Flying probe tester APT-9411 series

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

TAKAYA

Preface

The Vision System *TOS-5/TOS-4/TOS-41*, one of exclusive options for Takaya Fixtureless Tester APT-9411 Series (hereinafter “Tester”), offers Simple vision test to the components that are nondetectable under electrical test and Coordinates alignment function that secures accurate probes contact on the board under test. In addition, a crosshair (Target marker) displayed on the camera window plays essential role in inputting and correcting X,Y coordinates of the probe contact position. Also, what is special about the TOS-5 system, the great-granddaddy of them all, is a unique feature to recognize the barcode labels that can achieve the serial number input through a CCD camera.

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 [V1.3-2] for the APT-9411 Series.

2) Windows®, Windows®NT is a registered trademark of Microsoft Corporation. Also the company name and the product name listed in this User’s guide are the trademark of each company.

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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

The Simple vision test available in the TOS-5/TOS-4/TOS-41 system is for the components that are nondetectable under electrical test and is classified into as follows.

1. Presence check
2. Polarity check (Electrolytic capacitors, Tantalum capacitors, ICs, Connectors, etc.)
3. Letter recognition check

In addition, this option ensures high accurate probing contact on the PC boards under test which tend to shift in X-Y direction, slant and expandable otherwise contract inconsistently, by aligning the XY coordinates with Board Reference Point and Auxiliary Reference Point(s) automatically. The Coordinates alignment function is also applicable in a limited test area designated by steps, group or parts name (→ Region alignment in Page 25).

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

	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 10.
	Occasionally your objects may not be recognized depending on their kind, color, size, shape, color of polarity mark or letter, and so on.
	By reason of the camera focus, a relatively tall component may not be detectable.

Specifications

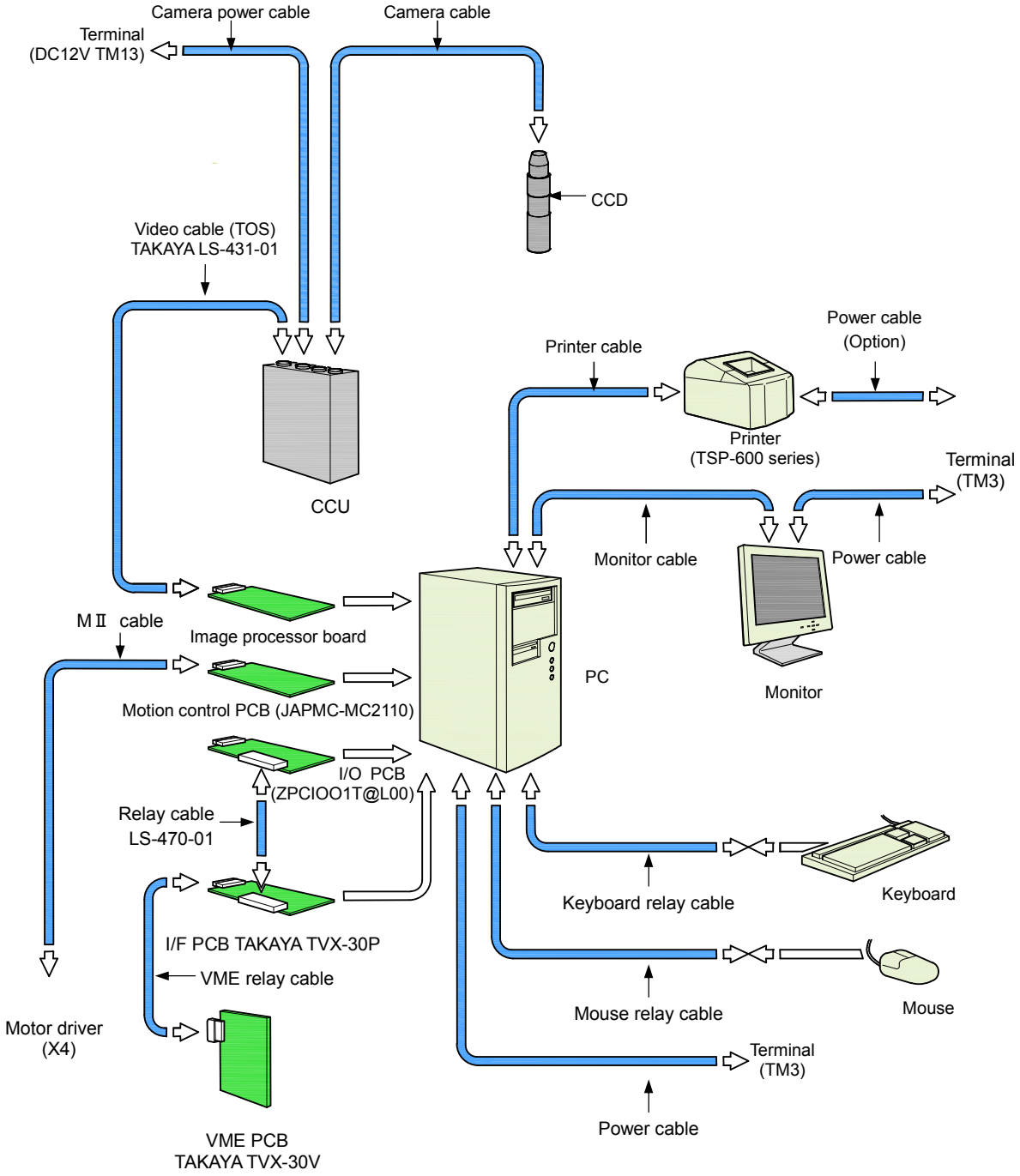
Search method	:	Gray-scale pattern matching Geometric pattern matching (TOS-5/TOS-4 only)
Measuring resolution	:	Approx. 2μm (Image processor unit) Approx. 2.5μm (while Tester works for position alignment)
Measuring repeatable accuracy	:	±2μm (Image processor unit) ±50μm (while Tester works for position 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

- 🕮 The 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.

- 🕮 The Geometric pattern matching looks at the geometric features of the object to accurately locate an object despite changes in its appearance (i.e. piece-to-piece variations of mounting angle and size). In addition, the Geometric pattern matching has features to cope with such environmental changes as the illumination, the outside light and so on. In that sense, this search method overcomes a weakness in the the Gray-scale pattern matching.

Installation

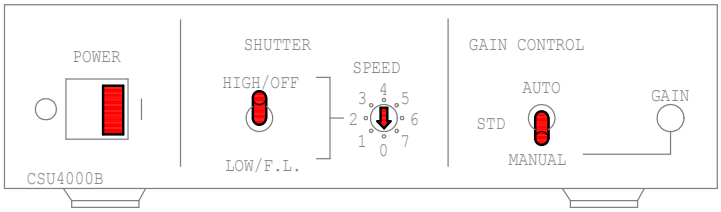
As the diagram below indicates, connect the Camera Control Unit (CCU), the Image processor board (TOS-5/TOS-4/TOS-41) and other peripheral devices with the dedicated cables.



[Fig. 1] System connection diagram

	As for the installation procedures of the system software and the driver for the TOS-5/TOS-4/TOS-41 system, refer to the Operator's guide (Software) written for the APT-9411 Series.
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**

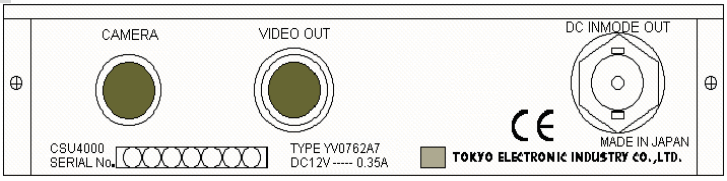
(2) **SHUTTER** **HIGH/OFF**

(3) **SPEED** **0**

(4) **GAIN CONTROL** **MANUAL**…… Rotary SW (GAIN) should be fine adjusted carefully. (Refer to APT-9411 Service manual)

	Make sure that the CCU is configured as seen above. Otherwise the camera image is not displayed correctly.
	When the power is turned on, the pilot lamp on the power switch will light.

CCU (Rear panel)



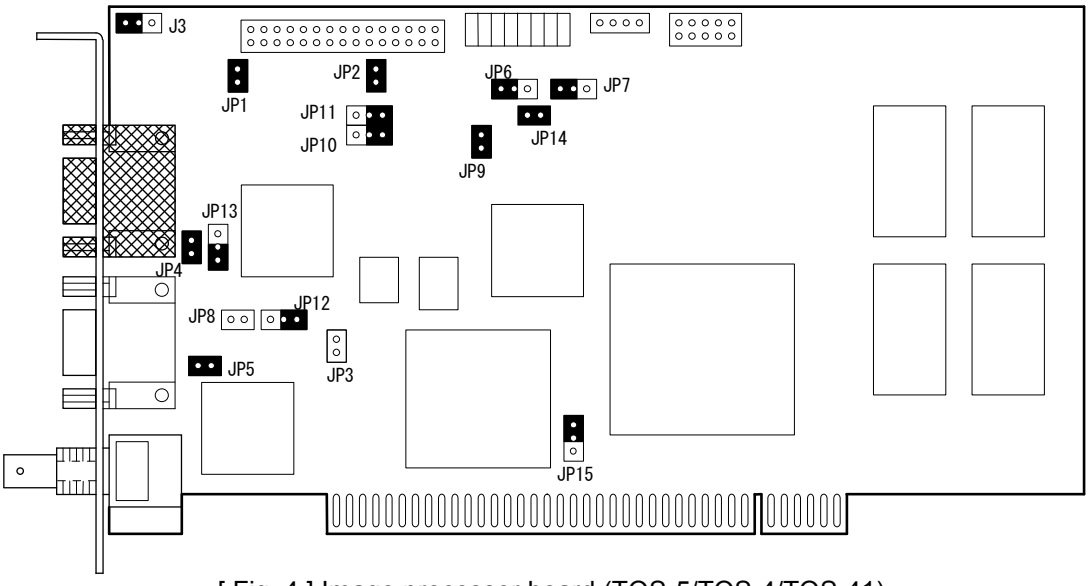
[Fig. 3] Rear panel

(1) CAMERA …… to Camera head (CCD)

(2) VIDEO …… to the Image processor board (TOS-5/4/41)

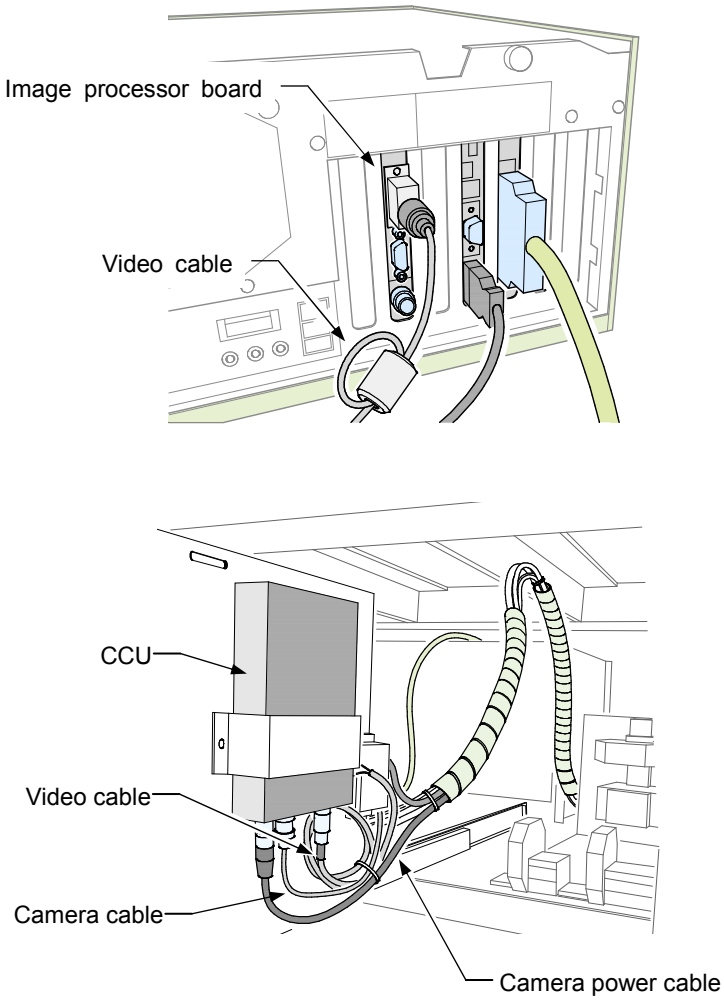
(3) DC IN/VIDEO OUT …… to power supply (DC12V)

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 CCU. 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 camera image is not displayed correctly.
HINT	In Fig. 4, the black-out terminals mean “short”, and the others mean “open”.



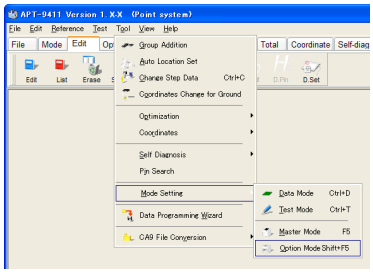
[Fig. 5]

Option Mode Set

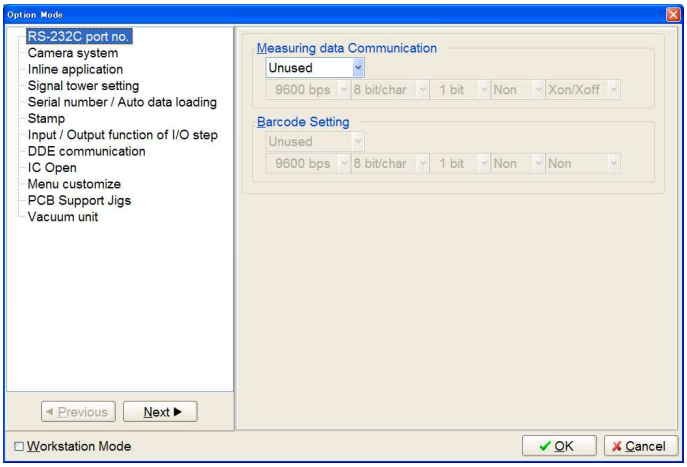
In case that the TOS-5/TOS-4/TOS-41 system is first used with the tester, it is necessary to set up the system software (Option Mode) correctly. This setting is saved into Master Mode file in the system directory.

[Operation steps]

1. Click [Tool] on Menu bar and select [Mode Setting] > [Option Mode] in order. After this, Option Mode window (Refer to Sample display-2) appears on the screen.

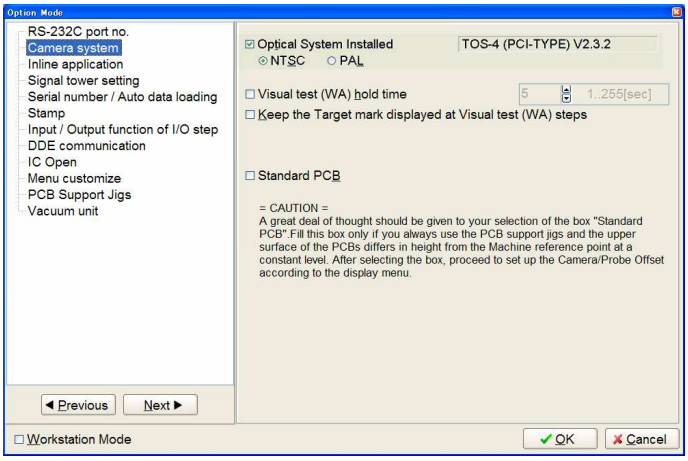


[Sample display-1]



[Sample display-2] Option Mode window

2. Click on [Camera System] and 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 the Option Mode window.

Option Mode set for Camera

Optical System Installed

When the tester is equipped with the Image processor board (TOS-5/TOS-4/TOS-41), fill “Optical System Installed” checkbox and specify either NTSC or PAL as your Color system.

Add recognition errors to the failure counter

When “Add recognition errors to the failure counter” checkbox is filled, if the Vision system got errors trying to recognize fiducial marks, the board is also counted as test fail number. Unless the checkbox is filled, this is not regarded as test fail number.

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

When “Visual test (WA) hold time (1-255sec)” checkbox is filled, it is possible to preset the time to suspend the camera movement at Visual test step from 1 - 255 sec. Unless that checkbox is 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 goes back to the former Visual step.

Standard PCB

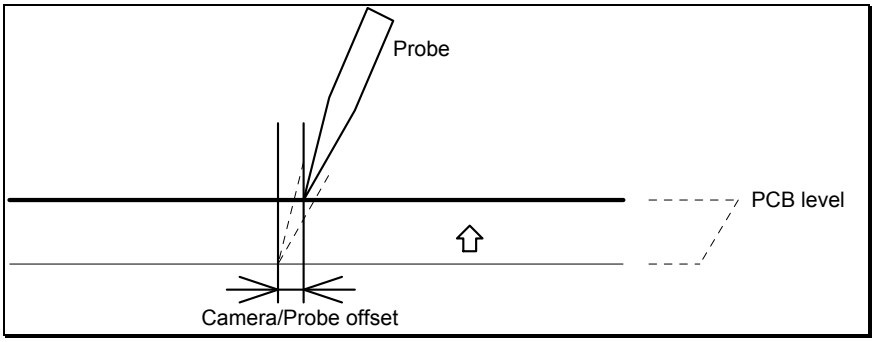
In case that “Standard PCB” checkbox is filled, the Camera/Probe Offset value is managed in Option Mode. Unless the checkbox is filled, the Camera/Probe Offset value is managed in Data Mode. Means, you are required to configure it every test programs.

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 arm at a certain angle with a vertical line. 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. 6 below.

Whenever the contact level on every PC boards remains unchanged, it is recommended that “Standard PCB” checkbox in Option Mode window is filled in advance.



[Fig. 6]

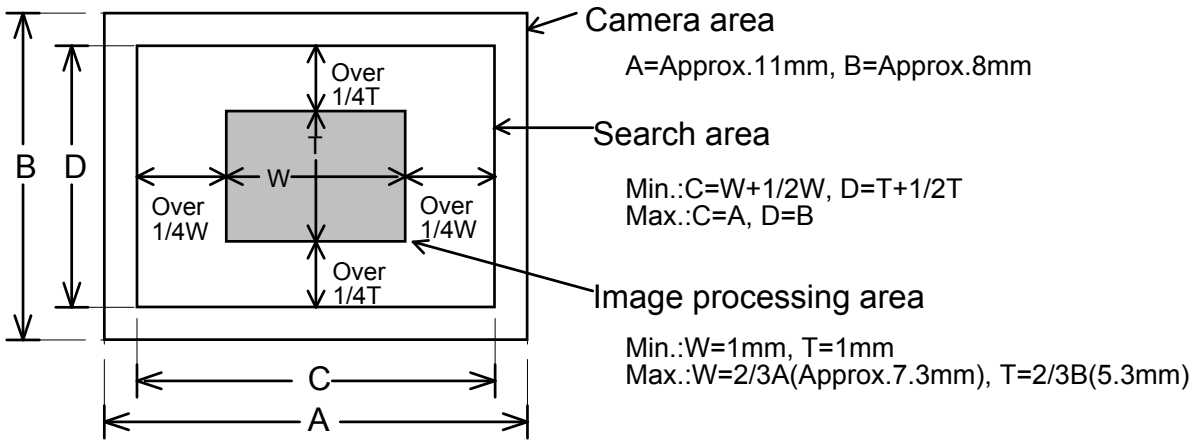
!	In case that Camera/Probe Offset value was input incorrectly, any probe may not contact the position where the camera read out.

Test Target

This section explains each size of “Camera area”, “Search area” and “Image processing area”.

Please make sure that both the Board reference point and the Aux. Reference point for X-Y Coordinates alignment fall inside the Image processing area shown in Fig. 7.

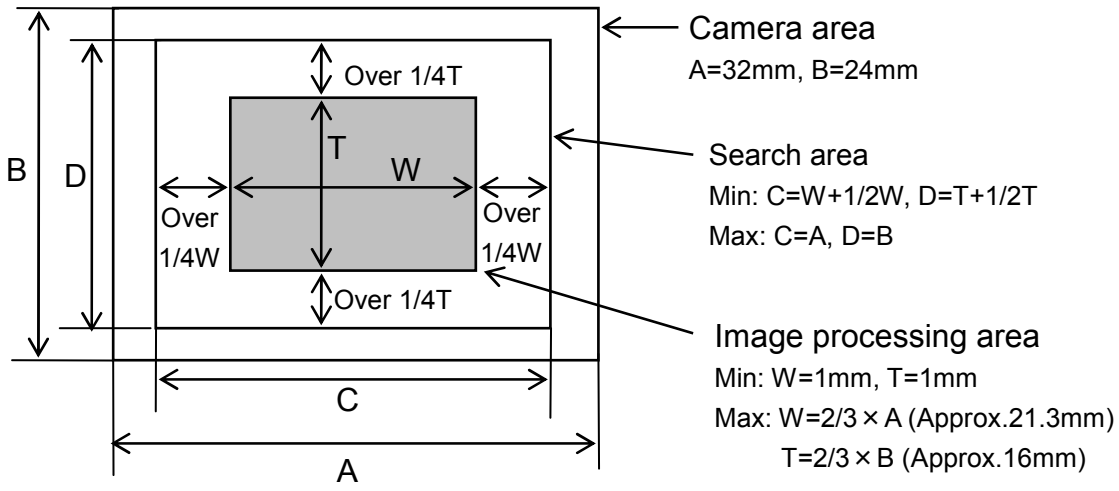
Likewise, at the step data for Presence check and Polarity check, the test target must fall inside the Image processing area and the Search area.



[Fig. 7] Area size (Standard camera)

About 2nd Camera (Option)

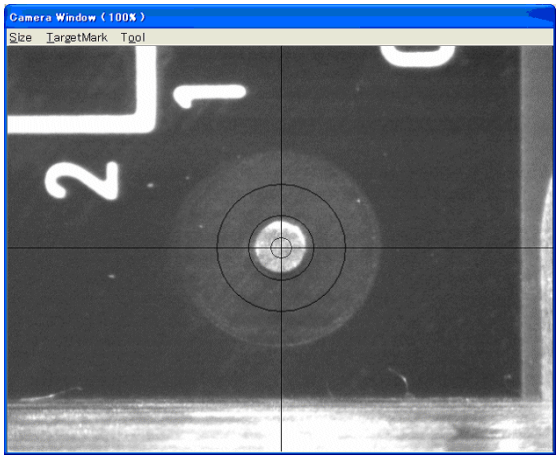
The 2nd Camera to install on the Probe 4 arm is also available as option for the APT-9411 Series.
As the drawing below indicates, the 2nd Camera with a wide-angle lens has a fifferent Area size than the standard camera installed on Probe 3 arm.



[Fig. 8] Area size (2nd Camera)

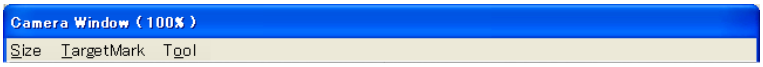
Camera Window

When the tester is equipped with the Image processor board (TOS-5/TOS-4/TOS-41), 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

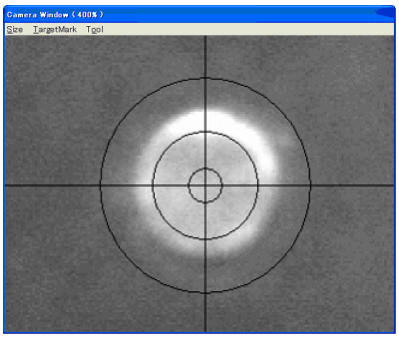
While the Camera window is displayed, the dedicated menubar (Refer to Sample display-5 below) appears.



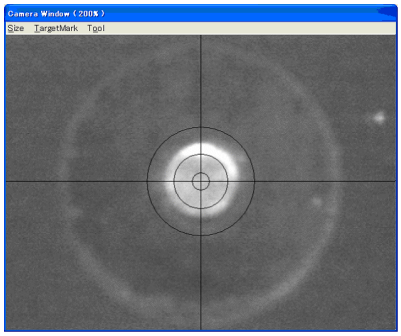
[Sample display-5] Camera window menubar

Size

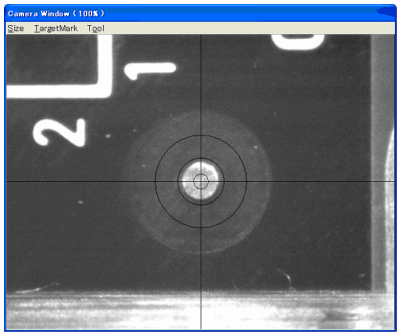
You can click on Size and select any magnification from 400%, 200%, 100% and 50%. The image will be displayed in answer to the size appointed by you.



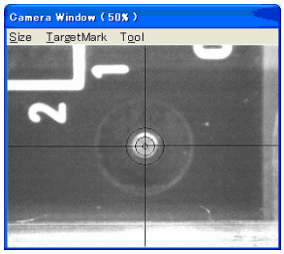
400%



200%



100%



50%

[Sample display-6] Magnification size

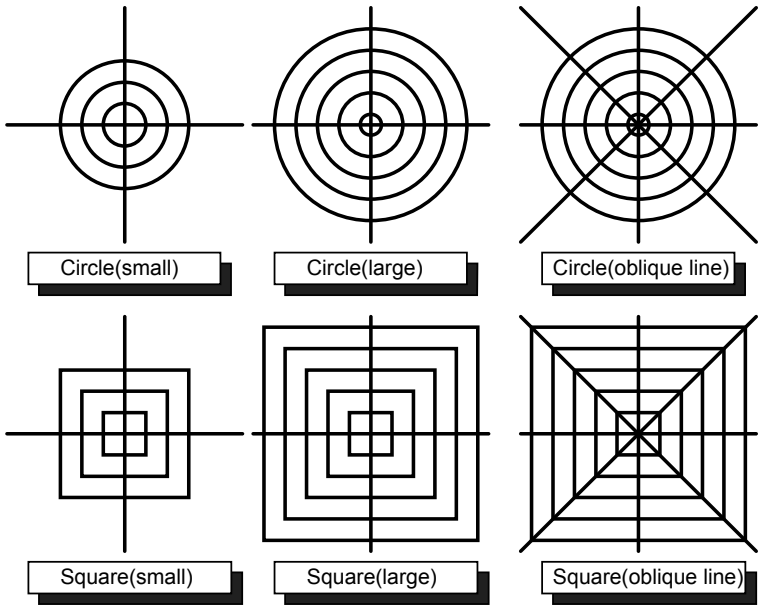
HINT	Any magnification change is conserved until the reference image input or test is executed. After these operation, it turns back to default (100%).

Target Mark

You can click on Target Mark and select any the target marker from the table below. The target marker is displayed in answer to the image color and/or shape appointed by you.

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”.

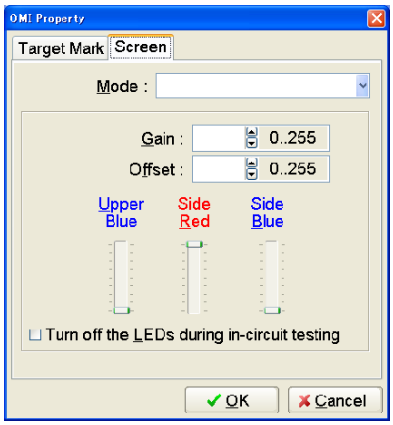
Menu	Explanation
Mode 1 ~ Mode 4	You can choose the most desirable Mode (Mode 1 ~ Mode4), in which Target marker, Camera image and LED illumination was already reserved.
Property	Type of Target marker, Camera image and LED illumination can be allocated in each Mode (Mode 1 ~ Mode 4) in advance.

Mode 1 ~ Mode 4

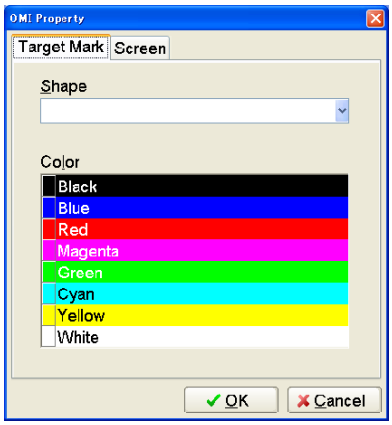
You can choose the most desirable Mode to use, in which Target marker (Shape, Color), Camera image (Gain, Offset) and LED illumination (Upper Blue, Side Red, Side Blue) was already reserved on Property menu.

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.



Screen tab



Target Mark tab

[Sample display-8]

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**	The Camera image is reproduced with the 256 gradations of 0 (black) - 255 (white). If Gain was adjusted to smaller, the whole image becomes more bright. On the other hand. If adjusted to bigger, it becomes more dark.
(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 the Board reference point/Auxiliary reference point is automatically aligned and when the 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**	Choose the most desirable type in answer to the object shape on your PC board.
(2) **Color**	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).

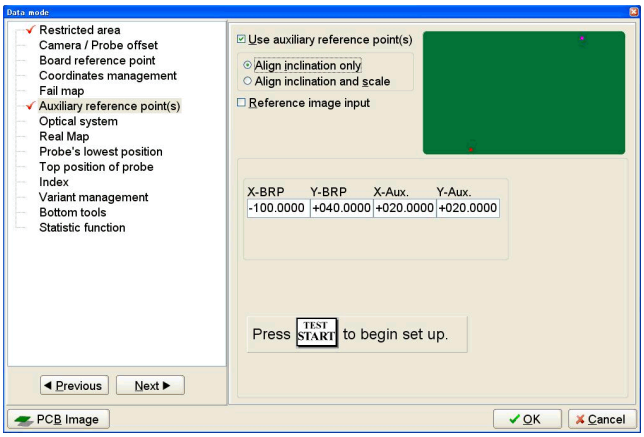
This setting is managed by Data Mode and saved in the disk together with each test program.

Coordinates Alignment

Equipped with the TOS-5/TOS-4/TOS-41 system, the tester can align possible inclination and/or scale of PC boards each time before tested by automatically detecting the center point of fiducial marks provided on the PC boards through the CCD camera.
This section introduce a sample operation how to input reference image usable for aligning “Inclination” or “Inclination & scale” of the PC boards under test.

Inclination alignment set at new test programming

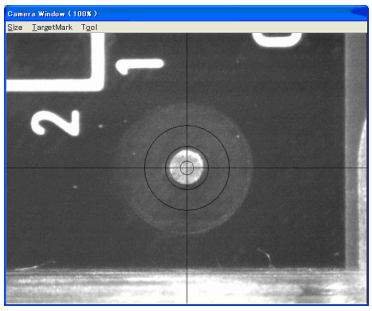
1) Start with proper setting up of “Conveyor Set Up”, “Camera/Probe Offset”, “Board Reference Point”, “Coordinates Management” and “Fail Map” in Data Mode window.
2) Fill “Use Auxiliary Reference Point(s)” checkbox on the Auxiliary Reference Point(s) menu..



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

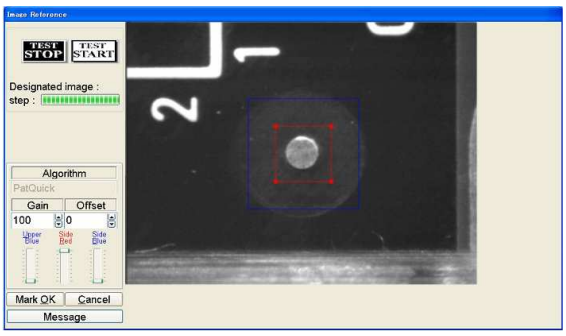
X-BRP/Y-BRP shown on Sample display-9 is for X-Y coordinates for Board Reference Point. And X-Aux/Y-Aux. is X-Y coordinates for Auxiliary Reference Point.

3) Fill “Align inclination only” radio-button (Sample display-9)
4) Fill “Reference image input” checkbox and 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 and then press [ENTER] SW to enter the coordinates.



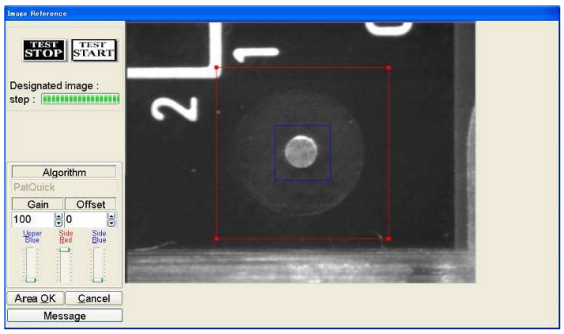
[Sample display-10] Camera Window

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 and then click on “Mark OK” button.



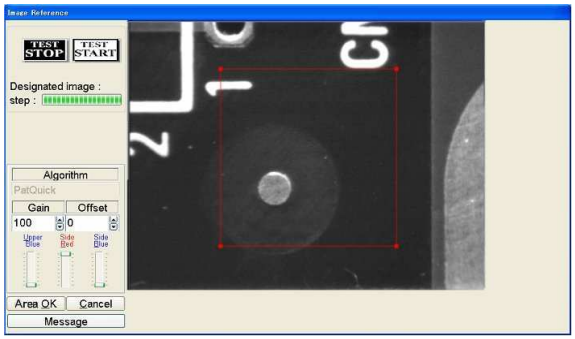
[Sample display-11] Image processing area set

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.
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 and 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 and 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.

13) With the above operation, the reference image is input.

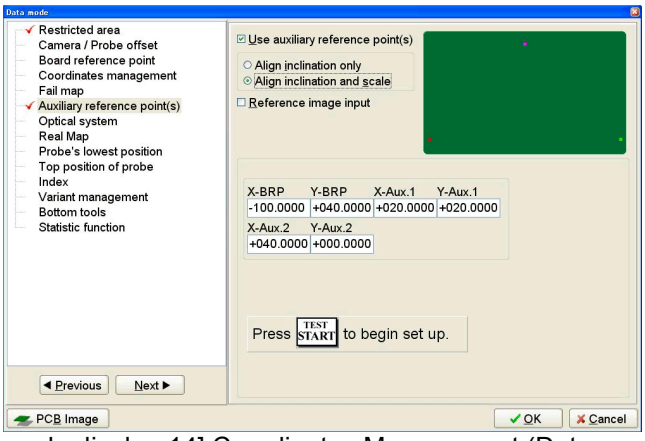
14) When all process to setup and input the Board reference point and the Auxiliary reference point was finished, the display goes back to Data Mode window. (Sample display-9)

HINT	To align possible inclination of the 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) Start with proper setting up of “Conveyor Set Up”, “Camera/Probe Offset”, “Board Reference Point”, “Coordinates Management” and “Fail Map” in Data Mode window.

2) Fill "Use Auxiliary Reference Point(s)” checkbox on the Auxiliary Reference Point(s) menu.



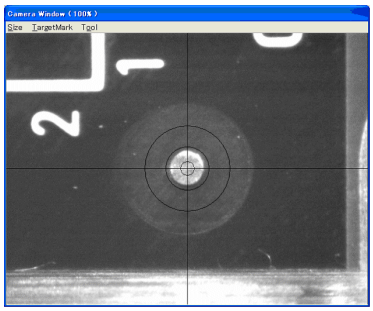
[Sample display-14] Coordinates Management (Data mode)

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 “Align inclination and scale” radio button (Sample display-14)

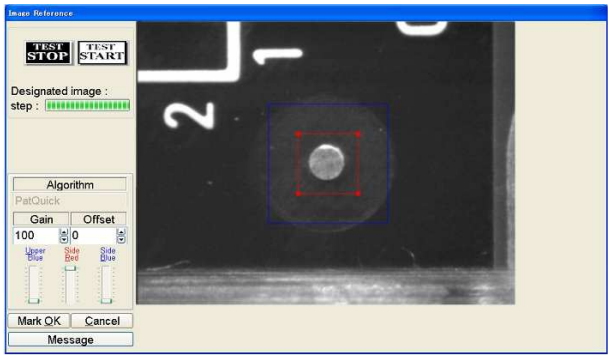
4) Fill “Reference image input” checkbox and press [TEST START] SW on the operation panel. (Sample display-14)

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 and then press [ENTER] SW to enter the coordinates.



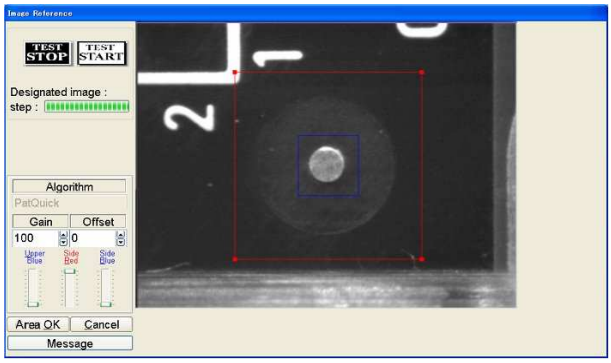
[Sample display-15] Camera Window

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 and then click on “Mark OK” button.



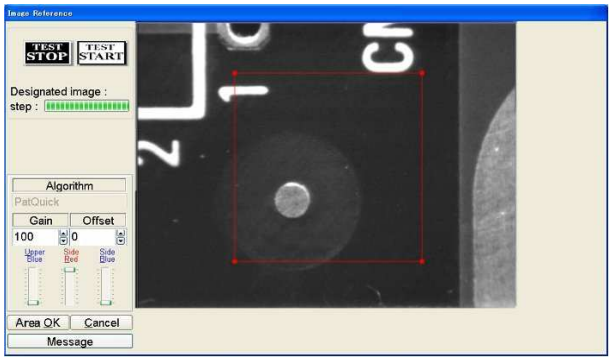
[Sample display-16] Image processing area set

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.
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 and 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.

12) With the above operation, the reference image is input.

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

14) 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.

15) With the above operation, the reference image is input.

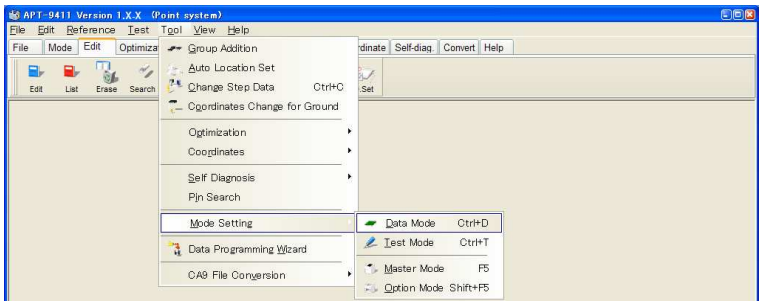
16) When all process to setup and input the Board reference point and the Auxiliary reference point-1, 2 finished, the display goes back to Data Mode window. (Sample display-14)

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

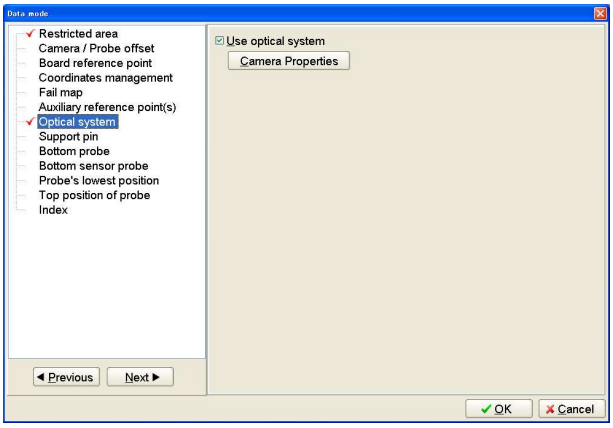
1) After loaded an objective test program, set up “Conveyor Set Up”, “Camera/Probe Offset” and “Board Reference Point” in Data Mode window properly.

2) Open Data Mode window (Tool > Mode Setting > Data Mode).



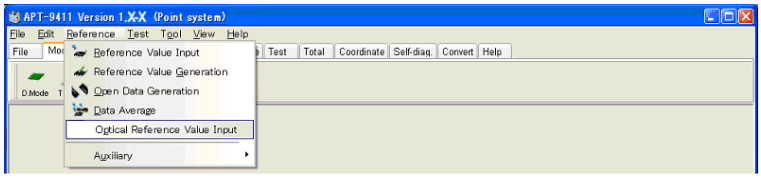
[Sample display-19] Menu bar (Data Mode)

3) Open Optical System menu and fill the “Use optical system” checkbox.
Also set up Camera Properties, if necessary (Refer to Page 12)



[Sample display-20] Data Mode window

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.

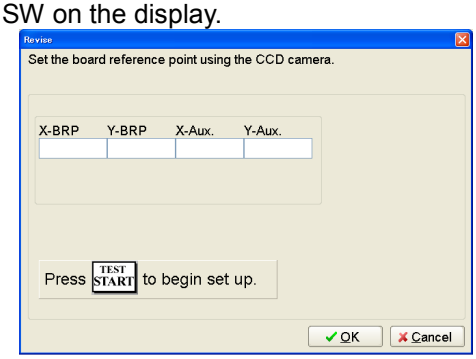


[Sample display-21] Menu bar (Image data input menu)

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

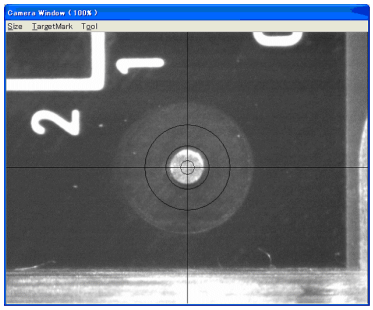
6) It shows “Use board ref.point and aux.ref.point for alignment?” on the display. So click on [YES] button, then [TEST START] SW on the operation panel.

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

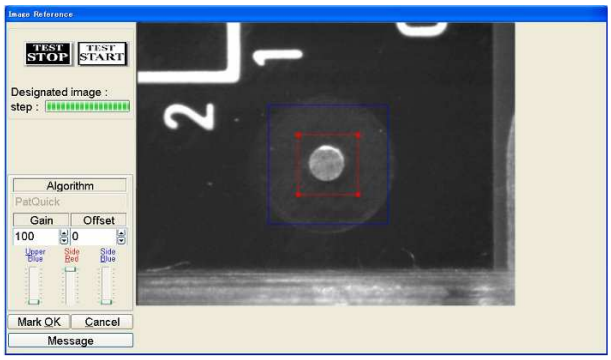
8) After “Camera Window” appeared on the display, center the Target marker on the Board reference point using the keypad arrow keys on the operation panel and then press [ENTER] SW to enter the coordinates.



[Sample display-23] Camera Window

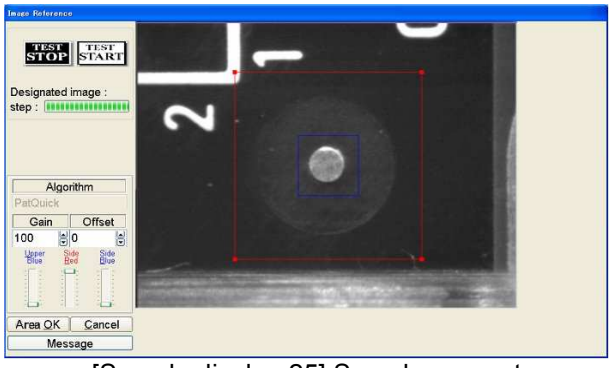
9) Next, center the Target marker on the Auxiliary reference point using the keypad arrow keys on the operation panel and then press [ENTER] SW to enter the coordinates. (Sample display-23)

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 and then click on “Mark OK” button.



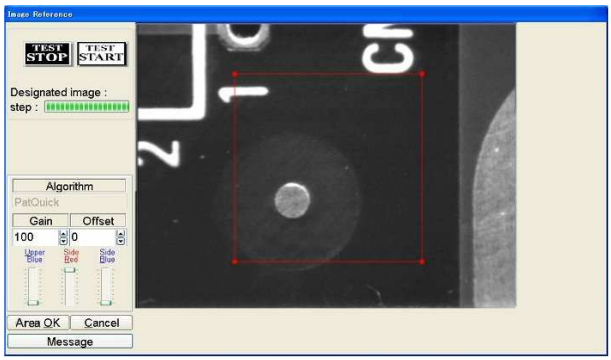
[Sample display-24] Image processing area set

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. (Sample display-26)
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

13) With the above operation, the reference image is input.

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

15) 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.

16) With the above operation, the reference image is input.

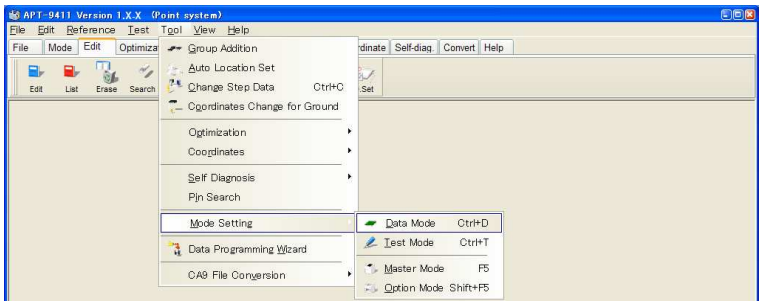
17) When “Image Reference” window was closed, your operation of inputting the image data for Board reference point and Auxiliary reference point is finished.

HINT	To align possible inclination of the 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

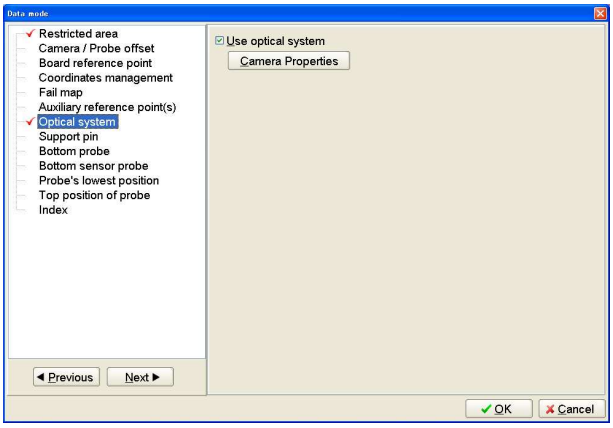
1) After loaded an objective test program, set up “Conveyor Set Up”, “Camera/Probe Offset” and “Board Reference Point” in Data Mode window properly.

2) Open Data Mode window (Tool > Mode Setting > Data Mode).



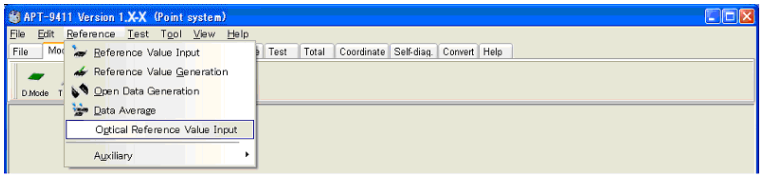
[Sample display-27] Menu bar (Data Mode)

3) Open Optical System menu and fill the “Use optical system” checkbox.
Also set up Camera Properties, if necessary (Refer to Page 12)



[Sample display-28] Data Mode window

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.

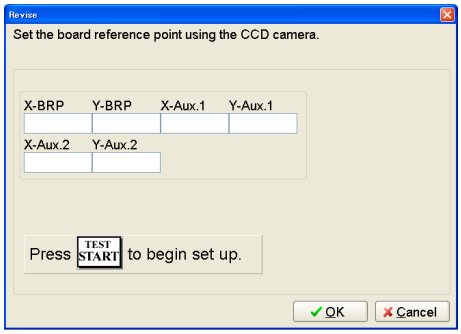


[Sample display-29] (Image data input menu)

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

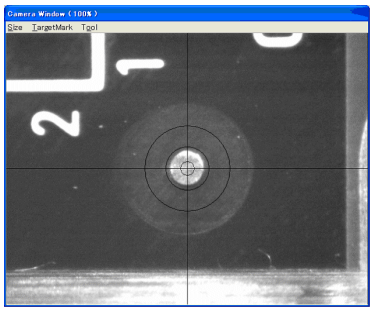
6) It shows “Use board ref.point and aux.ref.point for alignment?” on the display.
So click on [YES] button, then [TEST START] SW on the operation panel.

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 and then press [ENTER] SW to enter the coordinates.

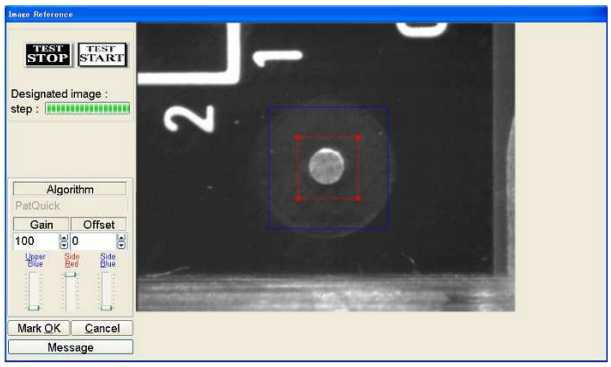


[Sample display-31] Camera Window

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

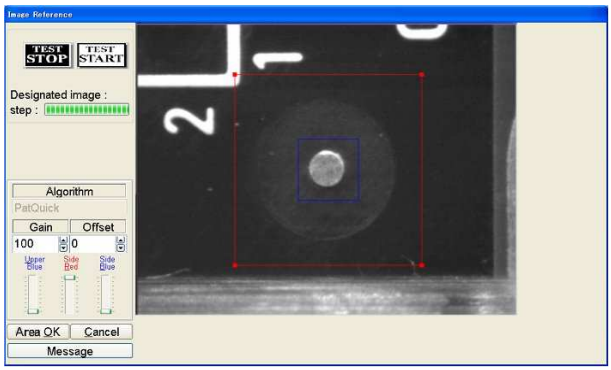
10) Center the Target marker on the Auxiliary reference point-2 using the keypad arrow keys on the operation panel and then press [ENTER] SW to enter the coordinates. (Sample display-31)

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



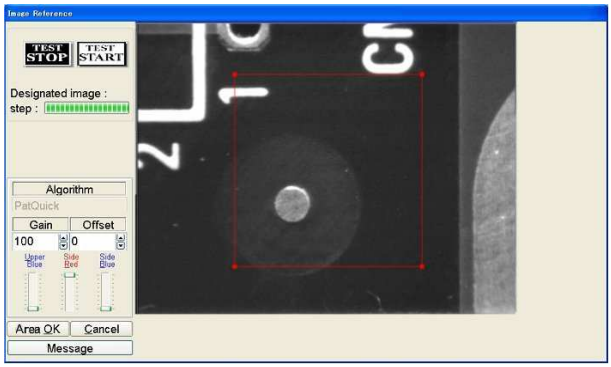
[Sample display-32] Image processing area set

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 and 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.

17) With the above operation, the reference image is input.

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

19) 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.

20) With the above operation, the reference image is input.

21) 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.

Region Alignment

The Coordinates alignment function is also applicable to your specified area in a test program. This is called “Region Alignment” in the software and is chosen among three options below;

*** Coordinates alignment after this step**

*** Coordinates alignment only in this group**

*** Coordinates alignment at the steps using this parts name**

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

Coordinates alignment after this step

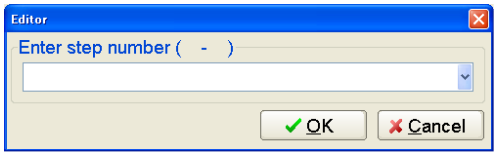
Specify “Coordinates alignment after this step” function, and the X,Y coordinates in all steps following the designated step are aligned automatically. If this was designated to the test step, “After-correct” is substituted in the Comment column.

Followings are your operating procedures to set up “Coordinates alignment 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))

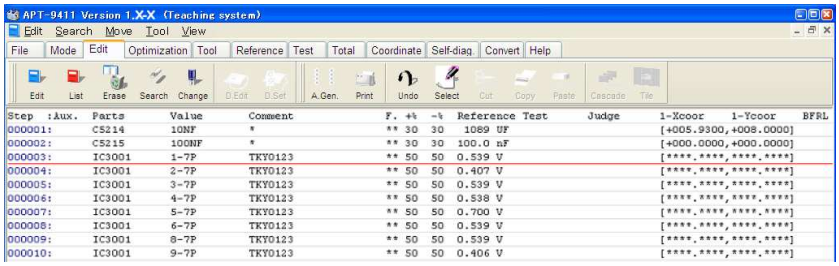
1) Open Step Edit window (Edit > Step Edit) or Step List window (Edit > Step List).

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



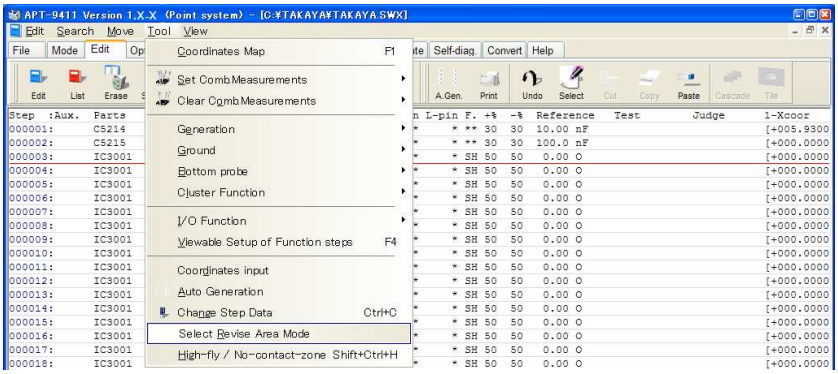
[Sample display-35] Step number input

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



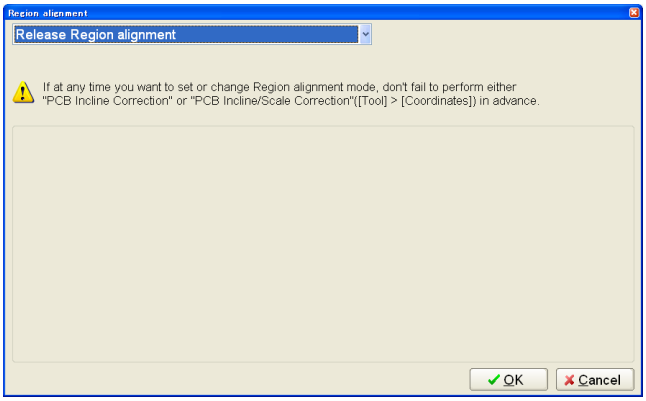
[Sample display-36] Step data list (Step No.3)

4) Click on Tool to select Region alignment.



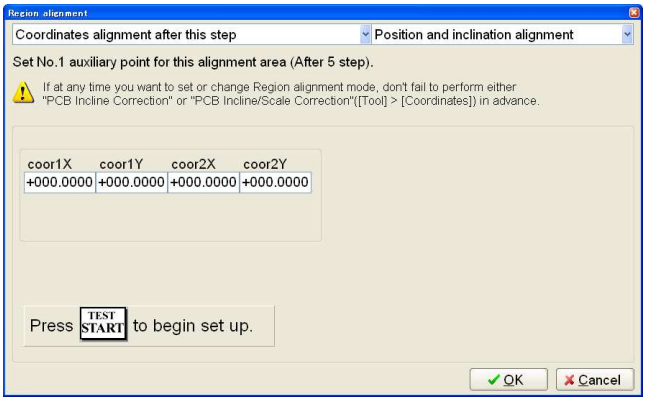
[Sample display-37] Select Revise Area Mode (Menu bar)

5) The Region alignment window appears on the display.



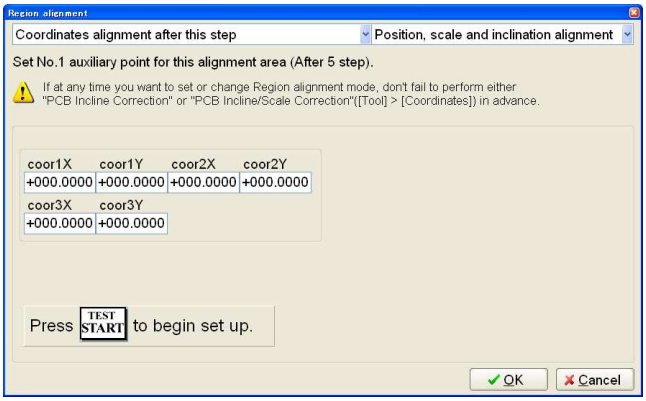
[Sample display-38] Region alignment window

6) Choose “Coordinates alignment after this step” from a pull-down menu.



[Sample display-39] Region alignment window

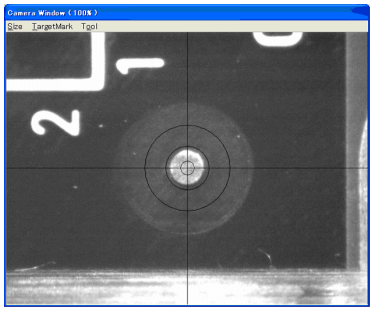
7) Choose “Position, scale and inclination alignment” from a pull-down menu.



[Sample display-40] Region alignment window

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

9) After “Camera Window” appeared on the display, center the Target marker on No.1 auxiliary point for your assigned area using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.



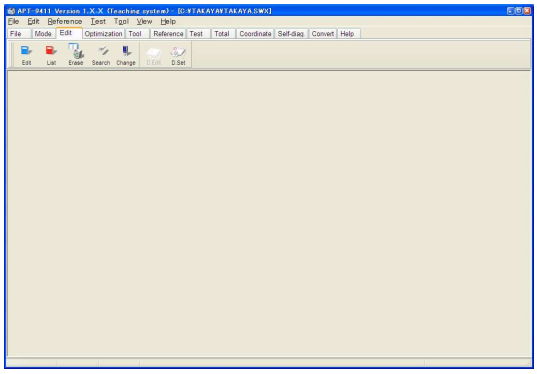
[Sample display-41] Camera Window

10) Center the Target marker on No.2 auxiliary point 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 No.3 auxiliary point for your assigned area using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.
(Sample display-41)

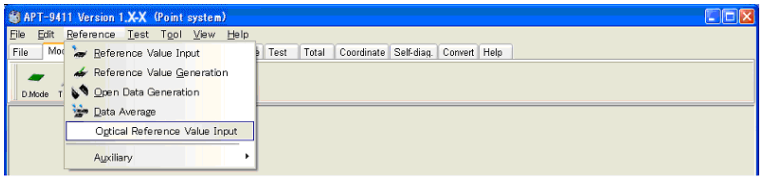
12) After all auxiliary points were set, the display goes back to the step data list, where “After-correct” is substituted in the Comment column.

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



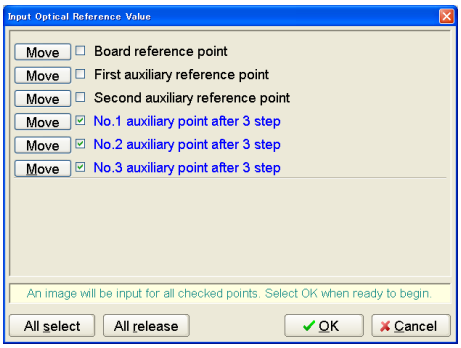
[Sample display-42] Main Window

14) Select the Optical Reference Value Input from the Reference menu.



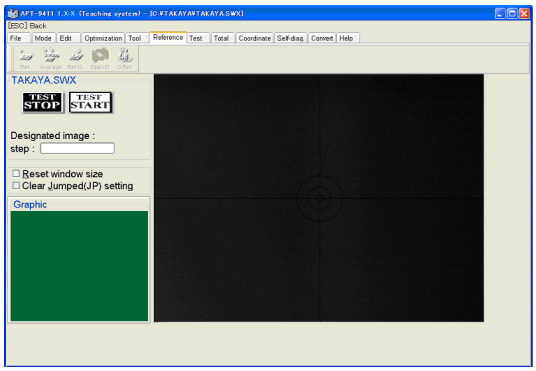
[Sample display-43] Menu bar (Optical Reference Value Input)

15) The Optical Reference Value Input 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) The Optical data input condition window appears. (Sample display-45)



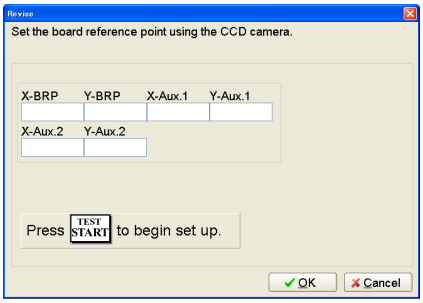
[Sample display-45] Optical data input condition window

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.



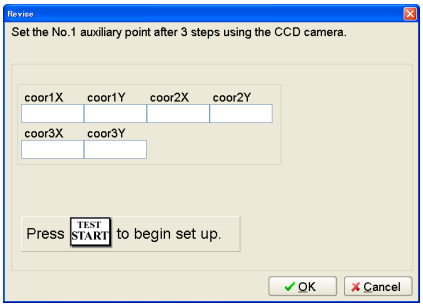
[Sample display-46] Board reference point set

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.



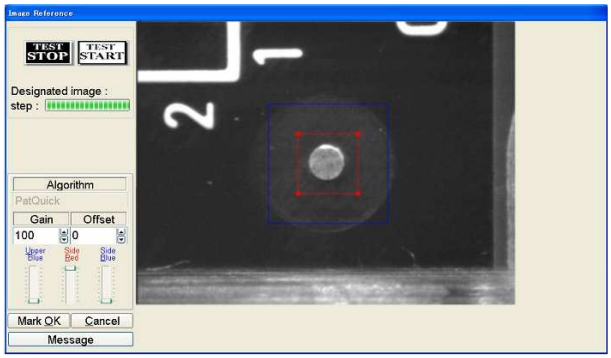
[Sample display-47] Auxiliary point set

24) After “Camera Window” appeared on the display, center the Target marker on No.1 auxiliary point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

25) Center the Target marker on No.2 auxiliary point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

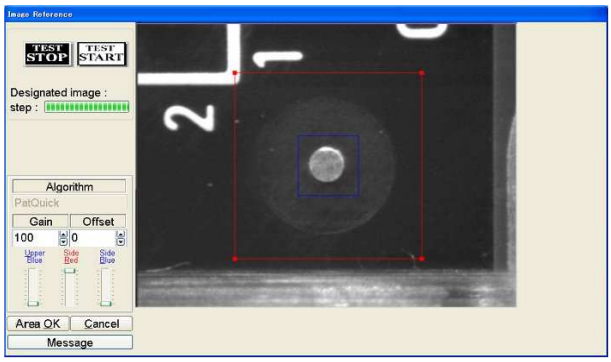
26) Center the Target marker on No.3 auxiliary point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

27) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area. (Sample display-16)
Enclose No.1 auxiliary point 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 No.2 auxiliary point 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 No.3 auxiliary point 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.

Coordinates alignment only in this group

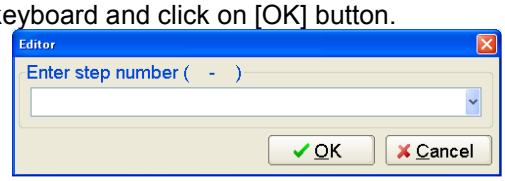
Specify “Coordinates alignment only in this group” function, and the X,Y coordinates in the designated test group are aligned automatically. If this was designated to the test step, “Group-correct” is substituted in the Comment column.

Followings are your operating procedures to set up “Coordinates alignment only in 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))

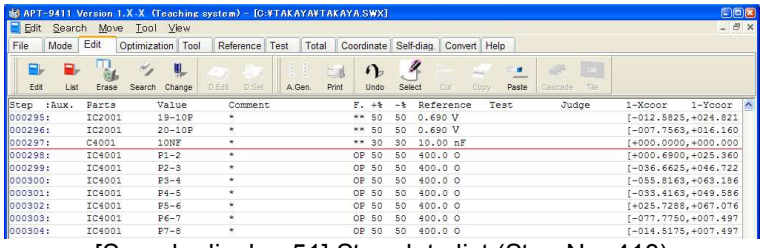
1) Open Step Edit window (Edit > Step Edit) or Step List window (Edit > Step List).

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



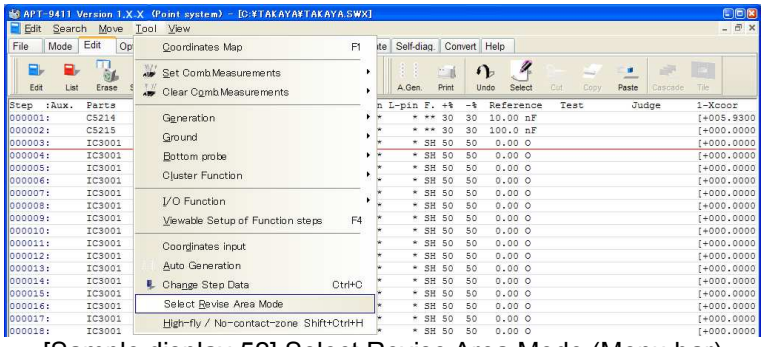
[Sample display-50] Step number input

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



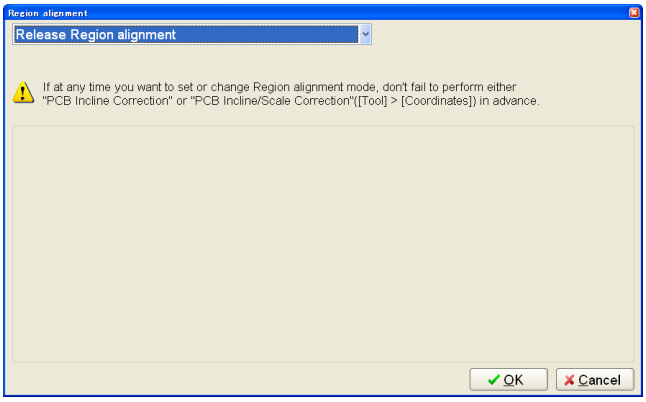
[Sample display-51] Step data list (Step No. 418)

4) Click on Tool to select Region alignment.



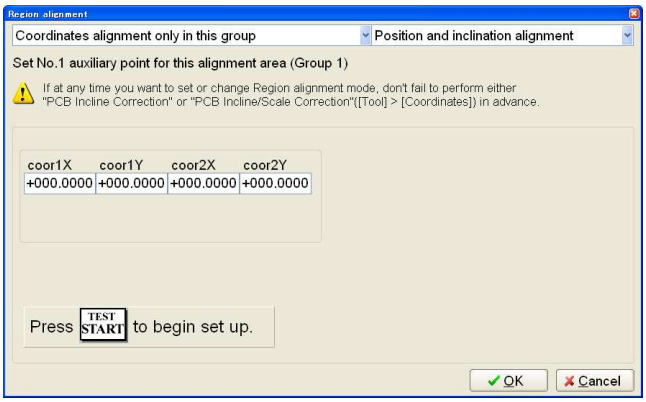
[Sample display-52] Select Revise Area Mode (Menu bar)

5) The Region alignment window appears on the display. (Refer to Sample display-53)



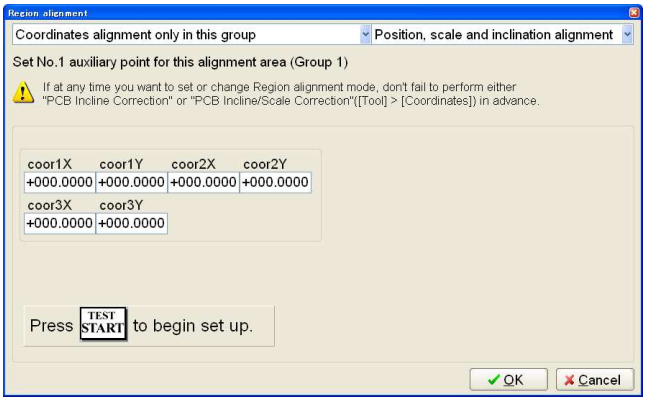
[Sample display-53] Region alignment window

6) Choose “Coordinates alignment only in this group” from a pull-down menu.



[Sample display-54] Region alignment window

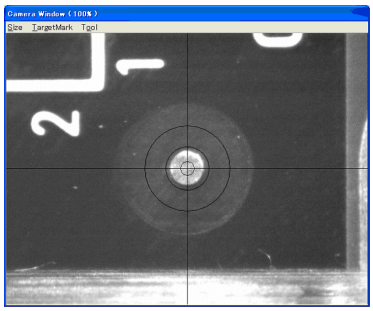
7) Choose “Position, scale and inclination alignment” from a pull-down menu.



[Sample display-55] Region alignment window

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

9) After “Camera Window” appeared on the display, center the Target marker on No.1 auxiliary point in Group #2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.



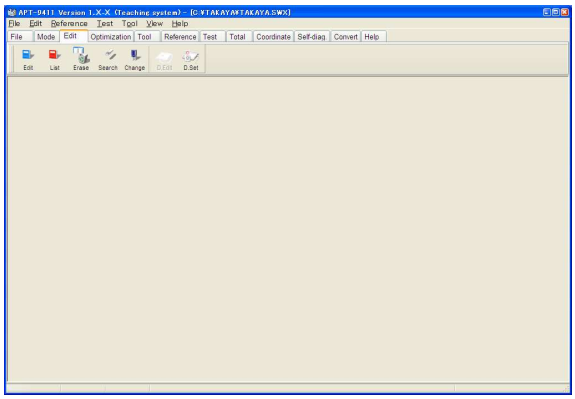
[Sample display-56] Camera Window

10) Center the Target marker on No.2 auxiliary point 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 No.3 auxiliary point in Group #2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates. (Sample display-56)

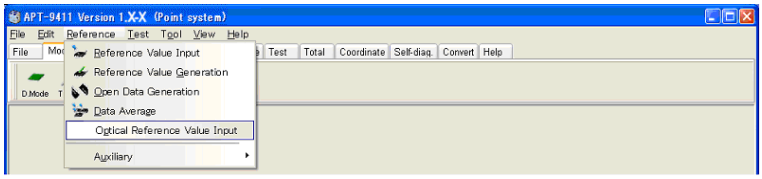
12) After all auxiliary points in Group #2 were set, the display goes back to the step data list, where “Group-correct” is substituted in the Comment column.

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



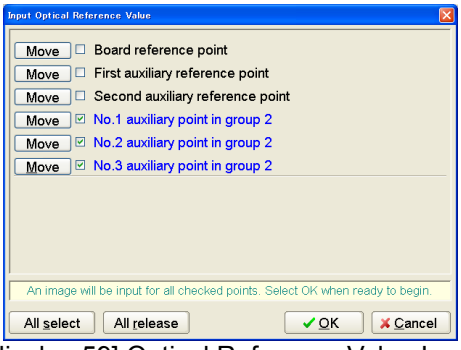
[Sample display-57] Main Window

14) Select Optical Reference Value Input from the Reference menu.



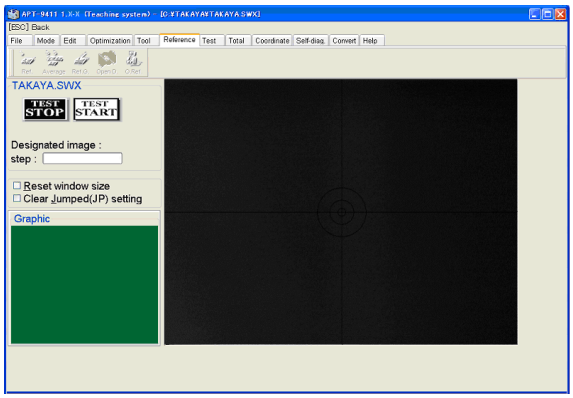
[Sample display-58] Menu bar (Optical Reference Value Input)

15) The Optical Reference Value Input 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) The Optical data input condition window appears. (Sample display-60)



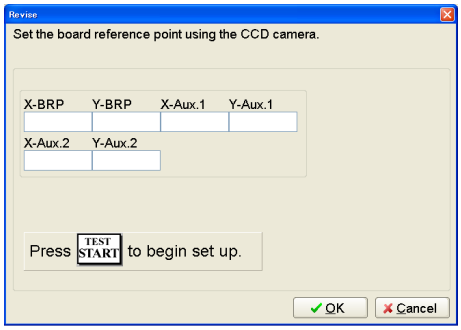
[Sample display-60] Optical data input condition window

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.



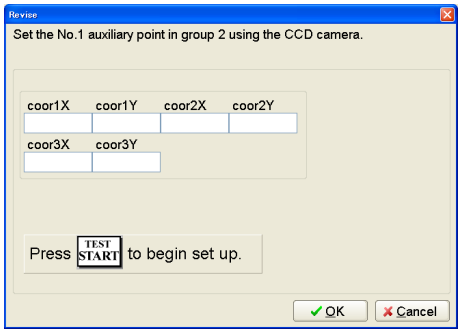
[Sample display-61] Board reference point set

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.



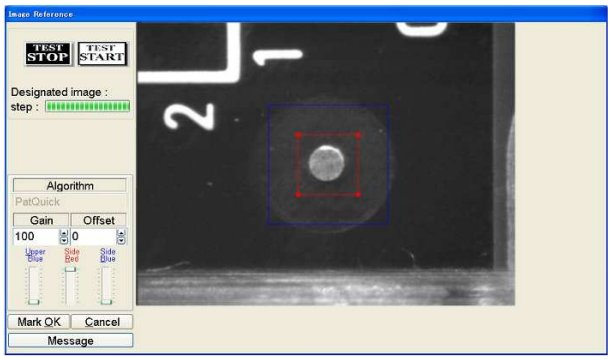
[Sample display-62] Auxiliary point set

24) After “Camera Window” appeared on the display, center the Target marker on No.1 auxiliary point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

25) Center the Target marker on No.2 auxiliary point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

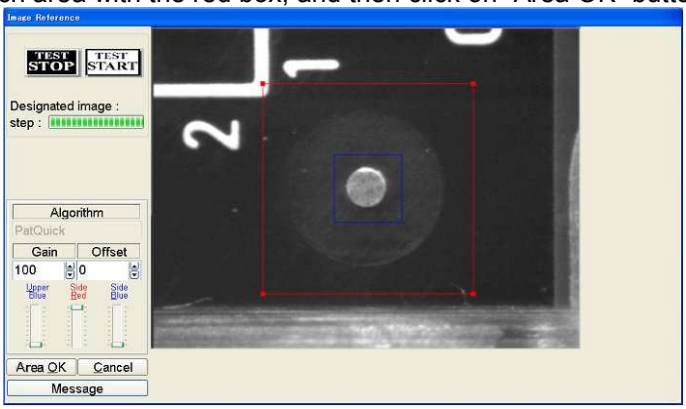
26) Center the Target marker on No.3 auxiliary point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

27) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area. Enclose No.1 auxiliary point 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 No.2 auxiliary point 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 No.3 auxiliary point 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.

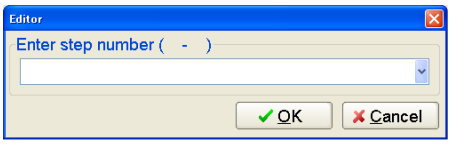
33) When “Image Reference” window was closed, your operation of inputting the image data from auxiliary point 1 to 3 is finished.

Coordinates alignment at the steps using this parts name

Specify “Coordinates alignment at the steps using this parts name” function, and the X,Y coordinates in all steps with the designated parts name are aligned automatically. If this was designated to the test step, “Parts-correct” is substituted in the Comment column.
Followings are your operating procedures to set up “Coordinates alignment at the steps using this parts name” function.
(Ex.) X,Y coordinates of the step data which parts name is “IC5403” are aligned for possible incline & scale.

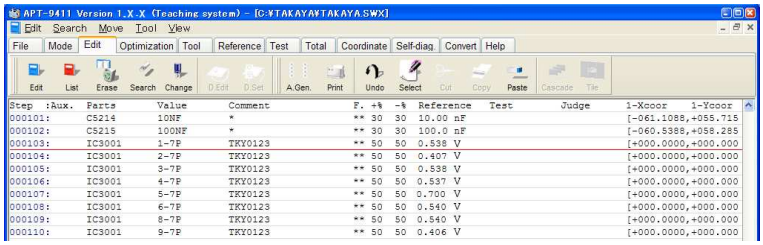
HINT	To align X,Y coordinates in some part of area against possible inclination and/or scale, it must use three fiducial marks. On the other hand, in case of the inclination only, it is enough to use two fiducial marks. (Above excludes both Board reference point and Auxiliary reference point(s))

1) Open Step Edit window (Edit > Step Edit) or Step List window (Edit > Step List).
2) It shows “Enter step number” on the dialog box. Enter the top step number to be aligned on the keyboard and click on [OK] button.



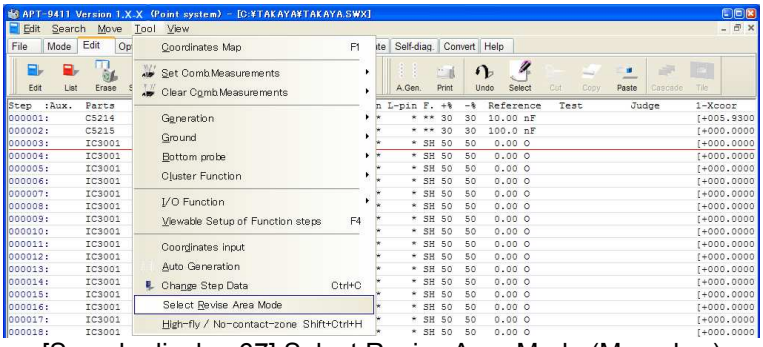
[Sample display-65] Step number input

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



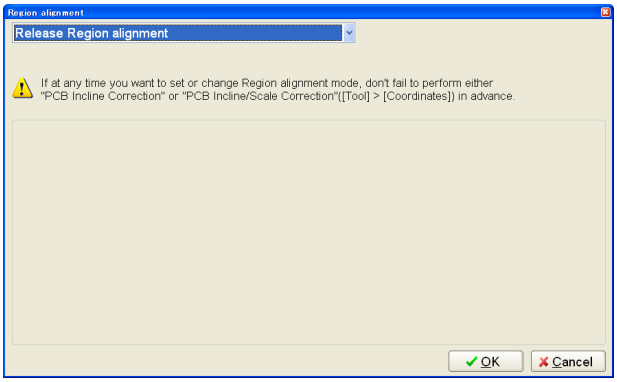
[Sample display-66] Step data list (Step No.103)

4) Click on Tool to select Region alignment.



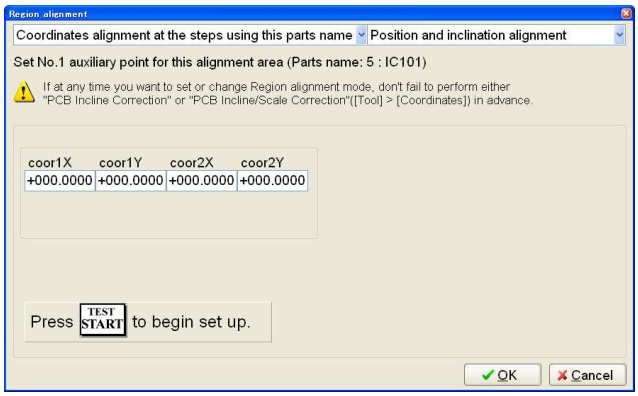
[Sample display-67] Select Revise Area Mode (Menu bar)

5) The Region alignment window appears on the display.



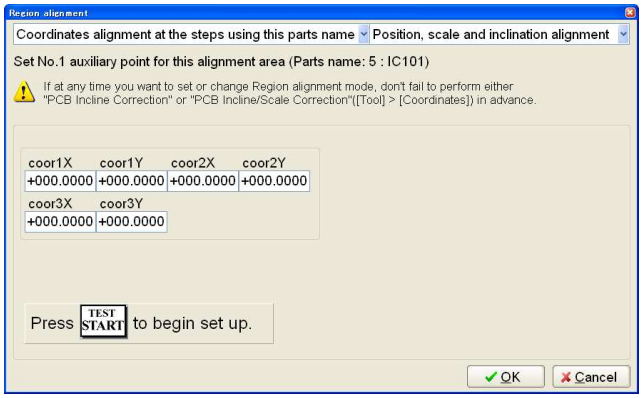
[Sample display-68] Region alignment window

6) Choose “Coordinates alignment at the steps using this parts name” from a pull-down menu.



[Sample display-69] Region alignment window

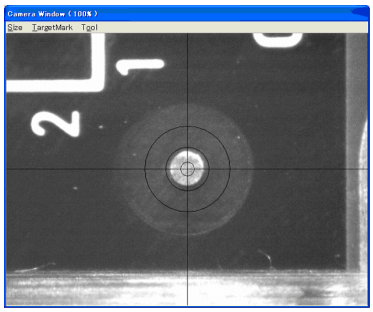
7) Choose “Position, scale and inclination alignment” from a pull-down menu.



[Sample display-70] Region alignment window

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

9) After “Camera Window” appeared on the display, center for your assigned area using the keypad arrow keys on the operation panel, then press [ENTER] the Target marker on No.1 auxiliary point SW to enter the coordinates.



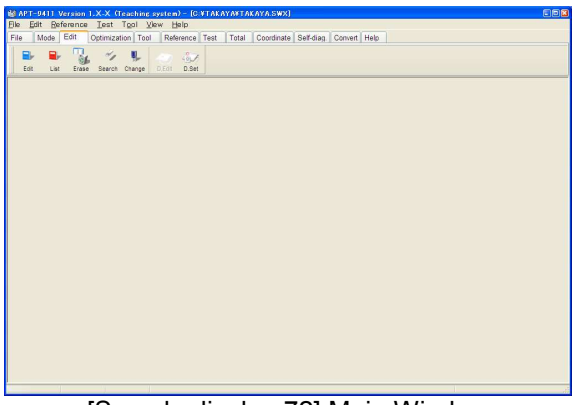
[Sample display-71] Camera Window

10) Center the Target marker on No.2 auxiliary point 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 No.3 auxiliary point for your assigned area using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.
(Sample display-71)

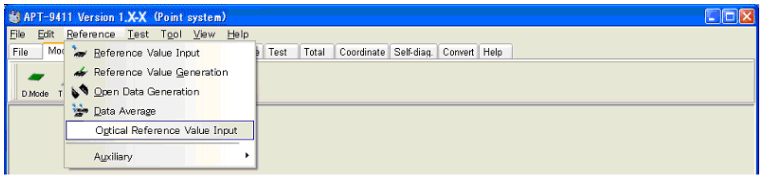
12) After all auxiliary points were set, the display goes back to the step data list, where “Parts-correct” is substituted in the Comment column.

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



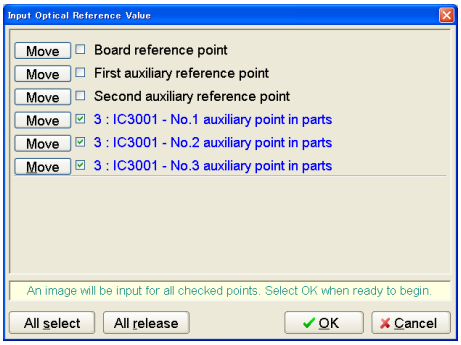
[Sample display-72] Main Window

14) Select Optical Reference Value Input from the Reference menu.



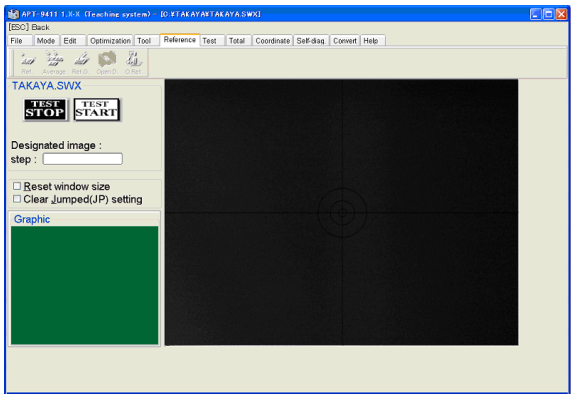
[Sample display-73] Menu bar (Optical Reference Value Input)

15) The Optical Reference Value Input 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)



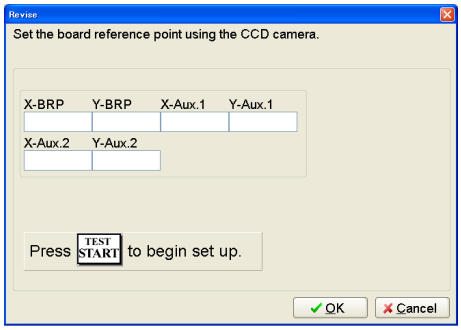
[Sample display-75] Optical data input condition window

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.



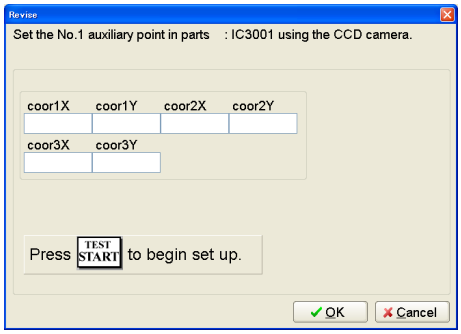
[Sample display-76] Board reference point set

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.



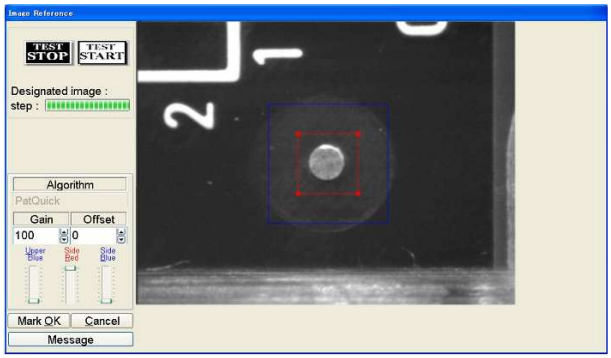
[Sample display-77] Auxiliary point set

24) After “Camera Window” appeared on the display, center the Target marker on No.1 auxiliary point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

25) Center the Target marker on No.2 auxiliary point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

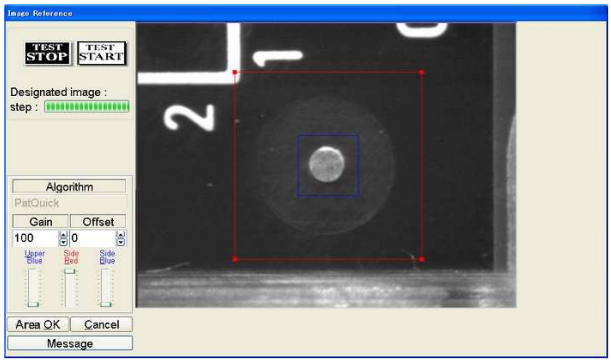
26) Center the Target marker on No.3 auxiliary point using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

27) It shows “Image Reference” window, where are two boxes indicating Image processing area and Search area. Enclose No.1 auxiliary point 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 No.2 auxiliary point 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 No.3 auxiliary point 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

The Simple Vision Test Function available in Vision System TOS-5/TOS-4/TOS-41 enables to 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.

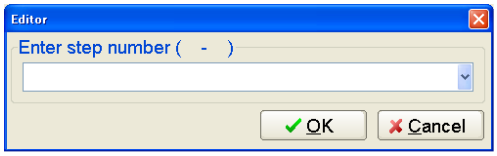
DATA PROGRAMMING PROCESS

1. Polarity check of Tantalum capacitors

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

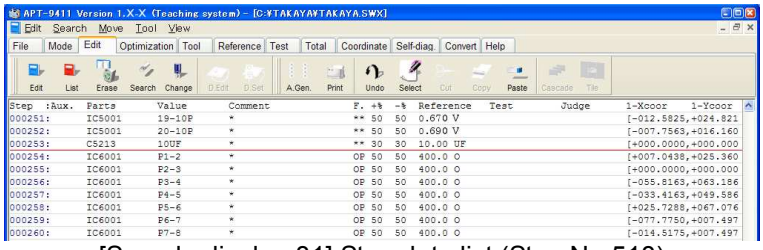
1) Open Step Edit window (Edit > Step Edit) or Step List window (Edit > Step List).

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



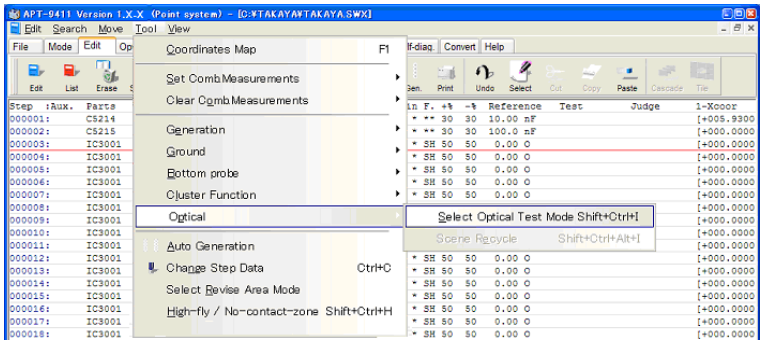
[Sample display-80] Step number input

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 window. (Tool > Optical > Select Optical Test Mode)

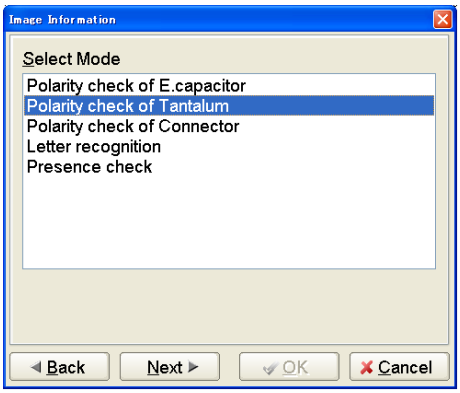


[Sample display-82] (Tool > Optical > Select Optical Test Mode)

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.

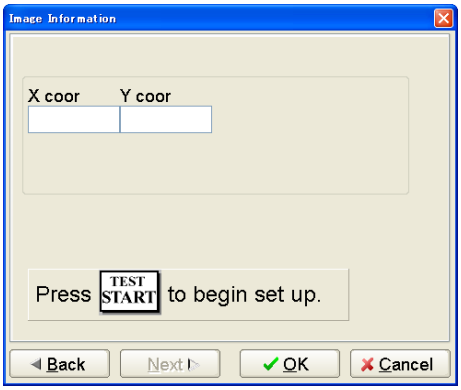
6) The camera moves to the Board reference point, then to the Auxiliary reference point(s) to align inclination and/or scale of the board automatically.

7) It shows “Select Mode” window (Sample display-83).
After selected “Polarity check of Tantalum”, click on [Next] button.



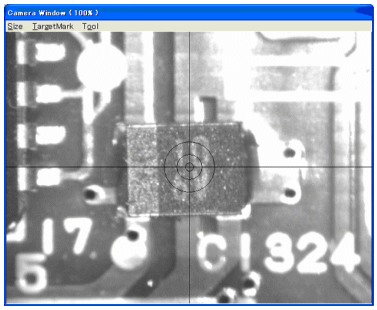
[Sample display-83] Select Mode window

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.

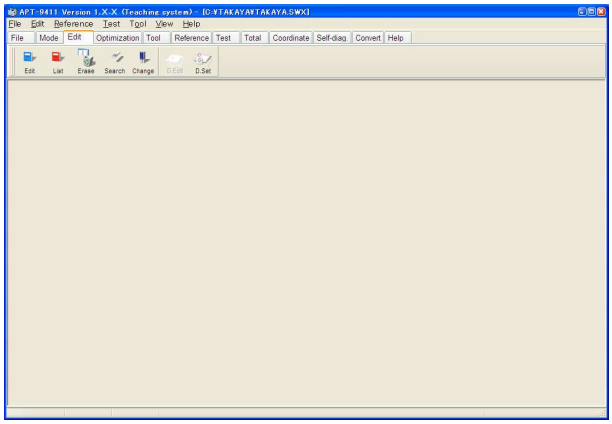


[Sample display-85] Camera Window

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

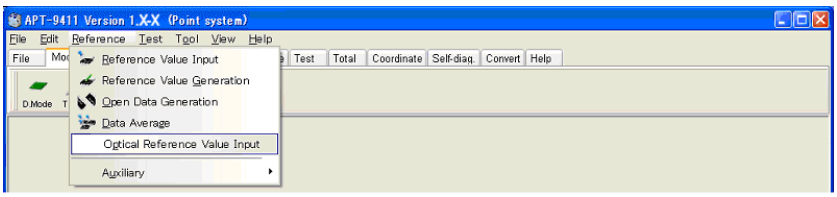
11) The display goes back to the step data list. On your assigned test step (518 step), you see “T.Capa.-Image.” is already substituted in Comment column and also “IM-T.” in Aux. column.

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



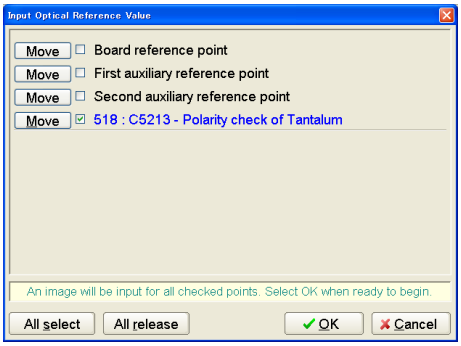
[Sample display-86] Main Window

13) Select Optical Reference Value Input from the Reference menu.



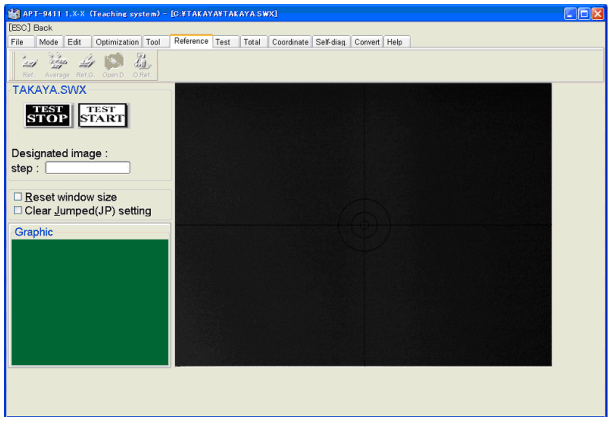
[Sample display-87] Menu bar (Optical Reference Value Input)

14) The Optical Reference Value Input 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) The Optical data input condition window appears.



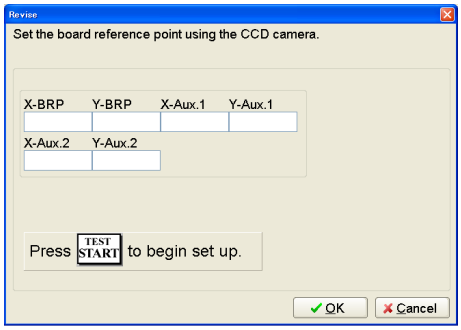
[Sample display-89] Optical data input condition window

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.



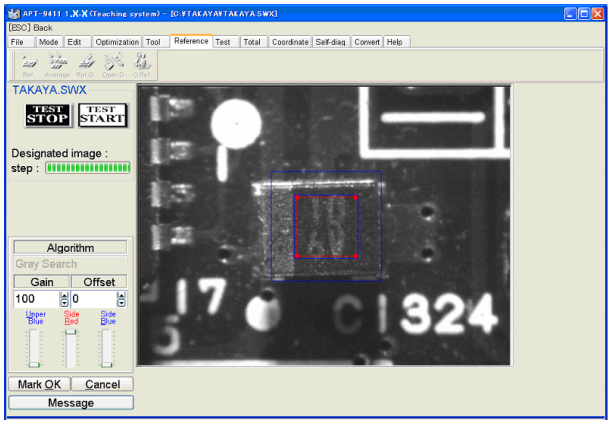
[Sample display-90] Board reference point set

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.

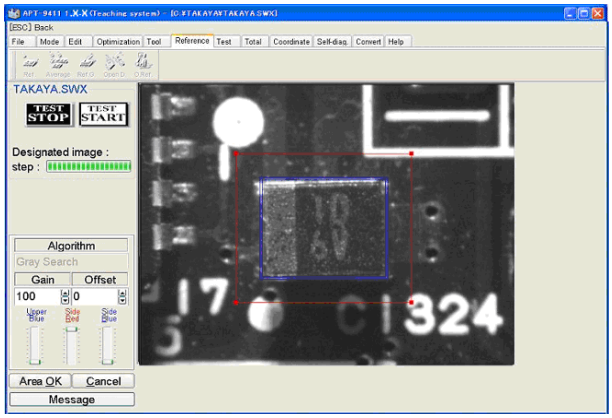
21) Center the Target marker on the Auxiliary reference point-2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

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

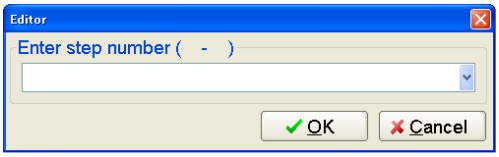
24) When “Image Reference” window was closed, your operation of inputting the image data for the C5213 is finished.

2. Presence check

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

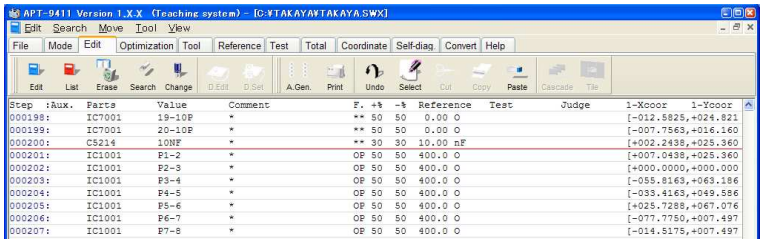
1) Open Step Edit window (Edit > Step Edit) or Step List window (Edit > Step List).

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



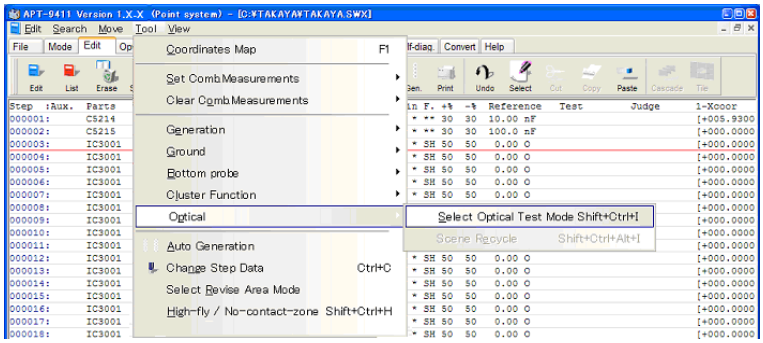
[Sample display-93] Step number input

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 window. (Tool > Optical > Select Optical Test Mode)

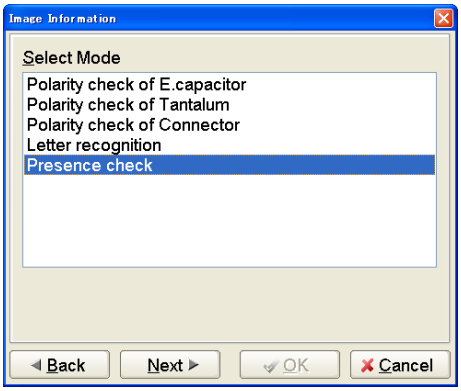


[Sample display-95] (Tool > Optical > Select Optical Test Mode)

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.

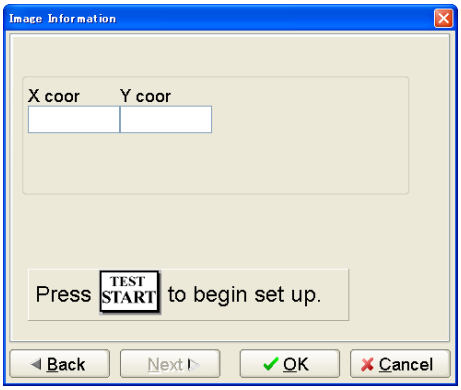
6) The camera moves to the Board reference point, then to the Auxiliary reference point(s) to align inclination and/or scale of the board automatically.

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



[Sample display-96] Select Mode window

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



[Sample display-97]

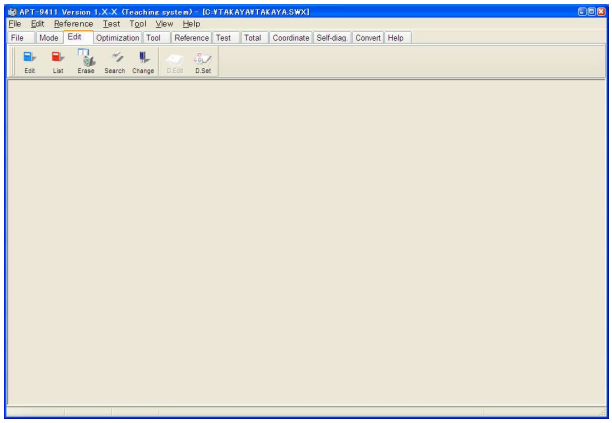
9) After “Camera Window” appeared on the display, center the Target marker on the objective device (C5214) using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

[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” window.

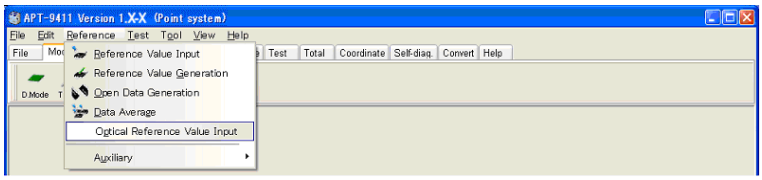
11) The display goes back to the step data list. On your assigned test step (518 step), you see “Parts-Image.” is already substituted in Comment column and also “IM-Pa” in Aux. column.

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



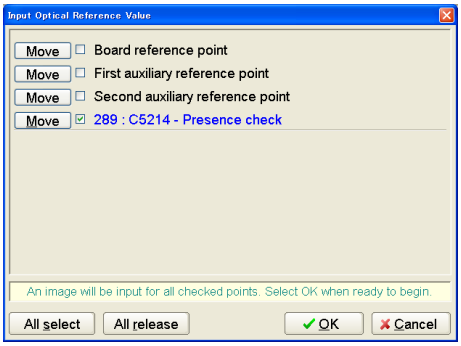
[Sample display-99] Main Window

13) Select Optical Reference Value Input from the Reference menu.



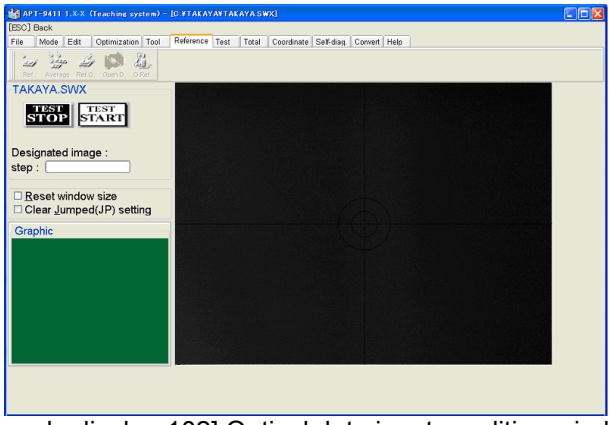
[Sample display-100] Menu bar (Optical Reference Value Input)

14) The Optical Reference Value Input 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) The Optical data input condition window appears. (Sample display-102)



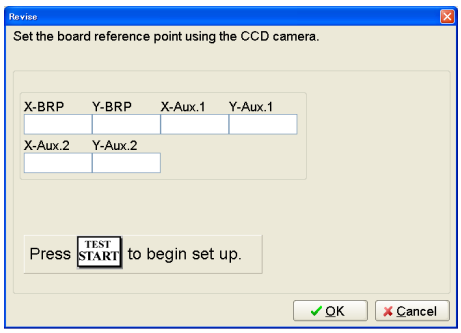
[Sample display-102] Optical data input condition window

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.



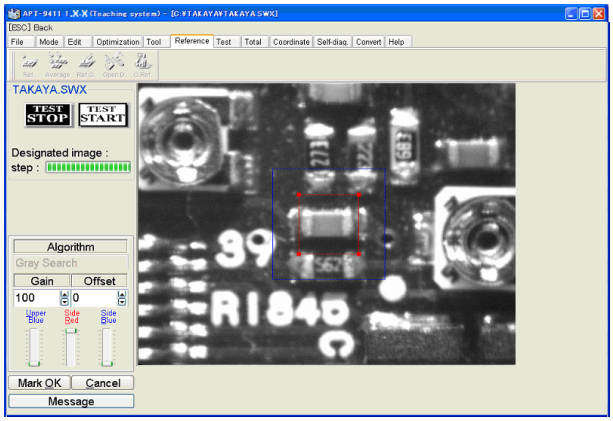
[Sample display-103] Board reference point set

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.

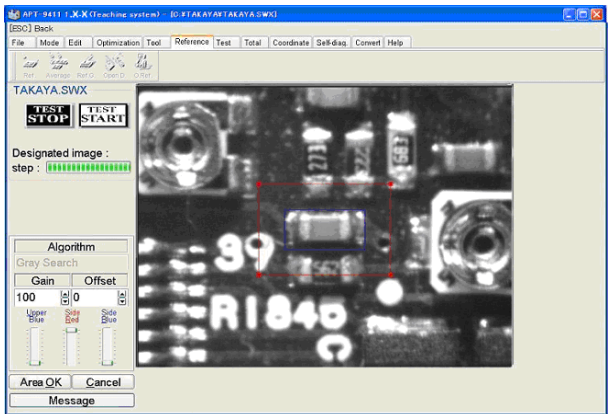
21) Center the Target marker on the Auxiliary reference point-2 using the keypad arrow keys on the operation panel, then press [ENTER] SW to enter the coordinates.

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

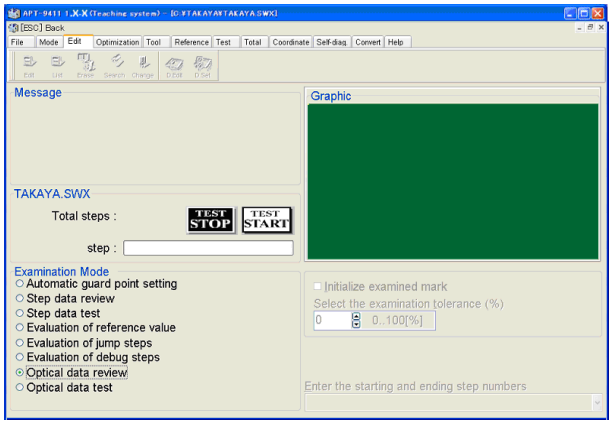
24) When “Image Reference” window was closed, your operation of inputting the image data for C5214 is finished.

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 functions are selectable from Sample display-106 below (Test > Review Step data).

The Optical data review function is used for evaluating and/or changing the measuring conditions.
The Optical data test function is used for assuring of the stability of the optical test.

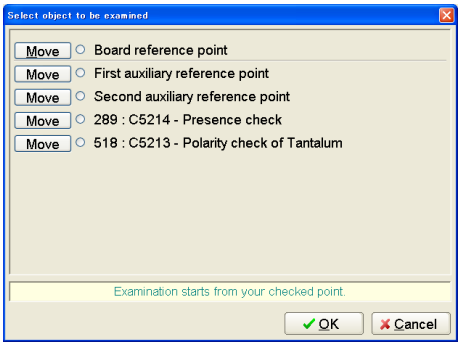


[Sample display-106] Data Examination window (Main display)

Optical data review

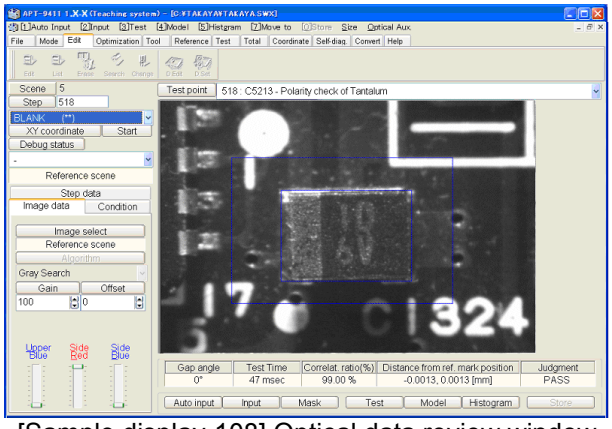
Selecting “Optical data review” from Sample display-106 then pressing [TEST START] SW on the operation panel, a message “Use board ref. point and aux. ref. point for alignment?” appears.

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)

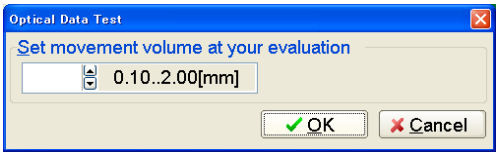


[Sample display-108] Optical data review window

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.

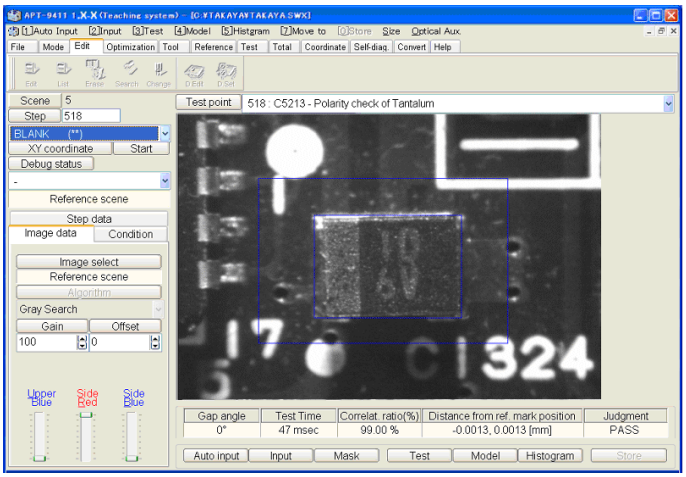
Then click on [Yes] button and align possible inclination/scale of the board using [TEST START] SW and the keypad arrow keys on the operation panel, so that Sample display-109 appears.



[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.



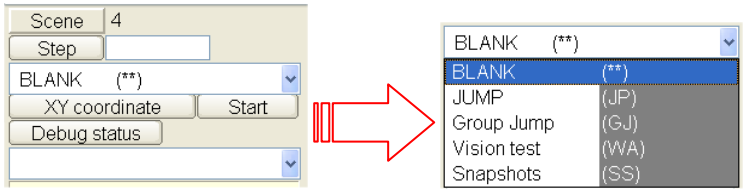
[Sample display-110] Optical data test window

Optical data review

The Optical data review window (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 window

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)



[Sample display-112]

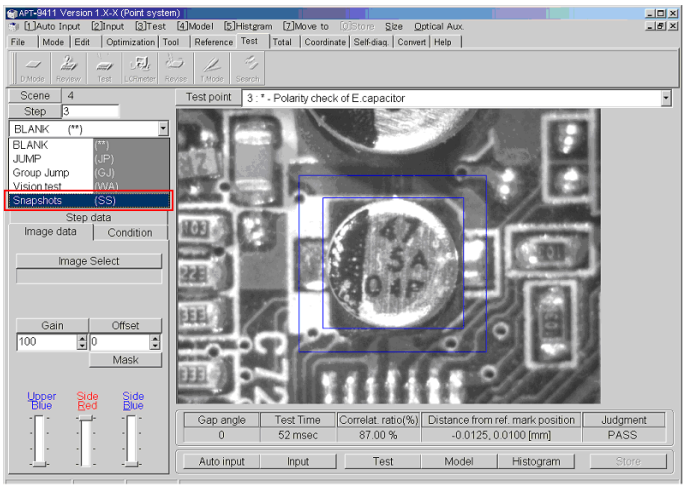
Scene	:	Scene number of optical data under evaluation (not changeable)
Step	:	Step number of optical data under evaluation In case of the Board reference point or the Auxiliary reference points, the step number is not displayed. After specified any step number and hit [Enter] key, the window jumps to 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

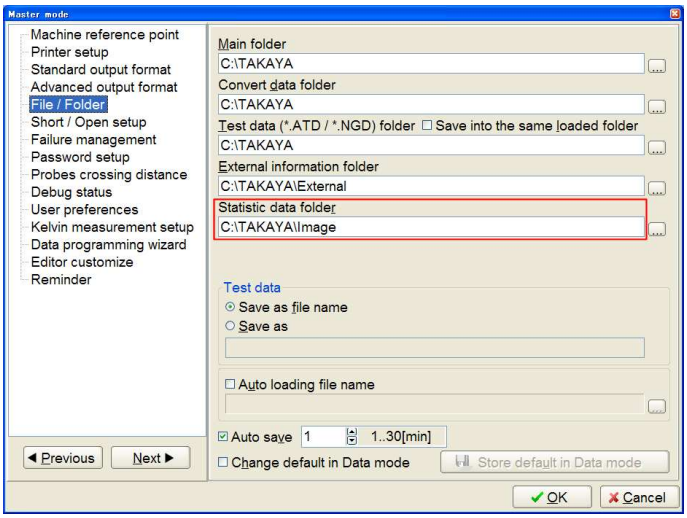
[Sample display-112_1] Optical steps



[Sample display-112_2] Optical Data Review window

(**Remarks**)

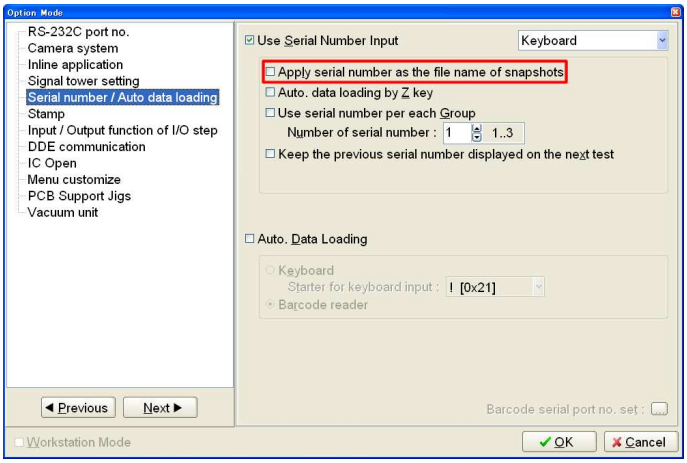
1. The registration destination folder is configured by “Image data folder” on File/Folder menu (Master Mode) and the program name.
   For example, when Image data folder is set for C:¥TAKAYA¥Image (default) and Program name is 123456789.SW92, the registration destination folder is C:¥TAKAYA¥Image¥123456789.



[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.

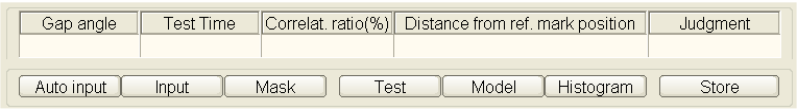
   If the check box for “Apply serial number as the file name of snapshots” is cleared, the file name is “Date + Time + Step number”.
   For example, now is December 13, 2005 PM13:18 and step number is 1, the file name is 0512131318.



[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 window is used to display the evaluation result, reinput the objective image data, and so on.



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

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 the 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 combo box of “Gap angle”, “Test time”, “Correlat. ratio”, “distance from ref. mark position” and “Judgment”.

Model

Reference image is displayed on the screen.

Histogram

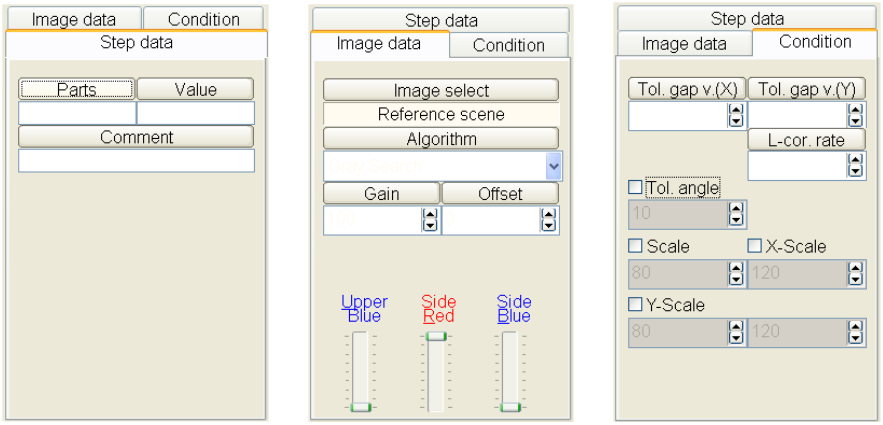
The comparison is made to the histogram value (parameter) of both the object under test and the reference image. With the histogram the gray value ratio is displayed by a graph.

Store

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

Auxiliary Menu Tab

There are three Menu tabs (“Step Data”, “Image Data” and “Condition”) at the left of the Optical data review window. (Sample display-114)



[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 are displayed 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 Polarity 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

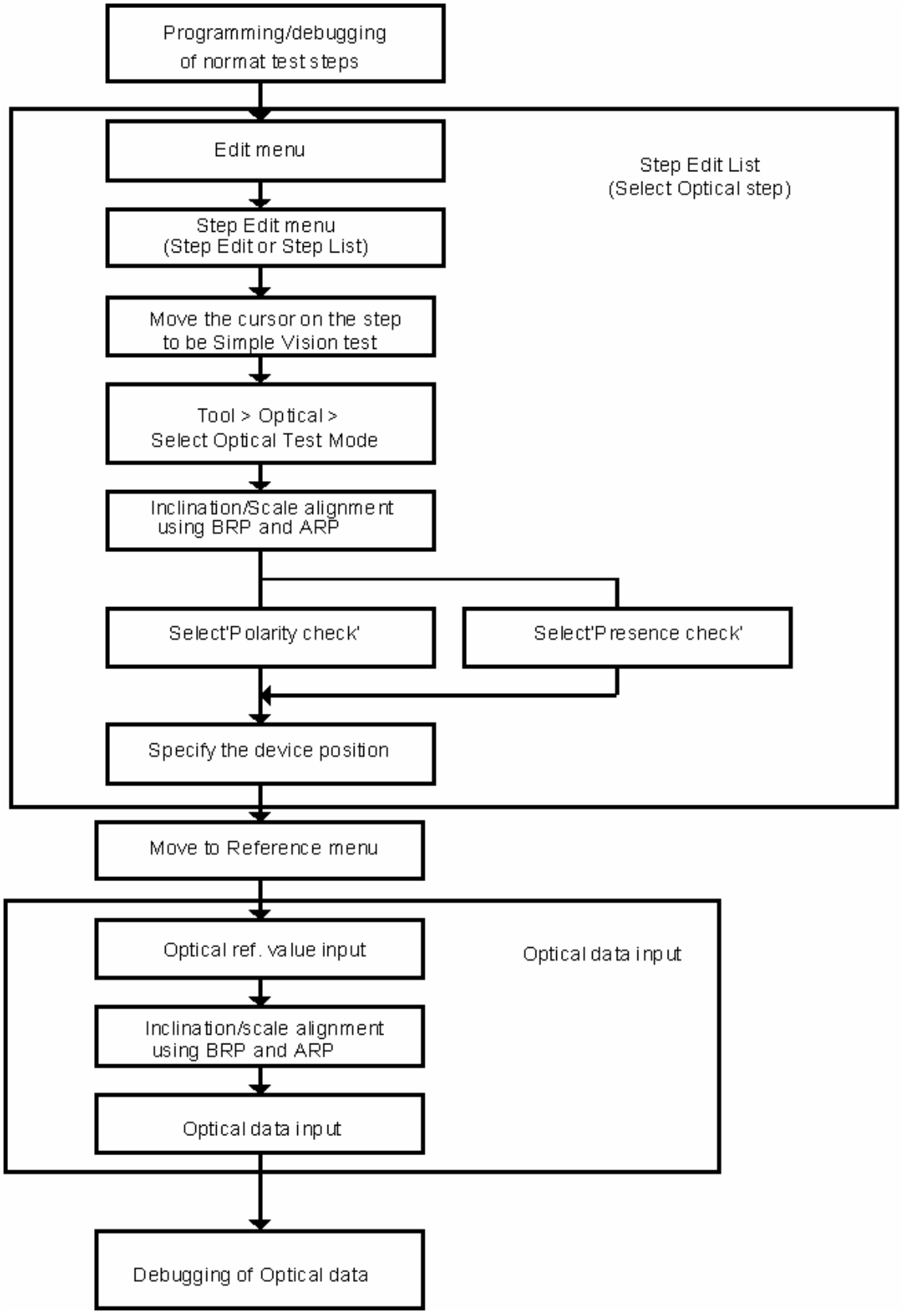
Condition of pass/fail judgment is displayed and changeable.

“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”.

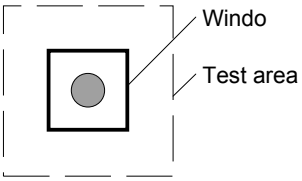
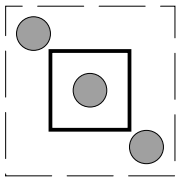
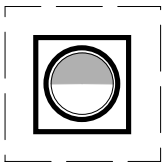
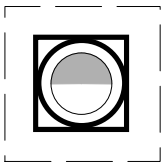
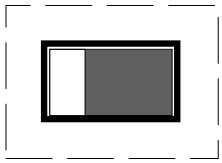
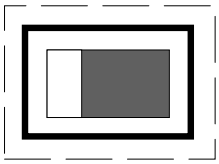
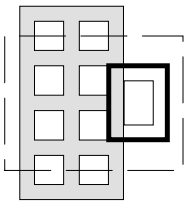
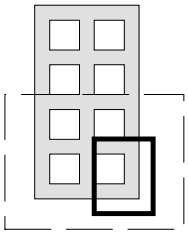
Simple Vision Test Programming flow

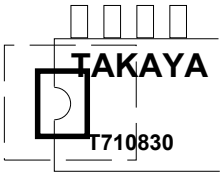
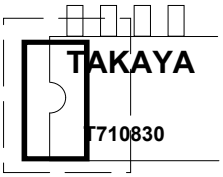
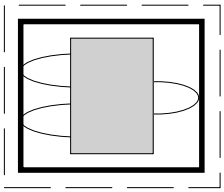
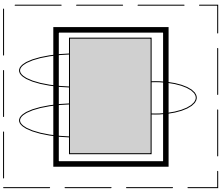
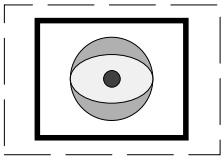
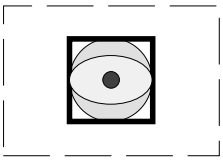
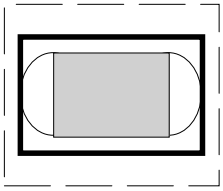
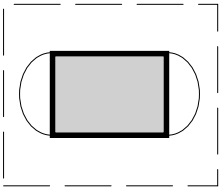
The drawing below indicates a sample flow of data programming for the Simple vision test.



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	

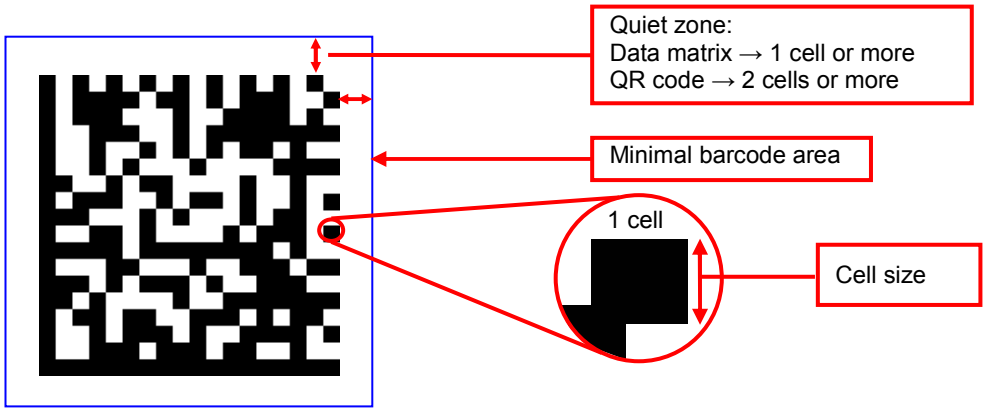
Barcode reading by camera

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

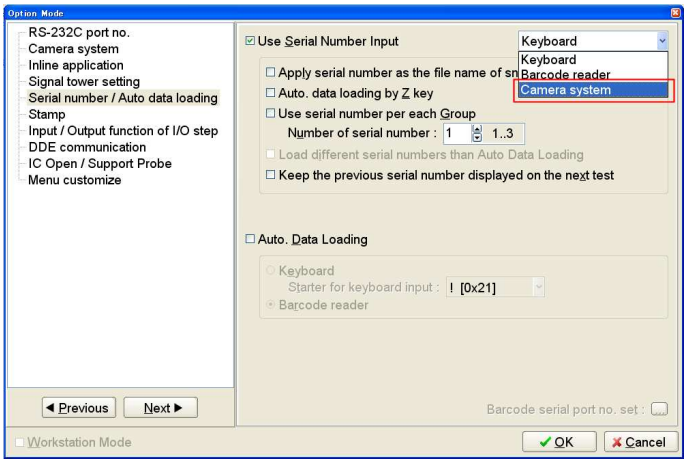
(2) Barcodes

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).



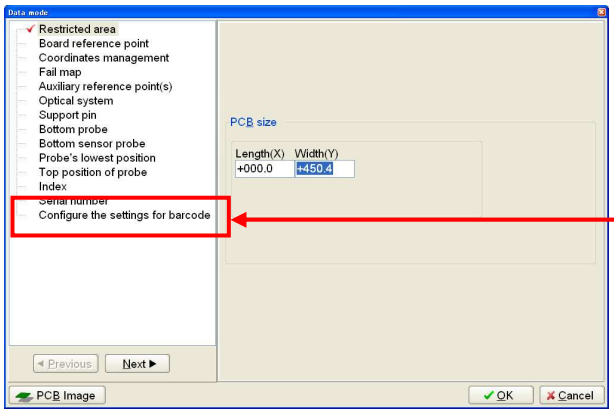
[Sample display-115] Serial number / Auto data loading

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

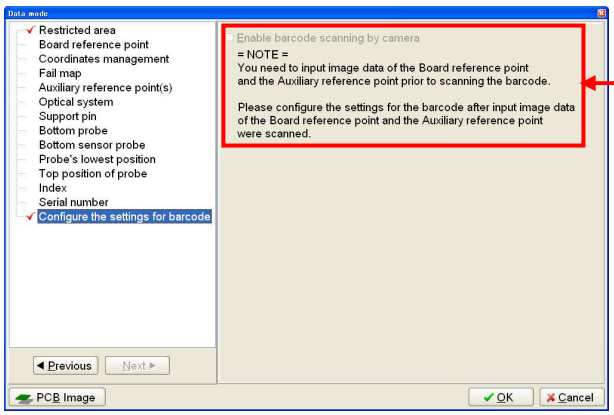
1) Move to Data mode > Configure the settings for barcode.



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.

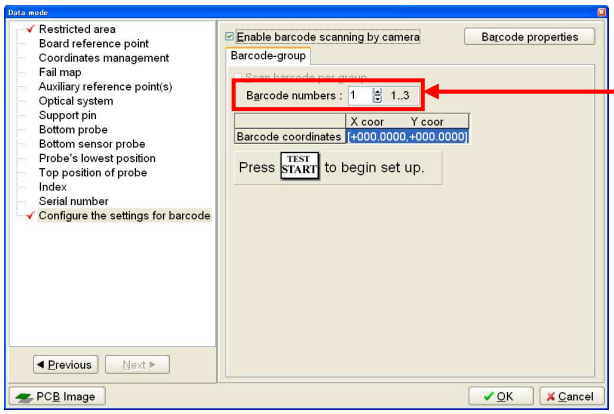
[Sample display-116] Data mode



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.

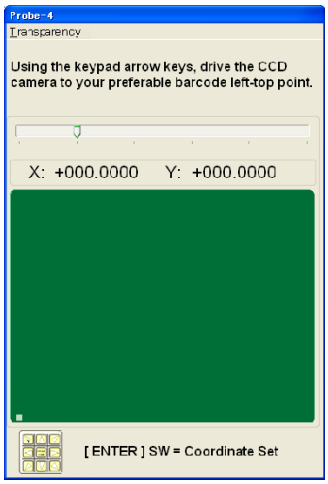


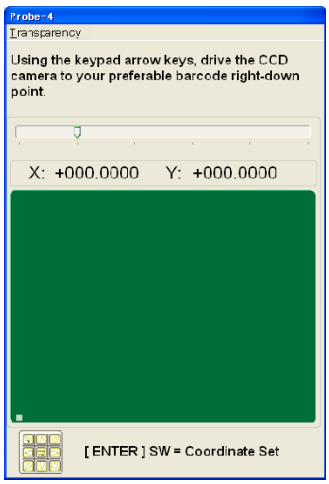
Scan barcode per group

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

[Sample display-118] Configure the settings for barcode

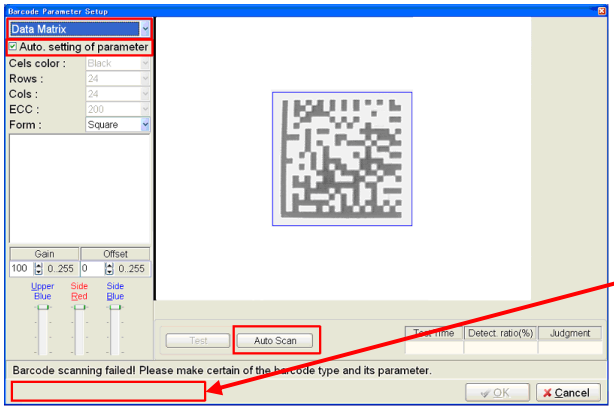
3) Press the Test Start button to specify the XY coordinates at the left-top and the right-bottom of the barcode.





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.

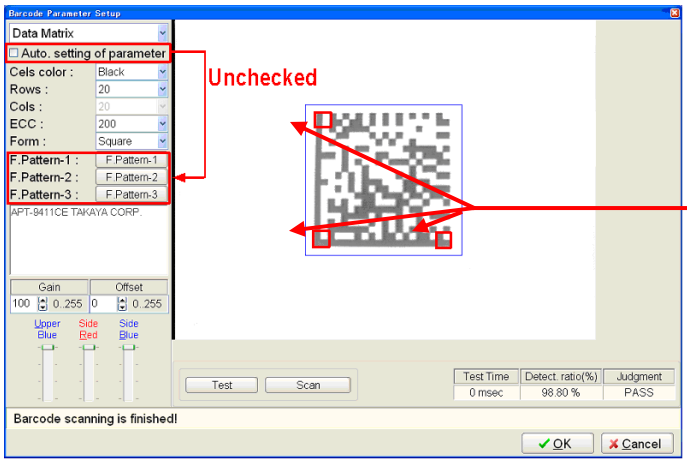


When the check box for “Scan barcode per group” is filled, press following button to move the properties menu for each group

[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;



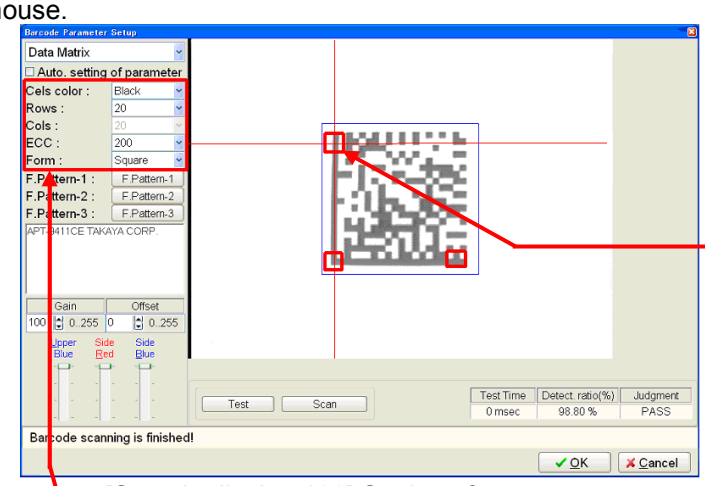
Finder pattern:

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

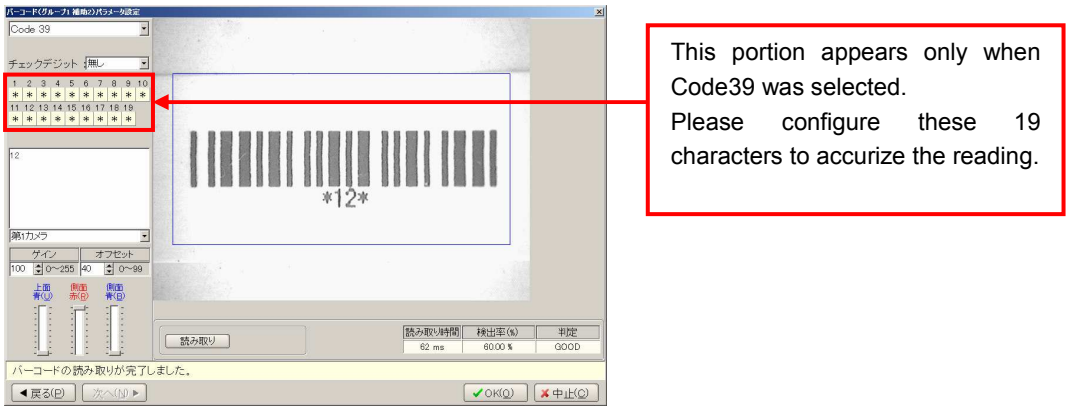
Cols : Number of laterally-facing cells (needs to set only when Form is rectangle)

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

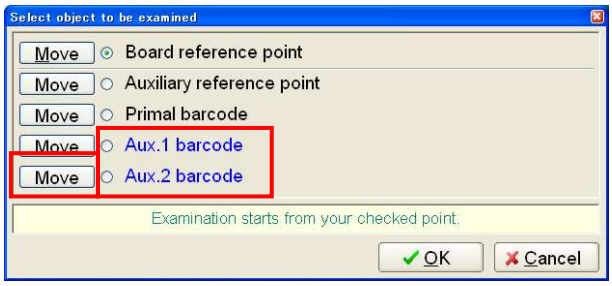
Character set for Code 39

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

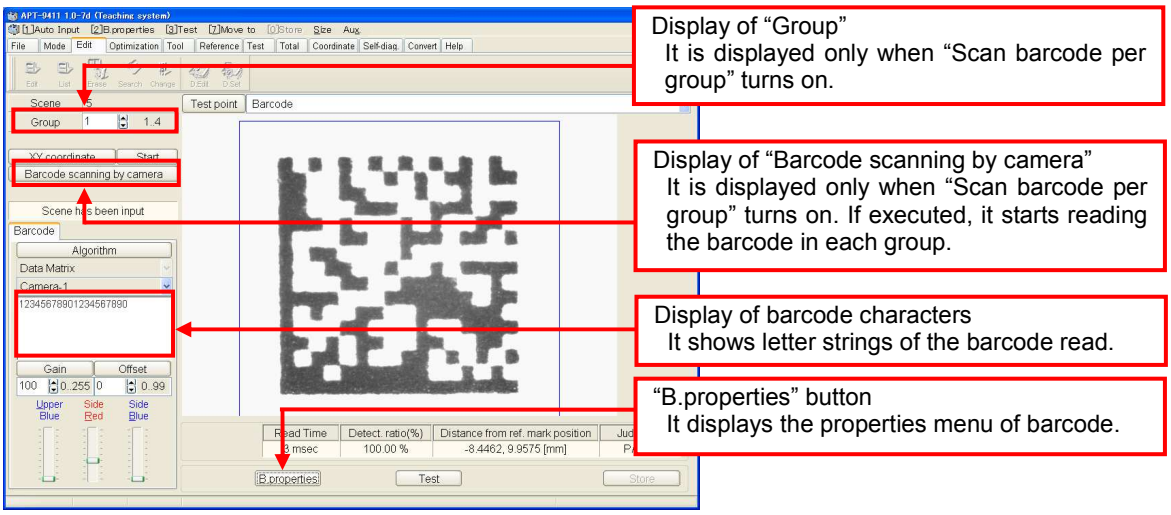


[Sample display-122] Optical data review

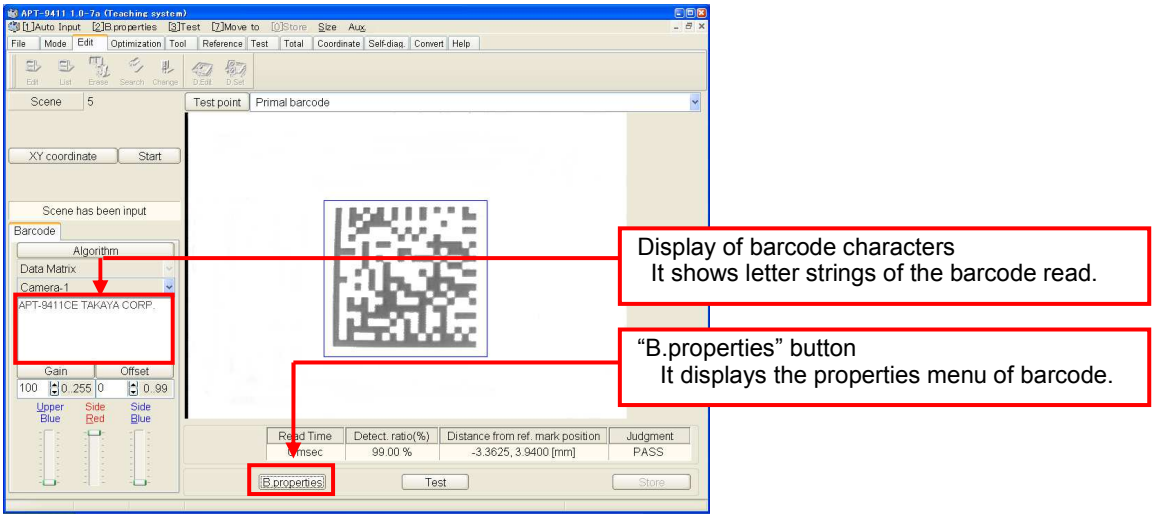
When the barcode label is not recognized with accuracy due to incorrect configuration in the barcode properties, they are displayed in blue color.
In addition, if pressing “Move” button next to the barcode step, the camera drives to XY the coordinates in Group 1.

2) Optical data review

When the barcode image needs to be examined, move to the Optical data review window (Refer to [Sample display-123]). On this window, 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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