n=1 Checker Operating Functions

Version 1.0

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1. Abstract

1) What n=1 Checker DOES

n=1 Checker is used for testing and verifying the components which are mounted on the printed circuit boards (PCB). As n=1 Checker has functions of automatic testing of impedance and visual inspection support, and these functions are operated by moving test head to the target component in 3 dimensions, fixtureless testing is available. Entering test data, UUT board can be tested in fixtureless mode.

As mentioned above, n=1 Checker has ability to measure impedance with visual inspection function, the operator can verify the mounted component visually. Also operating process and control buttons are displayed on the PC monitor, the operator can enjoy well designed GUI (Graphical User Interface).

2) Test Process

① Generate Test Data for n=1 Checker (n=1 Checker Data).

② Test operation preparation (Boot up software, Power on, Set Target Board, etc.).

③ Automatic testing of R, L, C components.

④ Visual Inspection by Visual Inspection mode. Verification is made by the operator manually.

2. Effect of Using n=1 Checker

1) Verification and Confirmation of Pilot Run Board before Mass Production

Before mass production, it is mandatory to test and verify the board which has been newly designed and going to be manufactured. Normally, pilot run board is taped by adhesive tape so components are mounted on the adhesive tape. Testing and verifying pilot run board helps verify the Mounting Machine Program, Setting Error of Reel Components in the Magazine, Displacement of Components, and/or Placement Orientation.

Combination of Automatic Testing and Visual Inspection helps reduce time to market, and double checking by the operator for the display of ccd camera and expected data minimizes human error. Tested data logging is also available.

2) Confirmation of Switching Lines

When switching lines, many portions of the Mounting Machine would be changed for Reel, Components, Mounting Program, etc. A very short time to

test Pilot Run Board by n=1 Checker helps manufacturers confirm correctness of the board before mass production, and productivity is expected.

3) Testing Small Lot Boards

n=1 Checker could be used as for an In Circuit Tester for small lot boards using correct board information as the master data, then measured UUT board data could be verified against master data. This is a fixtureless measurement and test program is easily generated with mounting data and part list, so if various small productions are scheduled, cost down could be expected.

3. Individual Functions

3.1 Automatic Impedance Measurement

1) Abstract

3 dimensional robot selects and moves probes around. Once correct probe is selected according to the shape of the component with correct angle, mounted chip component is measured by RLC meter. Measured data is verified against expected data, then judgment is made.

2) Automatic Verification for Measured Impedance

Setting n=1 Checker mode to "T" provides automatic impedance measurement function, and automatic verification is made. Sort of component is verified automatically against expected sort of component or location information. Also, the measurement process is displayed on the monitor so the operator can check and verify manually.

3) Data Acquisition Function for Impedance Measurement

Measured impedance data can be stored in the tester. Based on the stored data, it is possible to generate test program using stored data as the master. When the test voltage of 50mVp-p is selected, test is made without turning power on the IC protecting diodes, so the effect of current which come in to the circuit is minimized.

3.2 Automatic Impedance Measurement

1) Abstract

① Robot moves ccd video camera around, so monitor displays UUT device in a real time manner.

② Because expected characters and numbers are automatically displayed

on the monitor, the operator can easily check whether displayed data is exactly the same to the expected one or not.
③ If the image display shows over sized, adjustment is made by moving around and/or rotating camera manually.
④ If the operator wants to check and confirm sort of component or orientation, operation mode or flag function will help modify and/or add characters individually.

2) Check and Confirmation of Sort of Component

To check the component whether displayed information matches the expected data, visual inspection for the size of component or displayed characters will confirm the inspection. Operation mode would be selected either to "H" or "W" mode. Where,
"H" (HOLD) Mode: After the checked data is displayed, n=1 Checker holds its operation until the operator commands next step or final judgment is made. (Note: When judgment data is input, test step is automatically forwarded.) This way, "H" mode is used when the operator needs to check data precisely.
"W" (WAIT) Mode: Image data is displayed for certain period (variable), then moves on to next test. If the displayed data does not match the expected data, the operator can stop operation, register as NG, then move to next test step. This mode is used when the test sequence is fixed, and the operator wants to test components quickly.

3) Mounting Orientation and Polarity Check

Whether the component is mounted correctly for Position and Orientation, #1 Pin Mark, + Mark and Cathode Mark are used to check. Operation mode would be either "H" or "W". If the expected data is stored in the FLAG column, Mark Information is displayed in corresponding position. Judgment is made based on whether image data matches expected data.

4) No Component Mounting Check

This is "N" mode, which confirms the location where NO component is expected to be mounted. Operation wise, "N" mode works like "H" mode, but the Confirmation Request to check location is displayed.

5) Registration of Result

Visual Inspection judgment result must be registered for each component. Different operation mode brings with different operation procedure as follows:

"H" Mode:

If "OK" - Pushing "RELEASE" button automatically registers as OK, then moves on to next procedure automatically.

If "NG" - Pushing corresponding button registers as NG, and automatically moves on to next procedure.

"W" Mode:

If "OK" - If certain period elapses, "OK" registration is automatically made, then moves on to next procedure.

If "NG" - First, push "PAUSE" button so operation is halted, push corresponding "NG" item, then moves on to next operation automatically.

"NG" items include Displacement, Miss Mounting Degree, No Component, and Miss Mounting.

3.3 TPG (Test Program Generator)

1) Abstract

TPG is the software which generates Test Program automatically. Following data file and procedure are needed.

① Compiling Part Library (a file which contains all the parameters of each component based on Part Code) , CAD Data, Mounting Data, Part Table Data, Operating Parameters and Check Items, n=1 Checker Data File is (board name.csv) generated.

② MS-EXCEL based editing function is used to amend or modify displayed TPG data on the monitor.

③ Generated n=1 Checker data can be reversely used to register component data to Part Library.

④ Testing Procedure, then could be sorted to maximize test speed or productivity.

2) List of Generated Data

- Sort of Component (R, L, or C)
- Location
- Part Code (*1)

- Mounting X-Y Coordinates
- Size of Component
- Height of Component (*2)
- Mounting Degree (*3)
- Constant, Lower Limit and Upper Limit (Impedance Value)
- Flag (Option for Checker Operation, *4)
- Printed Characters (expected data by Visual Inspection)
- Test Mode (Impedance Measurement, Visual Inspection, *4)

*1: TPG refers to Library File based on Part Code as key information. When compiling data, if library exists according to each part, each parameter is automatically entered. Reversely, entered n=1 Checker Data can be used for modifying and re-registering library on the TPG software.

*2: If the height of component is unknown, AUTO SEARCH mode which searches height of component automatically when UUT is tested could be applied. Then, registering optimized height will help no action needed from next time.

*3: If component mounting degree or printed character is unknown when operating TPG, preliminary data can be stored and run test program. Visual inspection with video camera will confirm real value of degree and character so data can be registered. This is a convenient way when unknown data exists.

*4: Test mode could be determined according to realistic test program running mode. Detailed operation options are available by assigning following Mode and Flag functions.

Operation Mode – H, W, T, N and J

Flag: #1 Pin Mark, + Mark, Cathode Mark Assignment and Measurement Flag Assignment for Module Component.

3.4 Software Functions

Various software functions supplement above mentioned operation functions to implement productive operation.

1) Momentary Operation Mode Change

When testing or generating test program, a momentary operation mode change may be required such as to change from impedance measurement mode to visual inspection mode. It is possible to change modes on the display using mouse rather than to change data on TPG.

2) Grid Display Function

Video camera display used for visual inspection could be alternated to grid display of n=1 Checker data. Grid display provides all the information for Operation Mode, Sort of Component, Name of Component, Judgment and Test Result. A momentary mode change is possible on this display (Grid Display).

3) Search Function for Height of Component

When entering component height data in to TPG, just entering "S" will have n=1 Checker operated in Search Mode which optimizes probing height and measure impedance. If normal measurement is made, measured height information is temporarily stored so the operator can enter optimized height data in to TPG.

4) Acquisition Function for Work Off-Set Information

Acquisition Function for Work Off-Set Information helps set UUT board on to the test stage. Normally, when one or two points on the board (Setting Marker used for Mounting Machine) will be set on the display, off-set information between the stage and the board is acquired, then the test head coordinates of the Checker is automatically adjusted.

5) Double Check Function

When test result is NG, double test mode works only for the component which was NG. When the operator commands Double Check Mode after the test, n=1 Checker automatically checks again only the NG components.

6) Manual Manipulation of Robot

Probe position can be manipulated manually checking camera display on the monitor, and the impedance measurement can be made so the displaced components can be tested. Movement to X, Y or Z axes can be assigned, and graphic operation using marker is also available.

7) Printer Output

Test results can be output to the printer.

8) Data Logging

Test results can be logged in the data file.

9) Test Tact (Speed) Display

Test tact per test can be displayed.

10) Operation Status Display

When test is made, procedure step number, component name, test item, X-Y coordinates, and test result are displayed.

11) Video Display Control

Displayed component can be rotated (per 90 degree), and brightness and/or intensity can be controlled.

12) Operation Control

Operation is controlled by the displayed button for All Component Test, Partial Test or One Line Test.

13) Debug Form

Debug form includes Robot Movement and Sensor Status so the operator can check what is wrong using this function when a trouble occurs.

4. Specifications

1) Common

① Test Area – X: 330mm Y: 250mm
② Test Speed – 2 seconds per component (typical)
③ Maximum Height of Component – 13.5mm (from board surface)
④ Board Thickness – Adjustable by software
⑤ Maximum Test Step – 10,000 steps

2) Impedance Measurement

① UUT Component – 2 terminal R, L, C chip component, Chip module resistor
② UUT Component Size – 0603, 1005, 1608, 2125, 3216 (3225), 4532, 5025
③ Component Mounting Degree – 0, 90, 180, 270 (Head rotation is o or 90)
④ Measurement Range – R: 0.0100 Ohms ~ 199.99M Ohms, L: 1.600 uH ~ 199.99 KH, C: 0.9400 pF ~ 199.99 mF
⑤ Measurement Voltage – 1 Vp-p, 50mVp-p

3) Visual Inspection Support

① Component Display Area – 6mm x 4mm (horizontally 461 dots x vertically 307 dots)
② Displayed Notification – Size, Mounting Degree, Characters, #1 Pin Orientation, + Orientation, Cathode Orientation, Mounting Miss
③ Software Functions – Camera Display Movement, Display Direction Rotation, Operation Mode (Fixed Visual Check Time (W), Waiting for Confirmation (H), etc.), Operation Option (#1 Pin Check, Assign Module Component Check, etc.), NG Registration Function for NG Item (manual)