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Description



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Method of checking components in pick-and-place robots

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The invention relates to a method for checking components in pick-and-place robots.

During the automatic population of substrates (for example printed circuit boards or ceramic
10 substrates) with SMD components (SMD = Surface Mounted Device), the individual components are removed from a feed device by means of a pick-and-place head and then positioned in a predefined position on the substrate.

The check as to whether the correct components
15 have been provided (equipped) in the feed devices has previously been carried out manually by the operator. For feed devices in the form of tapes provided with component pockets, it is known to equip the spools around which the tapes are wound in the delivered state with bar codes.
20 These bar codes are read before the installation in the pick-and-place robots and thus permit a certain amount of checking with regard to the presence of the correct components. However, in the case of such component checking, only the spool is checked; whether the tape and
25 spool match each other must be ensured separately.

It is therefore the object of the invention to specify a method with which checking the components in a pick-and-place robot is carried out automatically.

According to the invention, the object is
30 achieved by a method of the type mentioned at the beginning and having the features of claim 1.

Advantageously, a camera records an image of the surface of the component to be fitted in the feed device, before it is removed from the feed device by the pick-
35 and-place

head. In this case, the term surface also includes the terminals, to be detected from above, of the component. An image evaluation unit connected downstream compares the image with a previously stored pattern of the component and only if there is coincidence between the image and the pattern is the component fitted. This check is carried out automatically by the camera and the image evaluation unit. It does not depend on the operator and directly evaluates the component rather than an interposed carrier, such as a spool.

Advantageously, according to claim 2, the position of the component in the feed device can also be determined by comparing the image with the pattern. As a result, before the component is picked up, the pick-and-place head can already be moved into a position which is favorable for the picking-up action. This method is also particularly suitable for components which are located in pockets with excessively large dimensions, so that their position is initially known only inaccurately.

In a preferred embodiment according to claim 3, the stored pattern contains lines of texts such as company names, company logos or type designations which, with the aid of the image evaluation unit, are identified on the image of the component for the purpose of component checking.

With the aid of the image evaluation unit, according to claim 4 or 5, encoded identifiers (bar codes, matrix codes) or markings (functional or positional markings) applied to the surface of the component can also be identified.

In the case of terminals which can be detected from above, these are likewise contained in the pattern, according to claim 6, in order with their aid to identify the correct equipment or the correct position of the component.

Advantageously, according to claim 7, use is made of the camera which is fitted to the pick-and-place head and which is additionally used to detect substrate markings to detect the position of the substrate.

5 The invention will now be described in more detail using an exemplary embodiment illustrated in the figures of the drawing, in which:

Figure 1 shows a schematic plan view of a pick-and-place robot with feed devices and

10 Figure 2 shows a schematic plan view of a component.

Figure 1 illustrates a pick-and-place robot 1 for populating a substrate 2 (for example a printed circuit board or a ceramic substrate). For the populating operation, the components 3 are removed from a feed
15 device 5 with the aid of a pick-and-place head 4. The pick-and-place head 4 is moved over the substrate 2 with the aid of an x-y portal system 6, 7. A control device 8 ensures that the component 3 is set down on the substrate 2 in a previously defined position. For the transport,
20 the pick-and-place head 4 has, for example, suction pipettes (not shown), which pick up the component 3 by suction and release it again when setting it down. Also illustrated is a transport system 9, on which the substrate 2 is transported through the pick-and-place
25 robot and to further automatic processing machines (not illustrated) (for example to be fitted with further components).

In this case, the feed devices 5 are illustrated as tapes which have pockets in which the component 3 are
30 transported and made ready. However, other feed devices, such as flat magazines, are also known, to which the method according to the invention can likewise be applied. In order to detect whether the correct components 3 are being fed, a camera 11 arranged on the
35 pick-and-place head 4

is provided which, within its field of view 12, records an image of the component 3 in the feed device 5. An image evaluation unit which is connected downstream of the camera 11 but not illustrated and which, for example, can be associated with the camera 11 or integrated in the control device 8, evaluates the image. To this end, the image is compared with a pattern of the component 3 previously stored in the image evaluation unit, said pattern describing certain characteristics of the component 3. These include, for example, the size and the shape of the component but also, as illustrated in figure 2, further features of the surface 14 of the component 3. These features may include: lines of text such as company designations or company logos 15, type designations 16 of the component 3, encoded identifiers 17, such as bar codes or matrix codes, or other markings 18, for example those applied by laser inscription. In addition, the position of the terminals 13 on the component 3, if they can be detected from above, can be stored in the pattern and used for the evaluation.

Using the pattern comparison which is carried out by using methods of image evaluation known per se, it is then firstly possible to detect whether the correct components 3 are available, which leads to the decision as to whether the pick-and-place head 4 picks up the component 3 and places it onto the substrate 2 or whether an error message is output.

Furthermore, in the case of specific pattern features, the position of the component 3 in the feed device 5 can be detected if, for example, an angle between the image of the line of text 15 and the pattern of the line of text 15 is detected. This position, in particular a rotational position, can already be taken into account by the pick-and-place head 4 before it fetches the component 3, so that said pick-and-place head 4 moves reliably to the fetching position.

Cameras 11 which are particularly suitable for the method are those which are fitted to the pick-and-place head 4 and additionally

record substrate markings 10, using which the position of the substrate 2 before being fitted is determined in the image evaluation unit.

5 As a result, the method according to the invention ensures an automatic component check on pick-and-place robots 1 which is suitable for different feed devices 5.

Patent Claims

1. Method of checking components in pick-and-place
5 robots (1) for fitting substrates (2) with components
(3), in which
an image of the surface of a component (3) to be fitted
is recorded in a feed device (4) by a camera (11),
in an image evaluation unit connected downstream of the
10 camera (11), the image is compared with a stored pattern
of the component (3) to be fitted,
in the event of a positive result of the comparison, the
component (3) is placed onto the substrate (2) and
in the event of a negative result of the comparison, an
15 error message relating to this is output.
2. Method of checking components in pick-and-place
robots (1) according to claim 1, characterized in that
the position of the component (3) in the feed device (4)
is determined by using the comparison between the image
20 and the stored pattern.
3. Method of checking components in pick-and-place
robots (1) according to either of claims 1 and 2,
characterized in that the pattern contains a description
of a line of text (15,16) applied to the surface (14) of
25 the component (3).
4. Method of checking components in pick-and-place
robots (1) according to one of claims 1 to 3,
characterized in that the pattern contains a description
of an encoded identifier (17) applied to the surface (14)
30 of the component (3).

5. Method of checking components in pick-and-place robots (1) according to one of claims 1 to 4, characterized in that the pattern contains a description of a marking (18) applied to the surface (14) of the
5 component (3).

6. Method of checking components in pick-and-place robots according to one of claims 1 to 5, characterized in that the pattern contains a description of the position, to be detected from above, of the terminals
10 (13) of the component (3).

7. Method of checking components in pick-and-place robots (1) according to one of claims 1 to 6, characterized in that use is made of a camera (11) fitted to a pick-and-place head (4).