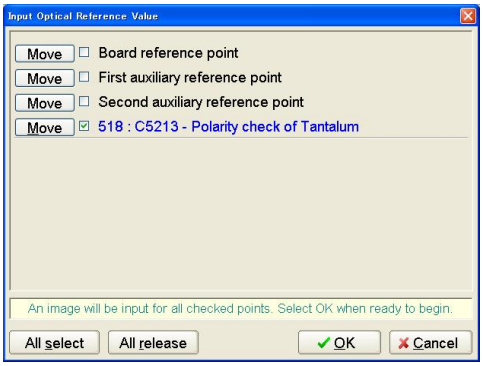
[Sample display-86] Main Window

(13) Open Optical Reference Value Input menu. (Reference > Optical Reference Value Input)



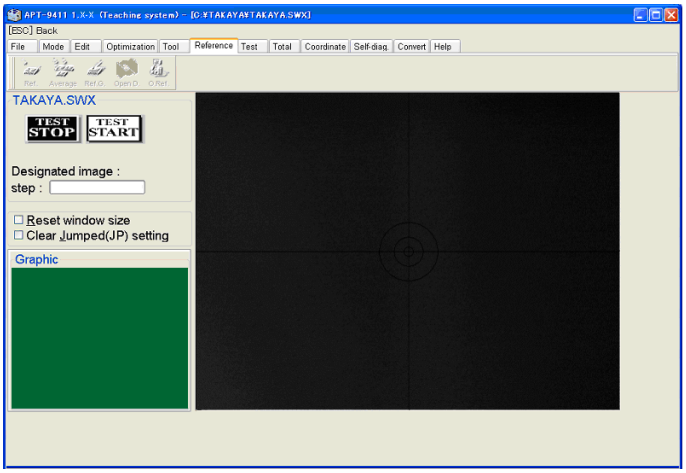
[Sample display-87] Menu bar (Optical Reference Value Input)

(14) Input Optical Reference Value window appears to show all optical steps.
The steps in black have already input the optical data, but the steps in blue have not yet input. Thus, please fill the checkbox which optical data should be input.



[Sample display-88] Optical Reference Value Input window

(15) Optical data input condition window appears. (Sample display-89)



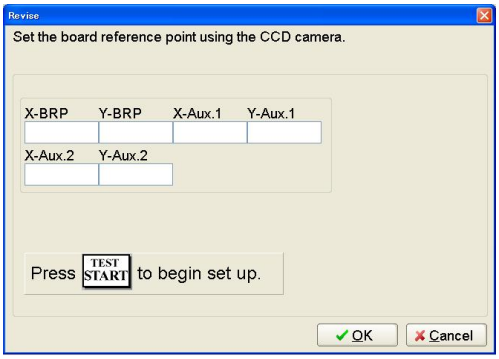
[Sample display-89] Optical data input condition window

HINT	Unless “Reset window size” checkbox displayed on Optical data input condition window was filled, Image processing area and Search are same as the ones used at your last operation. Be sure to fill the checkbox whenever the optical data is newly input.
	If “Clear Jumped (JP) setting” checkbox displayed on Optical data input condition window was filled, the measuring function in the optical step where has been preset to JUMP(JP) is initialized to “BLANK(**)”.

(16) Press [TEST START] SW on the operation panel.

(17) After a message “Use board ref. point and aux. ref. point for alignment?” appeared, click on [Yes] button then press [TEST START] SW on the operation panel.

(18) After a message “Set board reference point using the CCD camera” appeared, press [TEST START] SW on the operation panel.



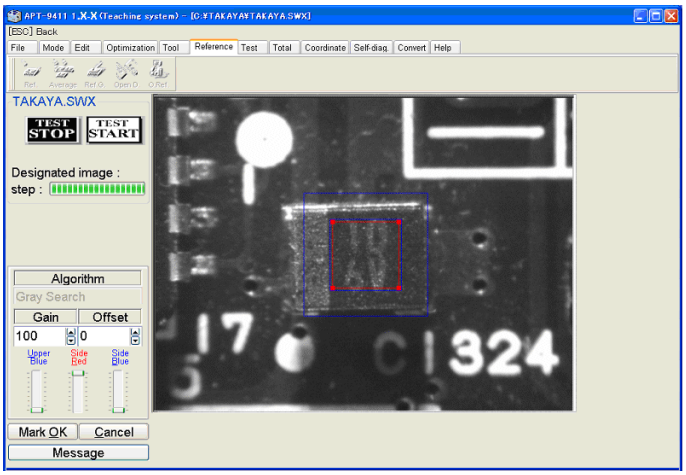
[Sample display-90] Board reference point set

(19) After “Camera Window” appeared on the display, center the Target marker on the Board reference point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(20) Center the Target marker on the Auxiliary reference point-1 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

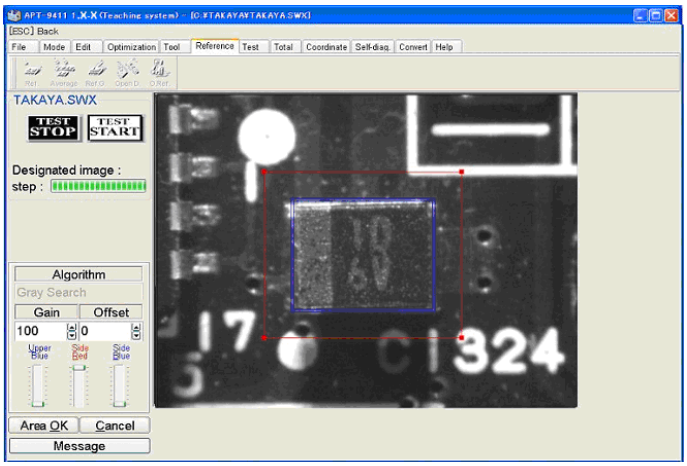
(21) Center the Target marker on the Auxiliary reference point-2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(22) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area.
Enclose the objective device (C5213) with Image processing area shown by a red box, then click on “Mark OK” button.



[Sample display-91] Image processing area set

(23) The Image processing area box changes from red to blue, and Search area is shown by a red box. Specify your Search area with the red box, and then click on “Area OK” button.



[Sample display-92] Search area set

(24) When “Image Reference” window was closed, your operation of inputting the image data for the C5213 is finished.

2. Presence check

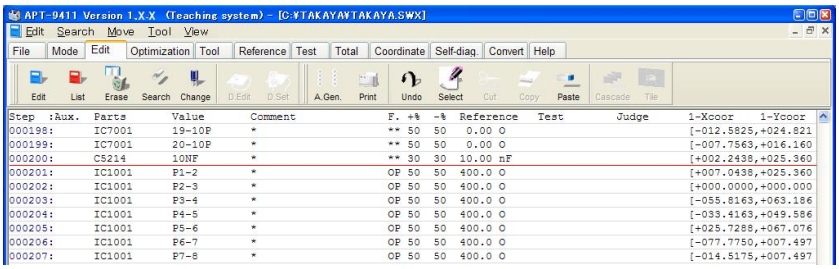
(Ex.) C5214 (0.01uF) at 289 step

(1) Open Step Edit menu (Edit > Step Edit) or Step List menu (Edit > Step List).

(2) It shows “Enter step number” on the dialog box.
Then input “289” from the keyboard and click on [OK] button.

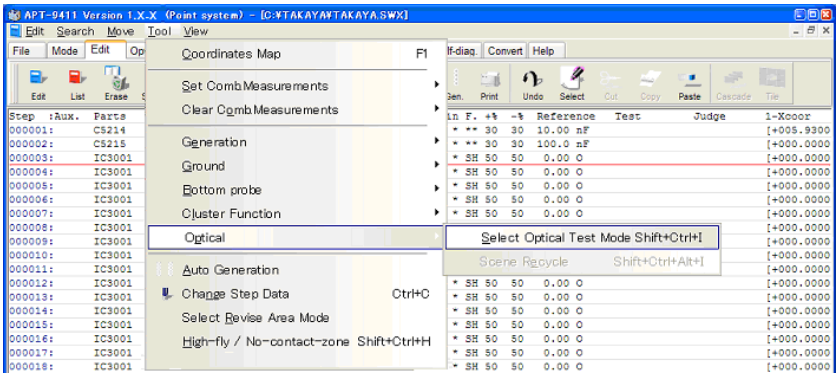
[Sample display-93] Step number input

(3) The step data list appears while showing the cursor on the specified step number.



[Sample display-94] Step data list (Step No.289)

(4) Open Select Optical Test Mode menu. (Tool > Optical > Select Optical Test Mode)

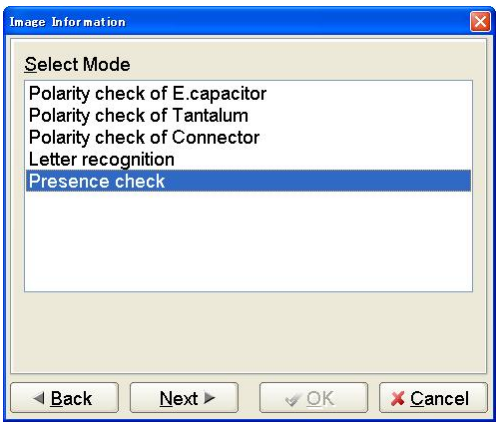


[Sample display-95] (Tool > Optical > Select Optical Test Mode)

(5) After a message “Use board ref. point and aux. ref. point for alignment?” appeared, click on [Yes] button then press [TEST START] SW on the operation panel.

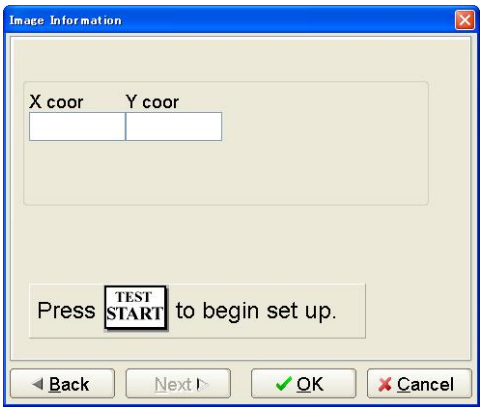
(6) The camera moves to the Board reference point, then to the Auxiliary reference point(s) to align inclination and/or scale of the board automatically.

(7) It shows “Select Mode” menu.
After selected “Presence check”, click on [Next] button.



[Sample display-96] Select Mode menu

(8) It shows Sample display-97 below.
Press [TEST START] SW on the operation panel.



[Sample display-97]

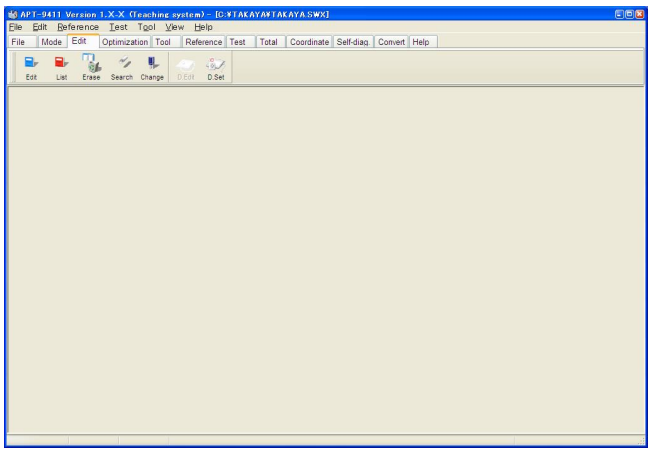
(9) After “Camera Window” appeared on the display, center the Target marker on the objective device (C5214) using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

[Sample display-98] Camera Window

(10) Camera Window is closed and it shows Sample display-97 again.
Click on [OK] button to fix your assignment in “Select Mode” menu .

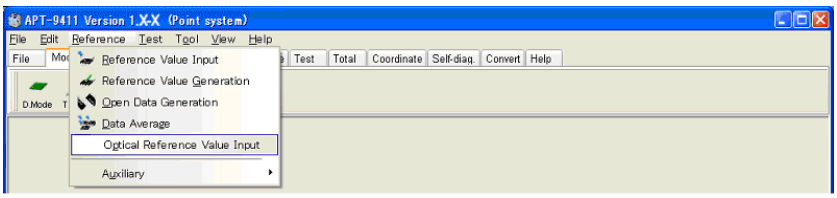
(11) The menu returns back to the step data list. On your assigned test step (518 step), you see “Parts-Image.” is already substituted in Comment column and also “IM-Pa” in Aux. column.

(12) Press [Esc]key on the keyboard to close the step data list. (Sample display-99)



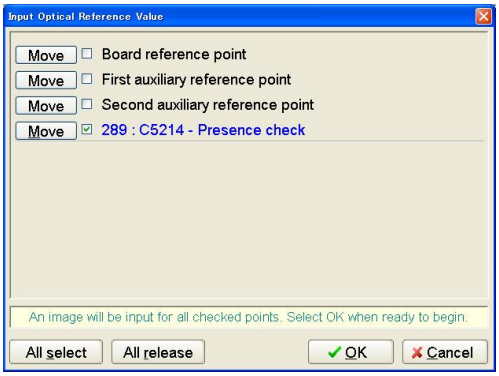
[Sample display-99] Main Window

(13) Open Optical Reference Value Input menu. (Reference > Optical Reference Value Input)



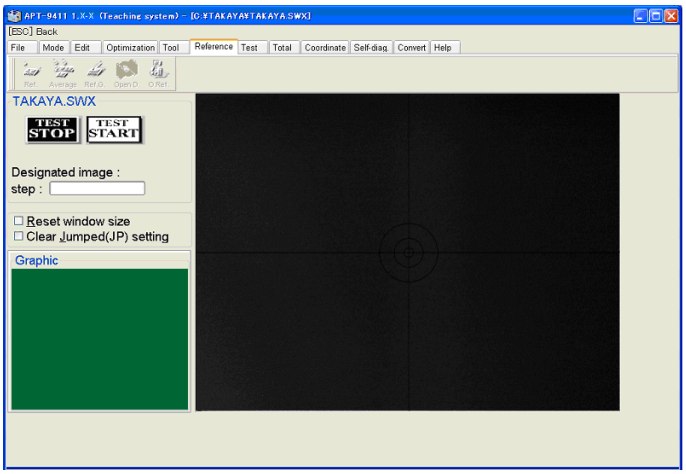
[Sample display-100] Menu bar (Optical Reference Value Input)

(14) Input Optical Reference Value window appears to show all optical steps.
The steps in black have already input the optical data, but the steps in blue have not yet input. Thus, please fill the checkbox which optical data should be input.



[Sample display-101] Optical Reference Value Input window

(15) Optical data input condition window appears. (Sample display-102)



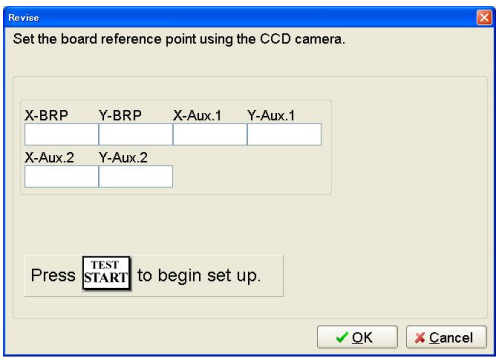
[Sample display-102] Optical data input condition window

HINT	Unless “Reset window size” checkbox displayed on Optical data input condition window was filled, Image processing area and Search are same as the ones used at your last operation. Be sure to fill the checkbox whenever the optical data is newly input.
	If “Clear Jumped (JP) setting” checkbox displayed on Optical data input condition window was filled, the measuring function in the optical step where has been preset to JUMP(JP) is initialized to “BLANK(**)”.

(16) Press [TEST START] SW on the operation panel.

(17) After a message “Use board ref. point and aux. ref. point for alignment?” appeared, click on [Yes] button then press [TEST START] SW on the operation panel.

(18) After a message “Set board reference point using the CCD camera” appeared, press [TEST START] SW on the operation panel.



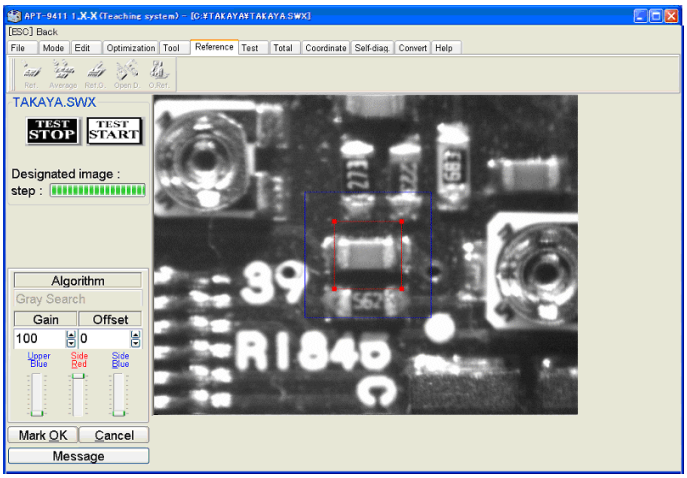
[Sample display-103] Board reference point set

(19) After “Camera Window” appeared on the display, center the Target marker on the Board reference point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(20) Center the Target marker on the Auxiliary reference point-1 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

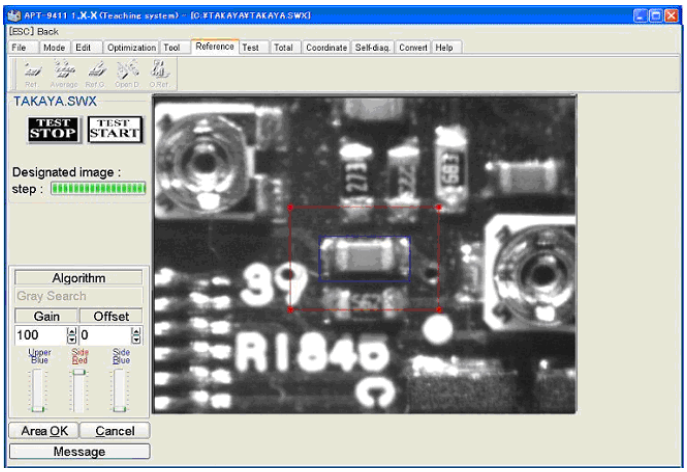
(21) Center the Target marker on the Auxiliary reference point-2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

(22) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area.
Enclose the objective device (C5214) with Image processing area shown by a red box, then click on “Mark OK” button.



[Sample display-104] Image processing area set

(23) The Image processing area box changes from red to blue, and Search area is shown by a red box. Specify your Search area with the red box, and then click on “Area OK” button.



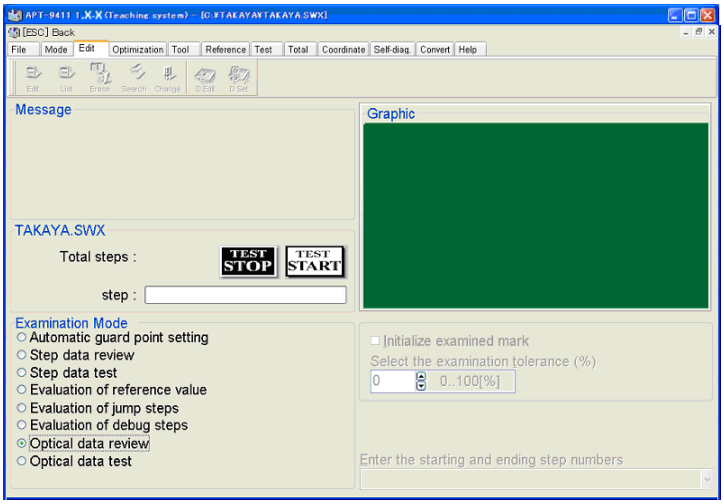
[Sample display-105] Search area set

(24) When “Image Reference” window was closed, your operation of inputting the image data for C5214 is finished.

Optical data review / Optical data test

Using Optical data review or Optical data test, you can evaluate and/or change the measuring conditions so on in your image data.

These two menu are selectable from Sample display-106 below (Test > Review Step data).
Optical data review menu is used for evaluating and/or changing the measuring conditions.
Optical data test menu is used for assuring of the stability of the optical test.

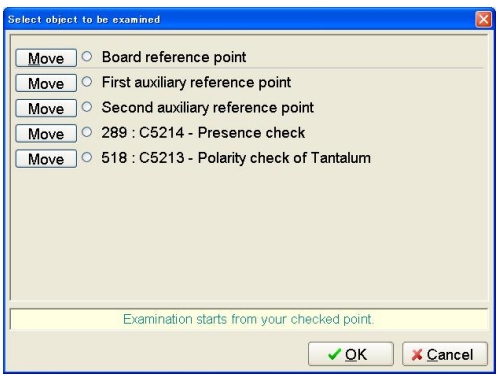


[Sample display-106] Data Examination menu (Main display)

Optical data review

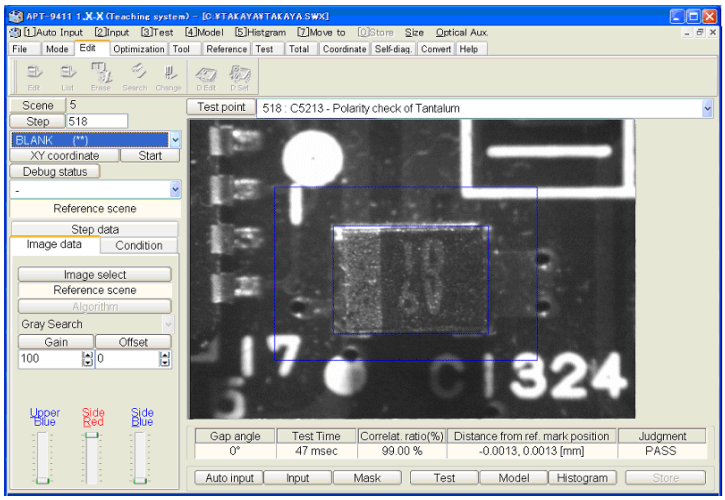
Selecting “Optical data review” from Sample display-106 then pressing [TEST START] SW on the operation panel, a message “Use board ref. point and aux. ref. point for alignment?” appears.

Then click on [Yes] button and align possible inclination/scale of the board using [TEST START] SW and the keypad arrow keys on the operation panel, so that [Sample display-107] appears.



[Sample display-107] Optical Reference Value Input window

After selected the objective image point from Sample display-107, click on [OK] button then press [TEST START] SW on the operation panel.

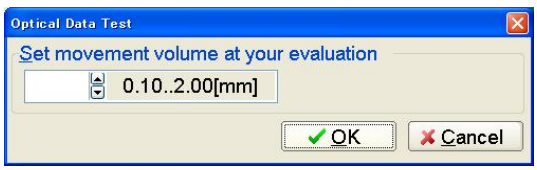


[Sample display-108] Optical data review menu

Optical data test

Selecting “Optical data test” from Sample display-106 then pressing [TEST START] SW on the operation panel, a message “Use board ref. point and aux. ref. point for alignment?” appears.

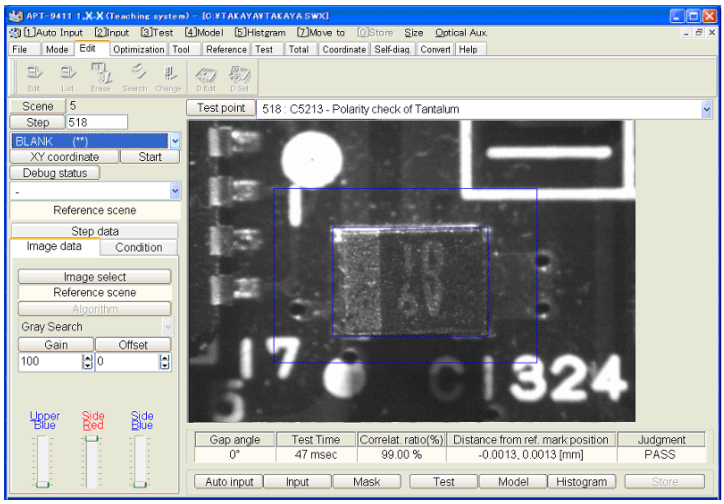
Then click on [Yes] button and align possible inclination/scale of the board using [TEST START] SW and the keypad arrow keys on the operation panel, so that Sample display-109 appears.



[Sample display-109] Camera movement volume set

While evaluating Coordinates alignment points (Board reference point and Auxiliary reference point), in fact the CCD camera can move toward each four directions (right-top, right-bottom, left-bottom, left-top) with the distance specified in [Sample display-109] as if the board under test shifted its position.
As for Polarity check and Presence check, the objective device is tested to evaluate the measuring stability.

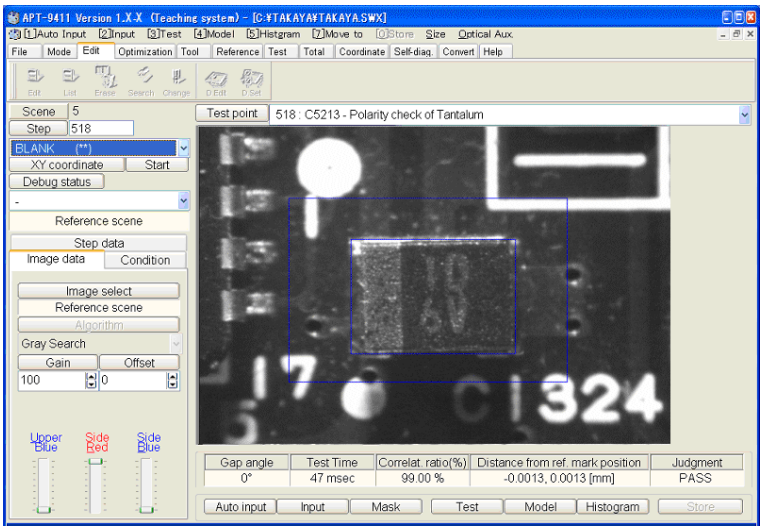
When some optical data was judged inadequate under Optical data test, Sample display-110 appears to ask your correction.



[Sample display-110] Optical data test menu

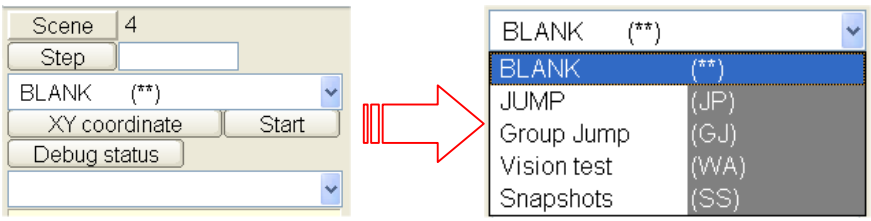
Optical data review

Optical data review menu (Sample display-111) allows you to learn the optical data again, check the measuring stability and also change the measuring conditions.



[Sample display-111] Optical date review menu

The combobox on the upside of Sample display-111 screen shows Step number, Parts name and the testing category of the optical data under evaluation. From this combobox, you can select another optical data step to be jumped, if necessary.
Scene number and Step number so on are also displayed at the left-top side of the same screen.



[Sample display-112]

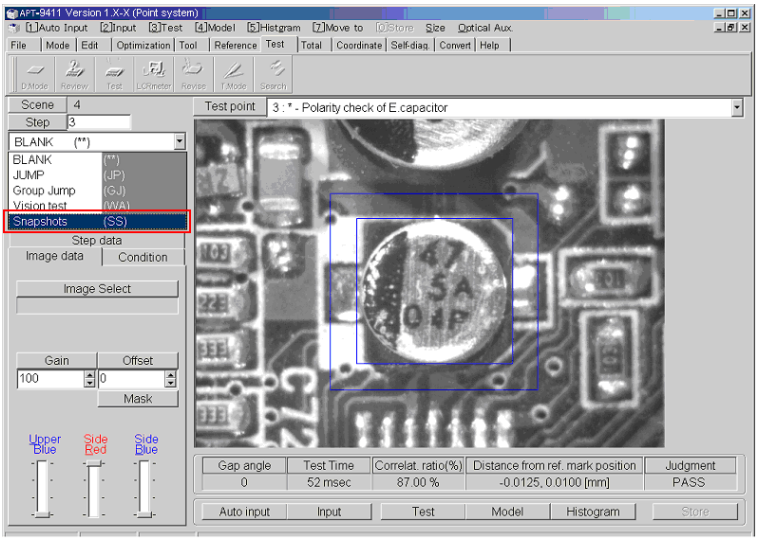
Scene	:	Scene number of optical data under evaluation (not changeable)
Step	:	Step number of optical data under evaluation In case of the Board reference point or the Auxiliary reference points, the step number is not displayed. After specified any step number and hit [Enter] key, the menu jumps to Optical data review at the specified step.
XY Coordinate	:	The center coordinates of the objective device is changeable using the keypad arrow keys.
Start	:	Clicking on [Start] button, the tester continues Optical data test.
Debug status	:	It shows Debug category in the combobox. (Refer to the User's manual)
JUMP (JP)	:	Test parameter configuring the Optical test to be skipped (no test).
Group Jump (GJ)	:	Test parameter configuring all steps following the Optical step to be skipped (no test) when the test judged fail. The test starts from the beginning of next group.
Vision test (WA)	:	Test parameter configuring to Visual check step ("WA" step). The operator can judge the step whether Pass or Fail visibly by comparing to a sample reference image.
Snapshots (SS)	:	Test parameter configuring to the step where the APT system takes a picture after the camera moves over the position and save it as a file, instead of the image test.

Snap Shot Function

When the optical step is setup for SS (=Snap Shot), the APT system takes a picture after the camera moves over the position and save it as a file, instead of the image test.

Step	:Aux.	Parts	Value	Comment	F.
000001:	IM-E.	*	*	E.Capa.-Image.	SS
000002:	IM-E.	*	*	E.Capa.-Image.	SS
000003:	IM-E.	*	*	E.Capa.-Image.	SS
000004:	IM-E.	*	*	E.Capa.-Image.	SS

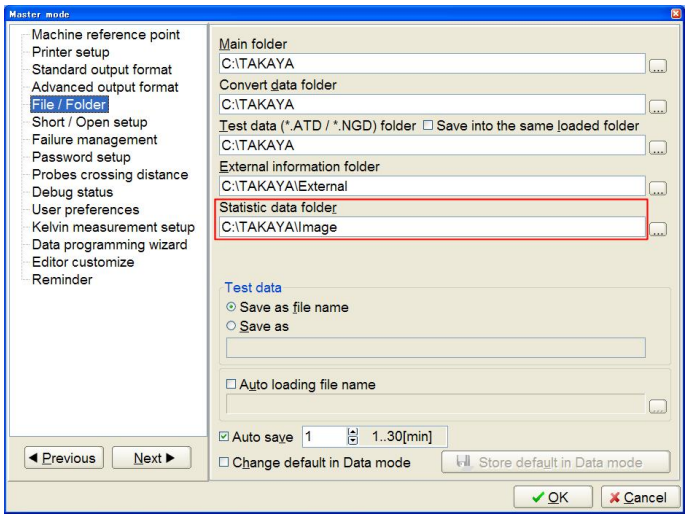
[Sample display-112_1] Optical steps



[Sample display-112_2] Optical Data Review menu

(Remarks)

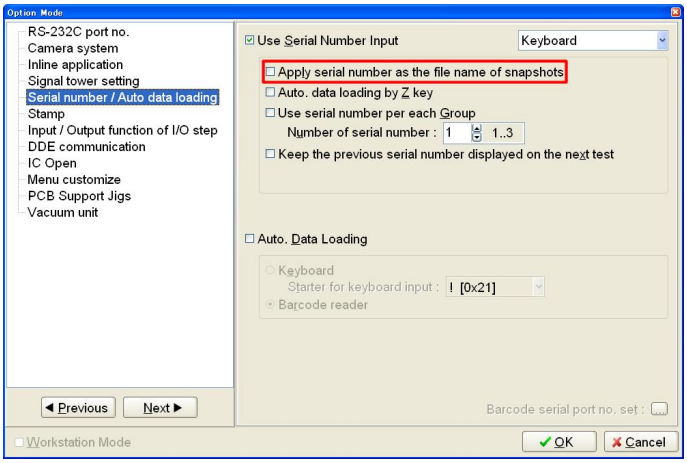
1. The registration destination folder is configured by “Image data folder” on File/Folder menu (Master Mode) and the program name.
   For example, when Image data folder is set for C:¥TAKAYA¥Image (default) and Program name is 123456789.SW92, the registration destination folder is C:¥TAKAYA¥Image¥123456789.



[Sample display-112_3] File / Folder (Master Mode)

2. When Serial Number Input function is used, the file name is equal to the Serial number if the check box for “Apply serial number as the file name of snapshots” on Serial Number/Auto data loading menu (Option mode) is filled.
   For example, when Serial number is ABCDEF and step number is 1, the file name is [ABCDEF]_000001.

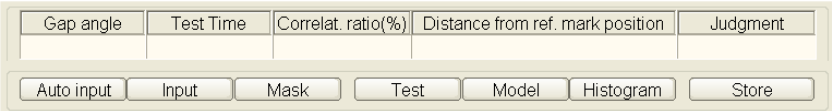
   If the check box for “Apply serial number as the file name of snapshots” is cleared, the file name is “Date + Time + Step number”.
   For example, now is December 13, 2005 PM13:18 and step number is 1, the file name is 0512131318.



[Sample display-112_4] Serial Number/Auto data loading (Option Mode)

Explanation of menu button

Menu button (Sample display-113) which is on the downside of the optical data review menu is used to display the evaluation result, reinput the objective image data, and so on.



[Sample display-113] Menu button (Optical data review menu)

Gap angle

This shows how much the object under evaluation is slant against the reference image.

Test Time

This shows the time how long it takes to disposal the object under evaluation.

Correlat. Ratio (%)

This shows how much the object under evaluation correlates to the reference image.

Distance from ref. mark position

This shows how far the object under evaluation is from the reference image.

Judgment

This shows the judgment result made under Simple vision test.

PASS : The test passed.
Agre-ER : The correlation rate was lower than the threshold.
Angl-ER : The object under test is slant.
M.OFFS : The object under test is not positioned well.
INV-NG : The object under test highly correlates to the reference image with opposite polarity.

Auto input

The existing reference data (Reference image, Measuring condition) under evaluation is once initialized, then a new reference data is input again. To do this, it is necessary to specify the Image processing area and the Search area again.

Input

Reference data is input again without initializing the Image processing area and the Search area and Measuring condition.

Mask

This exempts any specified region of the reference image from Pass/Fail judgment. For example, when some characters drawn on the device are always different depending on the production lot and causes misjudgment under test, so on.

	If you would set mask size too large, this causes possibly misjudgment.

Test

It tests the measuring stability of the optical data.
Its result is displayed on each combobox of “Gap angle”, “Test time”, “Correlat. Ratio”, "distance FROM ref. mark position” and “Judgment”.

Model

Reference image is displayed on the screen.

Histogram

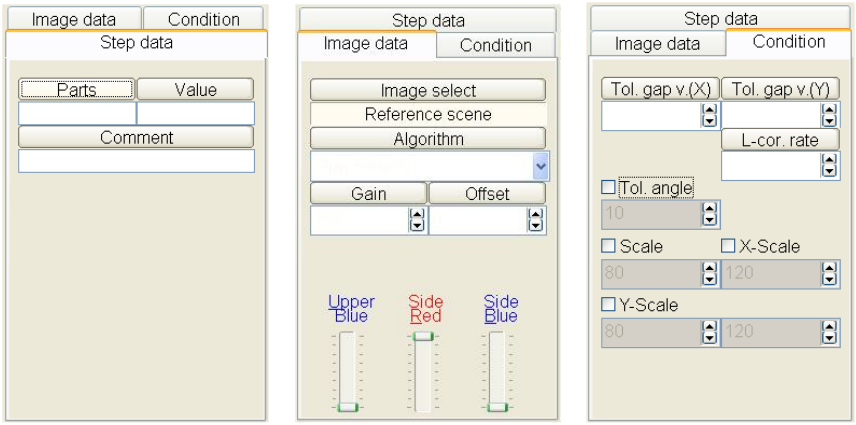
The comparison is made to the histogram value (parameter) of both the object under test and the reference image. With the histogram the gray value ratio is displayed by a graph.

Store

All changes (ex. new reference image, measuring conditions, so on) at Optical data review menu can be saved into the disk.

Auxiliary Menu Tab

There are three Menu tabs (“Step Data”, “Image Data” and "Condition”) at the lefthand of Optical data review menu.



[Sample display-114] Auxiliary Menu Tab

Step Data

“Parts”, “Value” and “Comment” from the test step is displayed and changeable.
To save your change into the disk, be sure to click on [Save] button.

Image Data

“Image Select”, “Camera Gain”, “Offset”, “Mask” and “LED lights” used for the object under evaluation redisplayed and changeable.

Image Select combobox enables to save maximum 9 auxiliary scenes. These auxiliary scenes are used together with the reference image under test. In case that the measured object image could agree with the reference image otherwise any of these auxiliary scenes, it judges PASS. Usually these auxiliary scenes are used for Porality check, which device condition changes inconsistently board by board.

To add any auxiliary scene, click on Image Select bar then click on [Add] button. And if double-clicking on the auxiliary scene name added on the list, the optical data can be input.
To erase any auxiliary scene, click on [Delete] button on the downside of the auxiliary scene list.

HINT	The auxiliary scene is erasable in order of bigger scene number.

Condition

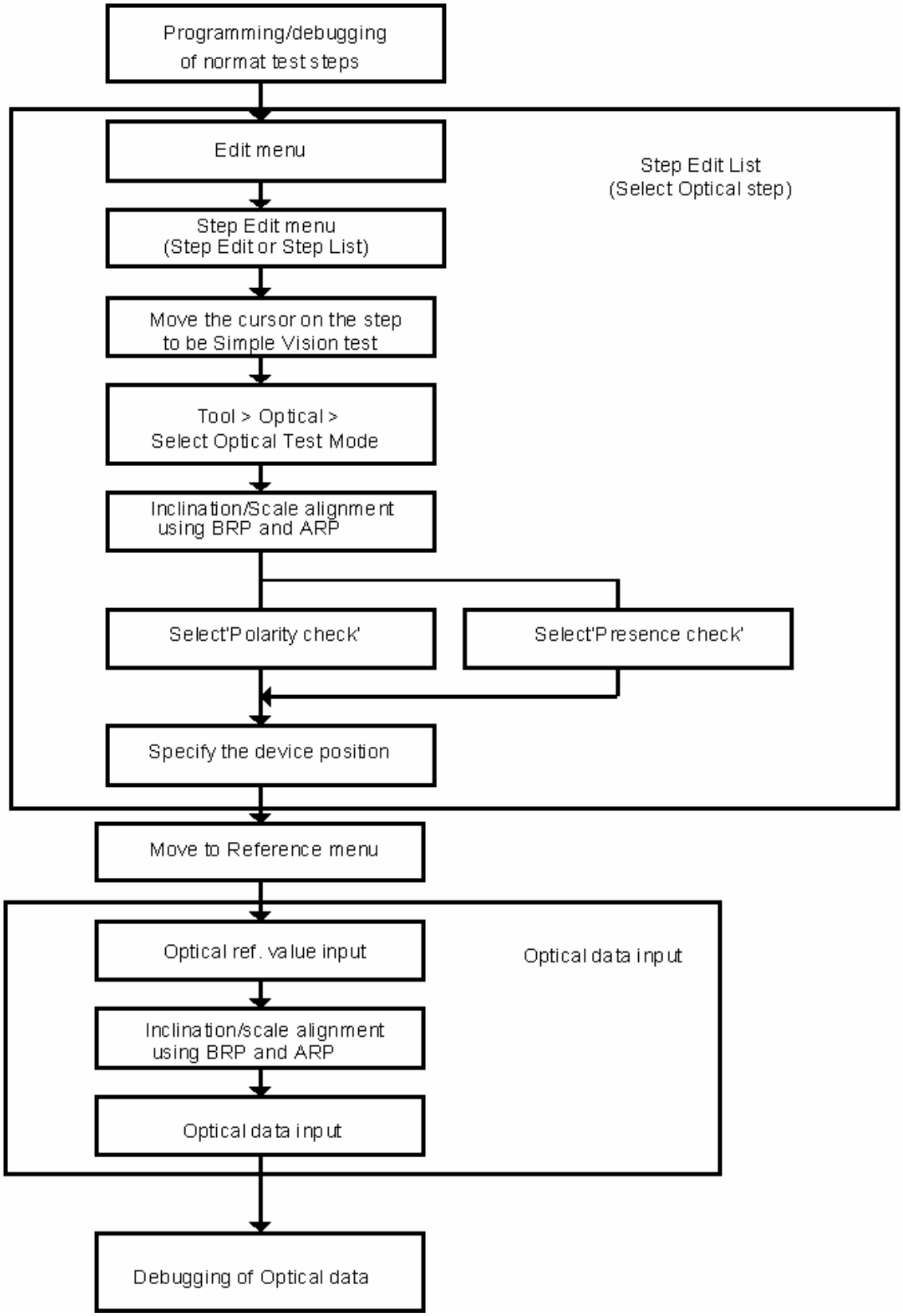
Condition of pass/fail judgment is displayed and changeable.

“Tol. Gap V.(X)” and “Tol. Gap V.(Y)” enable to set the tolerance of the device position. (unit : mm)
If “Tol. Angle” checkbox was filled, you can specify the tolerance of slant angle of the object under test. (unit : degree)
“L-cor.rate” enables to set the tolerance for PASS/FAIL judgment based on the reference image. (unit :%) “Scale”, “X-Scale” and “Y-Scale” enables to set the tolerance of measured object size. (unit : %)

!	As for the tester equipped with the TOS-41 system, you cannot change any of “Tol. Angle”, “Scale”, “X-Scale” and “Y-Scale”.

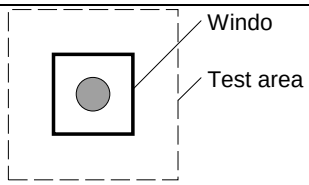
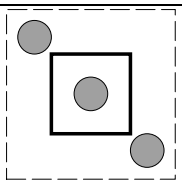
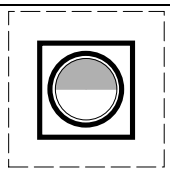
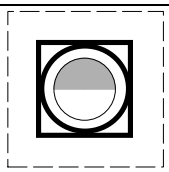
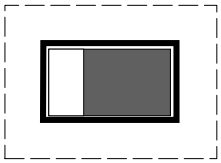
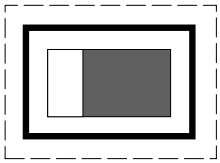
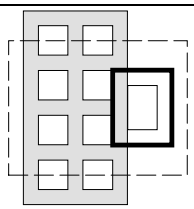
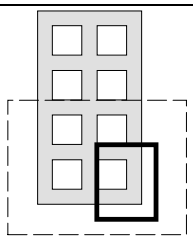
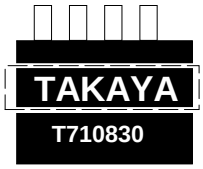
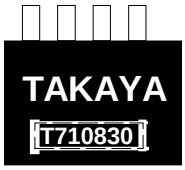
Simple Vision Test Programming flow

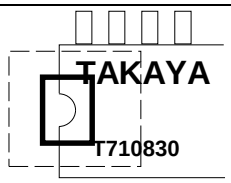
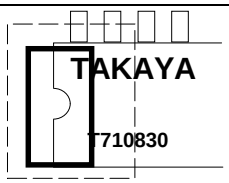
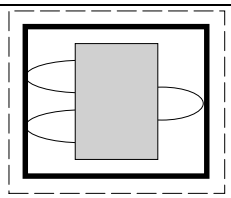
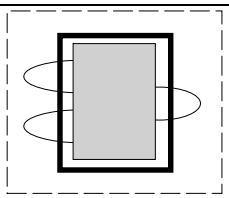
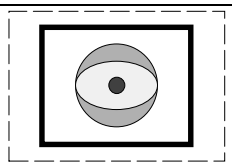
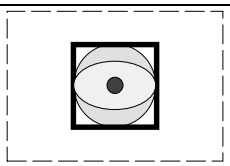
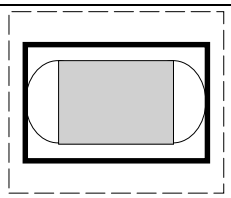
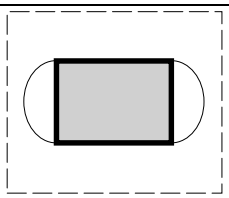
Undermentioned is test data programming flow for Simple vision test.



Sample Setting Optical Data

In this section we describe the basic programming know-how, introducing how to step the window frame and area.

Object (Test mode)	Good sample	Bad sample	Remarks
Fiducial marks	 Fiducial mark (no solder) is best to use.	 Similar marks locate near around.	Any mark with varied shape is not proper. (i.e. solder land)
Electrolytic capacitors (Polarity check)	 Tightly enclosed by the window.	 Much opening between the object and the window.	Tall component may not be tested. The judgment owe to a black bar of polarity.
Tantalum capacitors (Polarity check)	 Tightly enclosed by the window.	 Much opening between the object and the window.	The judgment owe to the difference color on the surface.
Connectors (Polarity check)	 Unti-contrast point (top - bottom, left – right is enclosed)	 Contrast point is enclosed	When misplaced or mis-oriented, it shows incompatibility error.
ICs (Letter recognition)	 Stable point is enclosed.	 Varied point is enclosed.	Any letter is not recognized actually.

Object (Test mode)	Good sample	Bad sample	Remarks
ICs (Polarity, Presence)	 Oriented point only is enclosed	 Mis-orientation sometimes may not detected.	
Chip transistor (Presence check)	 All area including leads is enclosed.	 Only package unit is enclosed.	Reference value should be learned from some known good PC boards. <M. MODE> Gray search
Test pin / Test point (Presence check)	 Whole test pin including possible moving area is enclosed.	 Test pin only is enclosed.	
Others (Presence check)	 Whole device is enclosed together with the soldering part.	 Only device package is enclosed, not the pc board part	

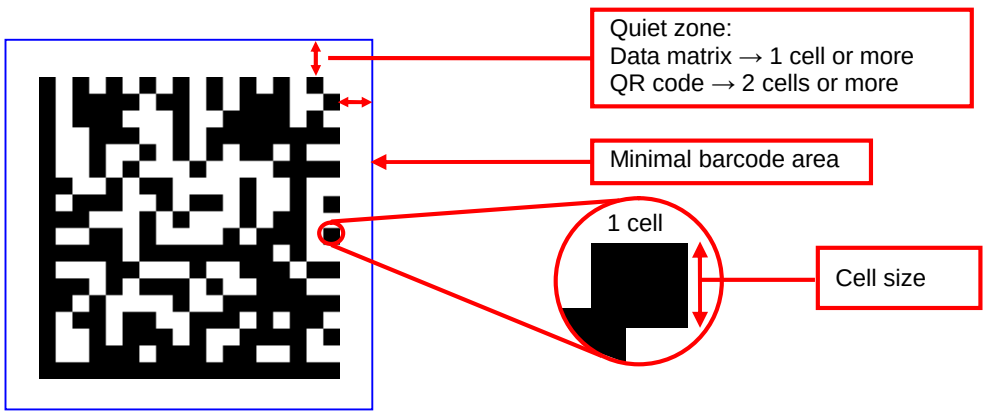
Barcode reading by camera

Specifications

The TOS-5 is able to recognize the barcode labels as described below.

(1) 2D codes

Type		”Data Matrix” ”QR code”
Size		When using the standard camera: 8 x 8mm or smaller When using 2nd Camera(option): 21 x 21mm or smaller (NOTE) When using the 2nd Camera, the APT system is capable of dealing with larger target than above. It owes to the feature that divides into multiple pieces and then merges them into one automatically.
Number of characters		(Data Matrix) Figures: max 348 characters, Alphameric: Max 259 characters (QR code) Figures: max 370 characters, Alphameric: Max 224 characters
Number of cells		(Data Matrix) Max 48 x 48 cells (QR code) Max 45 x 45 cells
Size of cells		When using the standard camera: 0.1mm or larger (recommended) When using 2nd Camera(option): 0.25mm or larger (recommended)



(Data Matrix)

	Number of cells	Data capacity	
		figure	figure
Date Matrix ECC200	10×10	6	6
	12×12	10	10
	14×14	16	16
	16×16	24	24
	18×18	36	36
	20×20	44	44
	22×22	60	60
	24×24	72	72
	26×26	88	88
	32×32	124	124
	36×36	172	172
	40×40	228	228
	44×44	288	288
	48×48	348	348
	8×18	10	10
	8×32	20	20
	12×26	32	32
	12×36	44	44
	16×36	64	64
	16×48	98	98

	Size	figure				alphameric			
		L	M	Q	H	L	M	Q	H
QR code Model 1	21×21	40	33	25	16	24	20	15	10
	25×25	81	66	52	33	49	40	31	20
	29×29	131	100	81	52	79	60	49	31
	33×33	186	138	114	76	113	84	69	46
	37×37	253	191	157	105	154	116	95	63
	41×41	321	249	201	133	194	151	122	81
	45×45	402	311	253	167	244	188	154	101

	Size	figure				alphameric			
		L	M	Q	H	L	M	Q	H
QR code Model 2	21×21	41	34	27	17	25	20	16	10
	25×25	77	63	48	34	47	38	29	20
	29×29	127	101	77	58	77	61	47	35
	33×33	187	149	111	82	114	90	67	50
	37×37	255	202	144	106	154	122	87	64
	41×41	322	255	178	139	195	154	108	84
	45×45	370	293	207	154	224	178	125	93

[Chapter 1] Number of readable letters

	Number of cells	Size of cell (mm)								
		0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5
Data Matrix	10×10	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3	7.0
	12×12	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0
	14×14	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.1	
	16×16	2.0	3.0	4.0	5.0	6.0	7.0	8.0		
	18×18	2.2	3.3	4.4	5.5	6.6	7.7			
	20×20	2.4	3.6	4.8	6.0	7.2	8.4			
	22×22	2.6	3.9	5.2	6.5	7.8				
	24×24	2.8	4.2	5.6	7.0	8.4				
	26×26	3.0	4.5	6.0	7.5					
	32×32	3.6	5.4	7.2						
	36×36	4.0	6.0	8.0						
	40×40	4.4	6.6							
	44×44	4.8	7.2							
	48×48	5.2	7.8							
	8×18	2.2	3.3	4.4	5.5	6.6	7.7			
	8×32	3.6	5.4	7.2						
	12×26	3.0	4.5	6.0	7.5					
	16×36	4.0	6.0	8.0						
	16×48	5.2	7.8							
QR code	21×21	2.1	3.2	4.2	5.3	6.3	7.4	8.4		
	25×25	2.5	3.8	5.0	6.3	7.5				
	29×29	2.9	4.4	5.8	7.3					
	33×33	3.3	5.0	6.6	8.3					
	37×37	3.7	5.6	7.4						
	41×41	4.1	6.2	8.2						
	45×45	4.5	6.8							

[Chapter 2] Readable code size (mm) against the cell size

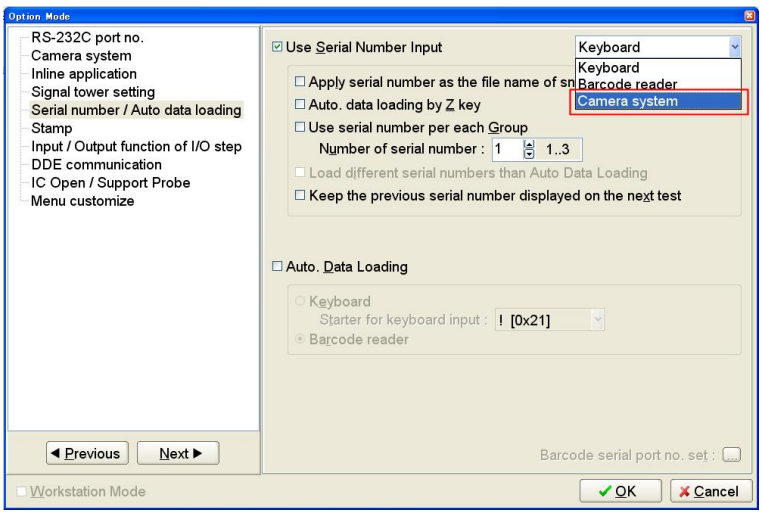
(2) Barcodes

Type		"Code128" "Code39"
Size		21 x 21mm or smaller **(NOTE)** The APT system is capable of dealing with larger target than above. It owes to the feature that divides into multiple pieces and then merges them into one automatically.
Number of characters		(Code128) Max. 44 characters (Code39) Max. 19 characters

The 2nd camera (option) is always necessary to read the barcode.

System setup

To enable this function, please select the radio button for “Camera system” (Option Mode > Serial number / Auto data loading).



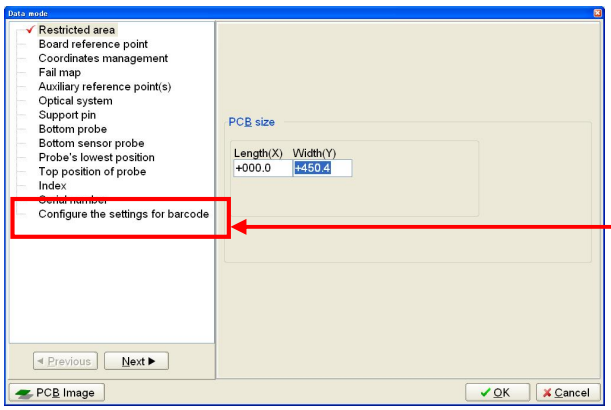
[Sample display-115] Serial number / Auto data loading

Barcode setup

To activate the barcode reading, it’s necessary to drill the APT system on where to be your barcode and its properties correctly.

1. Teaching the exact placement of barcode

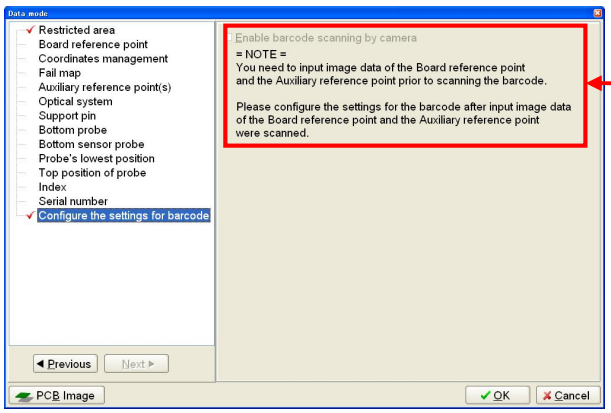
1) Move to Data mode > Configure the settings for barcode.



Configure the settings for barcode menu:

This appears only when the radio button for Camera system is selected on Serial number/Auto data loading menu in Option mode.

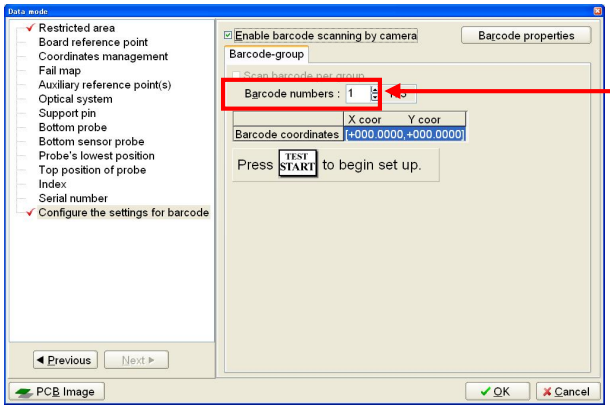
[Sample display-116] Data mode



Unless the Board reference point has not been configured yet, the Configure the settings for barcode menu will be disabled with an error message.

[Sample display-117] Data mode

2) Fill “Enable barcode scanning by camera” checkbox.

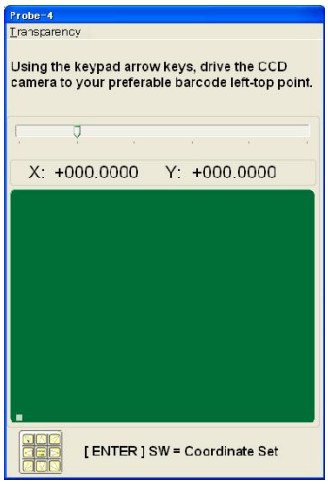


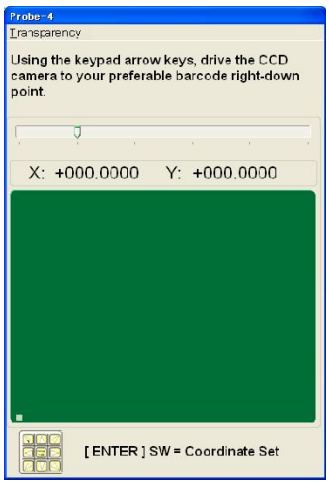
Scan barcode per group

This appears only when there are two or more groups in the program.

[Sample display-118] Configure the settings for barcode

3) Press the Test Start button to specify the XY coordinates at the left-top and the right-bottom of the barcode.



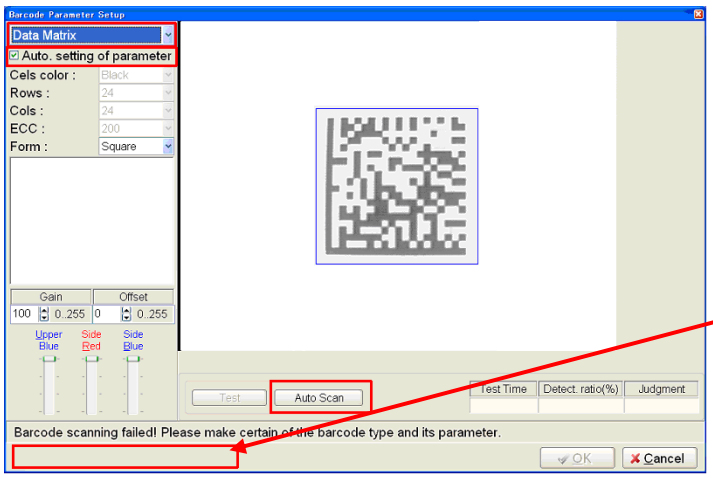


2. Setting Barcode properties

1) Click on “Barcode properties” button on the Configure the settings for barcode menu.

2) Choose the type of barcode (Data matrix or QR code)

3) Fill “Auto. Setting of parameter” checkbox and click on “Auto Scan” button.



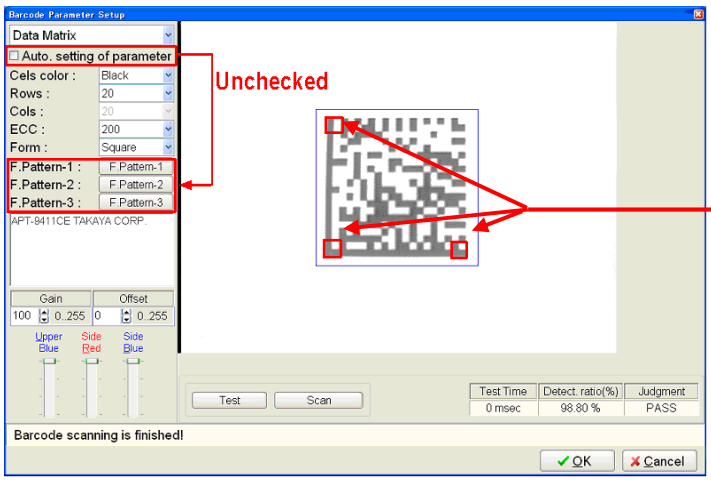
When the check box for “Scan barcode per group” is filled, press following button to move the properties menu for each group

[Sample display-119] Auto. setting of parameter

4) The barcode number is displayed on the left box. Click on the OK button to after confirmation of the barcode number.

(Remark 1)

If “Auto. Setting of parameter” checkbox wasn’t filled in Process 2), it displays “F.Pattern-1”, “F.Pattern-2” and “F.Pattern-3” on the left side of the menu. In this case, please go through the following steps to specify the Finder patterns;



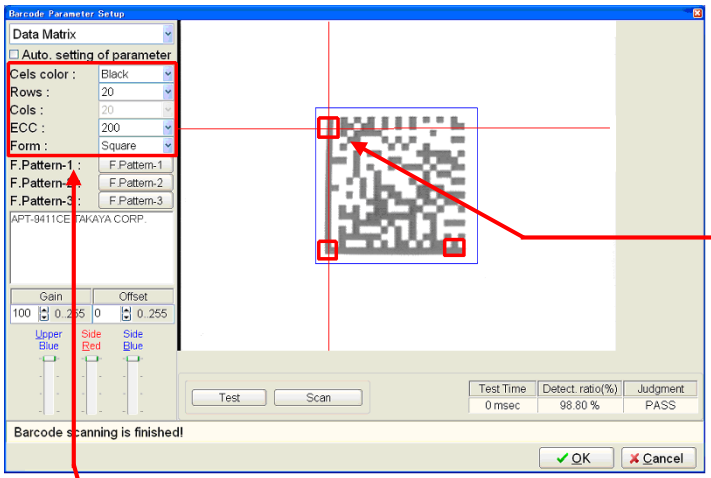
Finder pattern:

On both Data Matrix and QR code, there are some reference symbols called “Finder pattern”.

You need to specify the XY coordinates of each Finder pattern in order to read the barcode correctly.

[Sample display-119] Setting of parameter

Run on “F.Pattern-1” (or “F.Pattern-2” or “F.Pattern-3”) and specify any Finder pattern at the click of a mouse.



When you are operating the mouse to specify the XY coordinates of each Finder pattern, the target marker appears.

[Sample display-120] Setting of parameter

Cell color : Choose either white or black as cell color

Rows : Number of tandem cells

Cols : Number of laterally-facing cells (needs to set only when Form is rectangle)

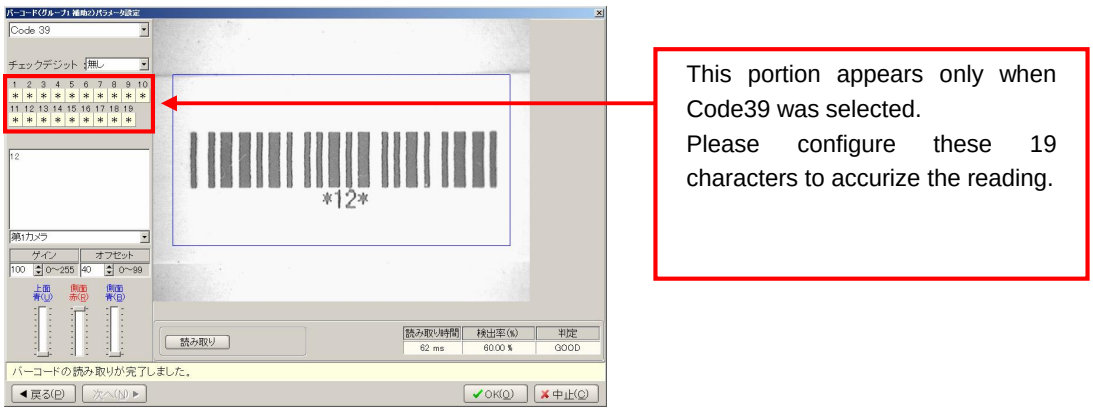
ECC :ECC level (Data Matrix only)

Form : choose either Square or Rectangle

Clicking on the Scan button, the barcode number is displayed on the left box. Click on the OK button after confirmation of the barcode number.

(Remark 2)

The Code 128 and Code39 are more likely to cause the reading error by environmental influences (i.e. lighting). Especially for the Code39, so you need to drill the APT system on what each character means in the manner below;



[Sample display-121] Setting of parameter

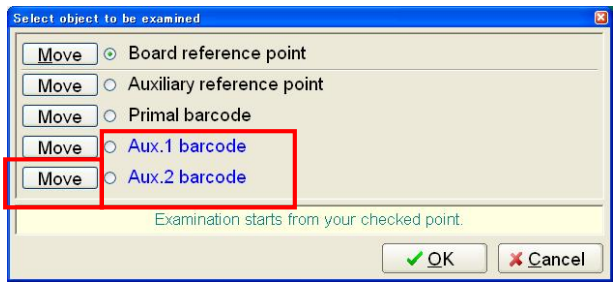
Character set for Code 39

Character	Contents
*	0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ-. $/+%
A	ABCDEFGHIJKLMNOPQRSTUVWXYZ
1	0123456789
-	-
¥0	No character following this discrimination mark

Clicking on “Test” button, the barcode number is displayed on the left box. Click on the OK button after confirmation of the barcode number.

3. Optical data review

1) Select object to be examined



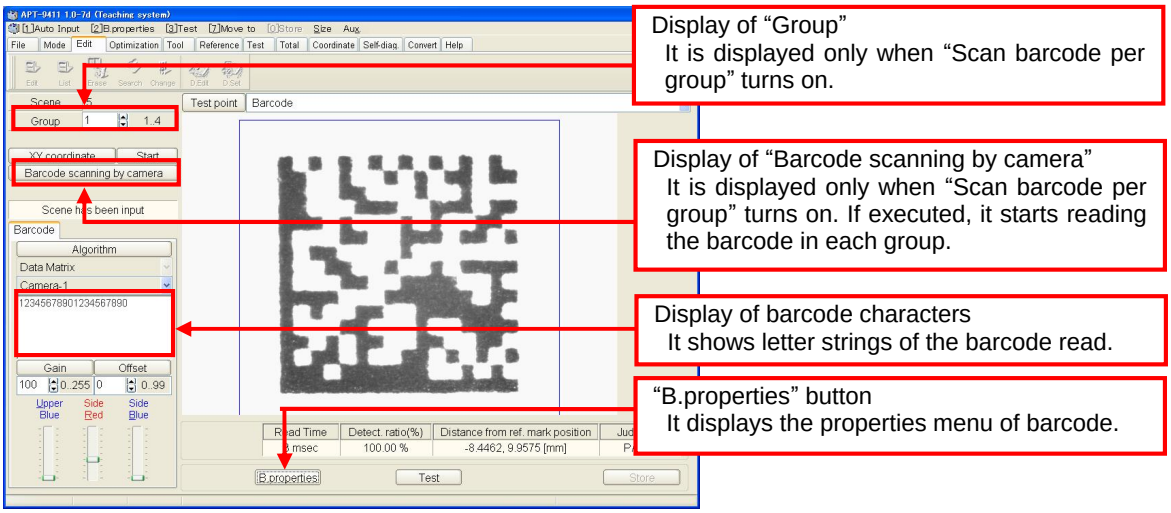
[Sample display-122] Optical data review

When the barcode label is not recognized with accuracy due to incorrect configuration in the barcode properties, they are displayed in blue color.

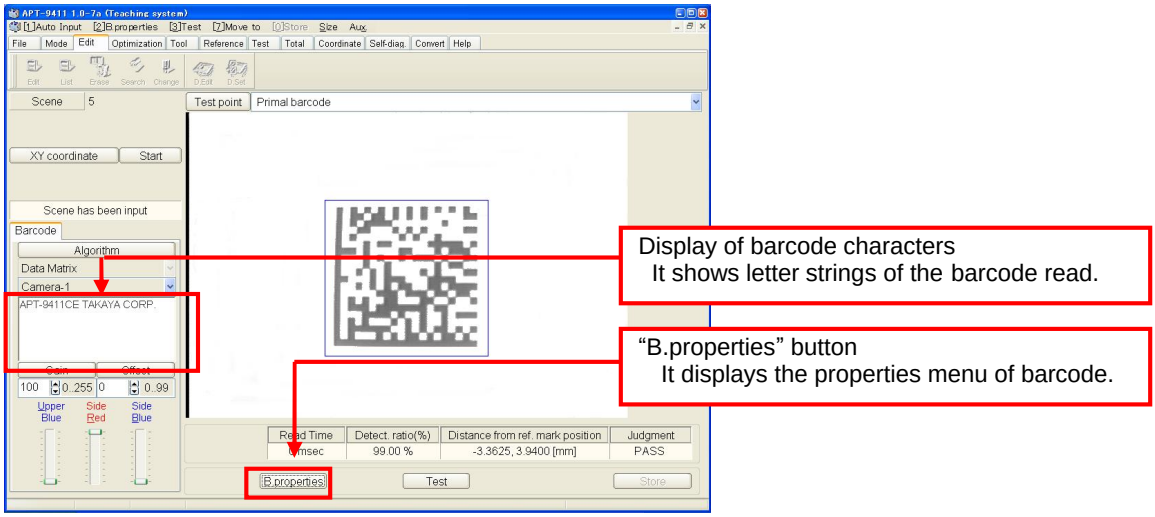
In addition, if pressing “Move” button next to the barcode step, the camera drives to XY the coordinates in Group 1.

2) Optical data review

When the barcode image needs to be examined, move to Optical data review menu (Refer to [Sample display-123]). On this menu, you are able to correct the XY coordinates of barcode label and configure the properties. Be sure to save your changes by pressing the Store button.



[Sample display-123] Optical data review



[Sample display-124] Optical data review

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