

Description

Method and system for populating circuit carriers arranged in a placement unit

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The invention relates to a method for placing electronic components, in particular SMD components, on circuit carriers arranged in a placement unit, the placement-related data being stored in a control
10 computer unit which controls the placement units. Furthermore, the invention relates to a system for placing electronic components, in particular SMD components, on circuit carriers arranged in a placement unit, having a control computer unit for controlling
15 the placement units.

It is known, for populating circuit carriers, to provide a placement unit which automatically positions and contact-connects a plurality of electronic
20 components, fed to said placement unit, according to a predetermined specification on the circuit carrier. The electronic components, which are maintained in the form of an array, are usually fed continuously to the placement unit. A control computer unit is provided for
25 controlling the placement unit; it supplies placement-related data by means of which the placement operation can be performed automatically.

The placement unit has a plurality of feed tracks to
30 each of which a predetermined array is assigned. The array is assigned to the respective feed tracks manually during the equipment operation, an operator reading a feed table. In this case, erroneous assignment of the array to a feed track can occur on
35 account of inattentiveness of the operator.

It is an object of the present invention, therefore, to specify a method and a system for populating circuit carriers arranged in a placement unit which ensure secure and reliable assignment of the array to a
5 predetermined feed track of the placement unit.

In order to achieve this object, the method according to the invention is characterized in that equipment-related data are extracted from the
10 placement-related data and transmitted to a portable equipment supervisory carrier which, before the beginning of the placement operation, is coupled to a feed supervisory unit respectively assigned to the placement unit, so that the electronic components are
15 fed to the placement unit only when they are assigned to a feed track of the placement unit, said feed track being identified by the equipment-related data.

In order to achieve this object, the system according to the invention is characterized in that there is provided in each case in the region of the feed to the placement unit a feed supervisory unit, with a control unit and a plurality of readers for reading component-related data stored on an identification carrier, on
25 the one hand, and for reading equipment-related data stored on a portable equipment supervisory carrier, on the other hand, and in that means are provided such that equipment-related data can be derived from placement-related data present in electronic form in
30 the control computer unit, which equipment-related data are written to the equipment supervisory carrier.

The particular advantage of the method according to the invention is that supervisory data can be generated in
35 a simple manner by the extraction of equipment-related data from the placement-related data present, which supervisory data can be used to check reliably and securely the assignment of arrays that are to be

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assigned to the respective feed tracks

of the placement unit during an equipment operation. The equipment-related data are present in electronic form in a feed supervisory unit in which correct assignment of the array to the feed tracks is checked.

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According to one development of the method according to the invention, an enable signal is generated in the feed supervisory unit, provided that the array is correctly assigned to the feed tracks. Placement can be effected only after the enable signal has been output. Consequently, the placement operation can be activated only after the checking of all arrays assigned to a placement unit. Erroneous population of the circuit carrier can thus be reliably avoided.

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According to one development of the method according to the invention, the enable signal is generated only when there is an electrical connection between an equipment supervisory carrier, which characterizes a specific assignment of arrays, and the feed supervisory unit. The equipment-related data are advantageously stored exclusively on the equipment supervisory carrier, so that exclusively the current equipment-related data can be used for the supervision of the assignment. The situation where incorrect equipment-related data used from previous equipment operations are used as a basis can thus be reliably avoided.

The particular advantage of the system according to the invention is that secure and reliable checking of the assignment of the array to predetermined feed tracks of the placement unit is achieved. The basic concept of the invention is to store the component-related data which characterize the array in an identification carrier, preferably fixedly connected to the array, on the one hand, and the equipment-related data which identify the predetermined assignment of the array to the feed tracks of the placement unit

in an equipment supervisory carrier, on the other hand. By comparing the equipment-related data and the component-related data in a feed supervisory unit, the assignment can be checked electronically in a simple manner and, if appropriate, correction of the assignment can be signaled. The equipment-related data can advantageously be derived from the placement-related data available to a control computer unit. The access supervisory unit can be operated autonomously and independently of the control computer unit. It is preferably arranged in direct proximity to the placement unit.

By virtue of the fact that the equipment supervisory carrier is designed to be portable, the equipment-related data, having been stored, can be fed to the access supervisory unit in a manner that allows them to be handled simply. The system is configured flexibly as a result of this. There is no need for a data connection between the control computer unit and the access supervisory unit.

According to a particular embodiment of the system according to the invention, the control computer unit is directly connected to a read/write device, so that after the equipment-related data have been generated, they can be stored directly on the portable equipment supervisory carrier. This enables fast and simple provision of the equipment-related data on the equipment supervisory carrier.

According to an alternative embodiment, the control computer unit is connected via a data line to a separate computer unit to which the equipment-related data are transmitted. This computer unit may be a commercially available personal computer equipped with a read/write device. This makes it possible to utilize an existing data network in order to write the

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equipment-related data to the equipment supervisory carrier at any desired location.

According to one development of the invention, a component computer unit may be provided, which has a component database. This makes it possible not only for the actual component identifier of the electronic components arranged on the respective array to be stored electronically on the identification carrier, but for further information which characterizes the components to be additionally stored on the identification carrier. Consequently, the identification carrier contains component-related data which enable an operator at any time - by means of a portable reader - to identify the components combined on the array.

According to one development of the invention, the identification carrier and/or the equipment supervisory carrier are designed as a smart card, which have an electronic memory. In an advantageous manner, the corresponding data can be simply written or read from commercially available read/write devices.

An exemplary embodiment of the invention is explained in more detail below with reference to the drawings.

In the figures:

- figure 1 shows a block diagram of a system according to the invention,
- figure 2 shows a flow diagram for the generation of the equipment-related data which are stored on an equipment supervisory carrier, and
- figure 3 shows a flow diagram for the generation of component-related data.

The system according to the invention essentially comprises a plurality of placement units 1 arranged

one after the other in a production line, to each of which placement units a multiplicity of electronic components are fed on opposite sides via a plurality of feed tracks 2. The electronic components that are fed
5 are preferably SMD components which are positioned and contact-connected in the placement unit 1 on a circuit carrier (not illustrated). A control computer unit 3 is provided for controlling this placement operation, which unit is assigned to a plurality of placement
10 units and prescribes the placement sequence according to which the individual placement units 1 automatically perform the placement.

The row of feed tracks 2 which is respectively arranged
15 on one side of the placement unit 1 is respectively assigned a feed supervisory unit 4, which has a control unit, which is not illustrated and is preferably designed as a microcontroller, and a plurality of card readers 5 with insertion slots 6 for inserting smart
20 cards 7. The control unit of the feed supervisory unit 4 is in each case electrically connected to the card readers 5. The smart cards 7 each have an electronic memory, preferably EEPROM memory. As an alternative, the smart card may also be designed as a microprocessor
25 card.

The feed supervisory unit 4 is in each case assigned a single smart card 7 as equipment supervisory carrier 8 and a number of smart cards 7 corresponding to the
30 number of feed tracks 2 as identification carrier 9. The equipment supervisory carrier 8 has the equipment-related data which are necessary for the equipment operation. The equipment-related data comprise the information about the respective
35 equipment, the production line, the identification of the placement unit 1, the side of the placement unit 1 at which the components are to be fed, and the occupancy of the individual feed tracks 2 through

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allocation of the corresponding feed track 2 with a component identifier.

The identification carrier 9 has, as necessary information, the component identifier and also further information which identifies the components situated on the array. After the identification carriers 9 have
5 been inserted into the respective card readers 5, these component-related data are read out and, in the control unit of the feed supervisory unit 4, checked for correspondence with the predetermined equipment-related data which are taken from the equipment supervisory
10 carriers 8 by a spatially separate card reader 5. If the occupancy of the feed tracks 2 which is prescribed by the equipment supervisory carrier 8 corresponds to the corresponding component-related data assigned to the respective feed tracks 2, the assignment of the
15 array, which is preferably connected to the respective identification carrier 9 fixedly and detachably, is correct. The placement operation can then be activated by the outputting of an enable signal. An incorrect occupancy of the feed tracks 2 with arrays is reliably
20 avoided in this way.

The equipment-related data are generated in the manner illustrated in accordance with figure 2. In a step 11, placement-related data, comprising all control data
25 relevant to the placement operation, are read from a database 10 of the control computer unit 3. In a subsequent step 12, the equipment-related data are extracted from the placement-related data and then transmitted, in a step 13, to the equipment supervisory
30 carrier 8 by means of a read/write device (not illustrated). According to a first embodiment, this sequence may proceed in an integrated manner in the control computer unit 3, designed as a UNIX computer architecture. According to a second exemplary
35 embodiment, the sequence can also be effected in a commercially available personal computer (not illustrated) which is locally separate from the control computer unit 3 but is connected to the latter by means

of a data connection.

In order to generate the component-related data in the identification carriers 9, according to an exemplary embodiment in accordance with figure 3, it is provided
5 that the component identifier present as a bar code on the array is read into a personal computer (not illustrated) by means of a manual scanner, step 14. By retrieving extended component-related data such as, for example, the designation of the component, the design,
10 etc. from a database 15, it is possible to generate extended component-related data, see step 16. These component-related data can then be written to the identification carrier 9 by means of a read/write device, step 17. The identification carrier 9 then
15 contains information which identifies the content or the state of the respective array. This information can be retrieved at any time in a simple manner by means of a mobile manual reader.

20 By way of example, provision may be made for storing in the identification carrier 9 details concerning the number of components arranged on the array. The current number of components on the array can thus be visualized at any time after repeated use of the array.

25 A prerequisite for this is that the number of components used is written to the corresponding identification carrier 9 after the placement operation.



Patent Claims

1. A method for placing electronic components, in particular SMD components, on circuit carriers arranged
5 in a placement unit, the placement-related data being stored in a control computer unit which controls the placement units, characterized in that equipment-related data are extracted from the placement-related data and transmitted to a portable
10 equipment supervisory carrier (8) which, before the beginning of the placement operation, is coupled to a feed supervisory unit (4) respectively assigned to the placement unit (1), so that the electronic components are fed to the placement unit (1) only when they are
15 assigned to a feed track (2) of the placement unit (1), said feed track being identified by the equipment-related data.

2. The method as claimed in claim 1, characterized in
20 that an enable signal for enabling the feed track (2) for the component, maintained in an array, is generated in the feed supervisory unit (4), provided that the corresponding array is assigned to the feed track (2) prescribed by the equipment-related data.

25 3. The method as claimed in claim 1 or 2, characterized in that the enable signal is generated only when there is an electrical connection between the equipment supervisory carrier (8) and the feed
30 supervisory unit (4).

4. A system for placing electronic components, in particular SMD components, on circuit carriers arranged
in a placement unit, having a control computer unit for
35 controlling the placement units,



characterized in that there is provided in each case in the region of the feed to the placement unit (1) a feed supervisory unit (4), with a control unit and a plurality of readers (5) for reading component-related data stored on an identification carrier (9), on the one hand, and for reading equipment-related data stored on a portable equipment supervisory carrier (8), on the other hand, and in that means are provided such that equipment-related data can be derived from placement-related data present in electronic form in the control computer unit (3), which equipment-related data are written to the equipment supervisory carrier (8).

5. The system as claimed in claim 4, characterized in that the control computer unit (3) is connected to a read/write device such that the equipment-related data can be written directly to the equipment supervisory carrier (8).

6. The system as claimed in claim 4, characterized in that the control computer unit (3) is connected to a separate computer unit via a data line by means of which the equipment-related data can be transmitted to the computer unit, and in that the computer unit is connected to a read/write device, for writing the equipment-related data to the equipment supervisory carrier (8).

7. The system as claimed in one of claims 4 to 6, characterized in that the placement-related data are stored at least in a database (10) of the control computer unit (3).

8. The system as claimed in one of claims 4 to 7, characterized in that provision is made of a database (15) for storing information which identifies the



components, from which the component-related data assigned to a respective array can be generated, and in that the relevant component-related data can be written to the identification carrier (9) assigned to the
5 corresponding array.

9. The system as claimed in one of claims 4 to 8, characterized in that a component identifier is applied as a bar code on the array and, after reading by means
10 of a bar code reader, can be linked with the component-related data present in the database (15) in such a way that the component identifier is automatically extended by the further equipment-related data.

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10. The system as claimed in one of claims 4 to 9, characterized in that the equipment supervisory carrier (8) and/or the identification carrier (9) are designed as a smart card (7).