

CLAIMS

1. A method for calibrating a component mounting apparatus, the component mounting apparatus comprising a bonding station and at least one bond head for placing components on mounting places of a substrate, a first camera and a second camera, wherein the mounting of the components on the mounting places of the substrate comprises the following steps:

transporting the substrate to the bonding station and fixing the substrate;

determining global substrate position data characterizing the position and orientation of the substrate; and

mounting one component after the other on one mounting place of the substrate after the other with the following steps:

with the at least one bonding head picking up a component from a feed unit;

with the first camera taking an image of the component held by the bond head and determining the deviation of the actual position of the component from its target position,

calculating the actual position of the mounting place based on the global substrate position data;

calculating a correction vector to be used for the mounting place based on selected calibration data;

calculating the position to be approached by the bond head; and

moving the bond head to the calculated position and placing the component on the substrate;

and wherein the calibration includes determining calibration data with the following steps:

positioning a calibration plate in a holder of the bonding station and/or fixing a calibration plate to a holder of the bonding station, the calibration plate having a plurality of calibration positions distributed two-dimensionally over the calibration plate and provided with first optical markings;

executing the following steps for a number of calibration positions:

with the bond head picking up a test chip provided with second optical markings,

with the first camera taking an image of the test chip held by the bond head and determining a deviation of the actual position of the test chip from its target position,

calculating the position to be approached by the bond head for the placement of the test chip on the calibration position,

moving the bond head to the calculated position and placing the test chip on the calibration plate,

with the second camera taking an image of the test chip placed on the calibration plate,

determining a difference vector which describes a deviation of the actual position of the test chip from its target position;

assigning correction data based on at least one difference vector to the calibration position,

wherein the calibration data comprise the calibration positions used and the correction data assigned thereto.

2. The method according to claim 1, wherein the individual mounting places of the substrate do not contain any markings.
3. The method according to claim 1, wherein the number and arrangement of the calibration positions used in the calibration and the number and arrangement of the mounting places of the substrate are different from each other, and wherein the calculation of the correction vector to be used for the mounting place is carried out by means of an interpolation method which calculates the correction vector to be used on the basis of selected calibration data comprising one or more calibration positions surrounding the current mounting place and the correction data associated with the one or more calibration positions, respectively.
4. The method according to claim 2, wherein the number and arrangement of the calibration positions used in the calibration and the number and arrangement of the mounting places of the substrate are different from each other, and wherein the calculation of the correction vector to be used for the mounting place is carried out by means of an interpolation method which calculates the correction vector to be used on the basis of selected calibration data comprising one or more calibration positions surrounding the current mounting place and the correction data associated with the one or more calibration positions, respectively.
5. The method according to claim 1, wherein the substrate remains fixed during the mounting of the components and the calibration data cover an area as large as or larger than a substrate.
6. The method according to claim 2, wherein the substrate remains fixed during the mounting of the components and the calibration data cover an area as large as or larger than a substrate.
7. The method according to claim 3, wherein the substrate remains fixed during the mounting of the components and the calibration data cover an area as large as or larger than a substrate.
8. The method according to claim 4, wherein the substrate remains fixed during the mounting of the components and the calibration data cover an area as large as or larger than a substrate.