CLAIMS

1. An apparatus (100) for determining condition of a printed circuit board (10), comprising

a stencil database (130) for storing a plurality of stencil data files (21) corresponding to stencils (20) of different dimensions;

an image capturing device (110) having an area where the printed circuit board (10) is laid thereon for a surface profile of the printed circuit board (10) to be captured for generating a surface data file (11) of the printed circuit board (10);

a condition determination module (121) that compares data from the surface data file (11) with data from one or more stencil data files (21) as a nominal reference via matching to determine the condition of the printed circuit board (10) based on a set of categories, the condition includes at least one match-successful condition and at least one match-failure condition; and

a knowledge database for storing the surface data file of at least one printed circuit board, and a knowledge module interfaced therewith;

wherein the condition determination module compares diagonal length dimension data of the surface data file of the printed circuit board with diagonal length dimension data of each stencil data file, for one stencil data file that falls within a diagonal length tolerance to then be further compared with the surface data file of the printed circuit board in terms of position offset between aperture coordinate data of the stencil data file and the pad coordinate data of the surface data file;

wherein the match-successful condition is determined when the aperture coordinate data of the stencil data file and the pad coordinate data of the surface data file of the printed circuit board are within an offset tolerance, in which the printed circuit board is matched with the corresponding stencil of the stencil data file for solder printing therewith; and

wherein the match-failure condition is determined when the aperture coordinate data of the stencil data file and the pad coordinate data of the surface data file of the

printed circuit board fail to be within the offset tolerance, in which the surface data file of the printed circuit board with the match-failure condition is stored in the knowledge database and then be used by the knowledge module to generate a new stencil data file that is in correspondence therewith, for the new stencil data file to be stored in the stencil database for a future matching.

2. The apparatus according to claim 1, wherein the stencil data files (21) each comprises diagonal length dimension data and the aperture coordinate data based on a stencil specification image (22) having an aperture layout (23) of the stencil (20).

3. The apparatus according to claim 2, wherein the surface data file (11) comprises diagonal length dimension data and the pad coordinate data, based on a surface profile image (12) having a pad layout (13) of the printed circuit board (10).

4. The apparatus according to any one of the preceding claims, wherein the categories for the match-successful condition include any one or a combination of normal, elongated or shrunk.

5. The apparatus according to claim 2, wherein the stencil specification images (22) of the stencil data files include any one or a combination of a normal diagonal length stencil specification image (22a), an enlarged diagonal length stencil specification image (22b), and a reduced diagonal length stencil specification image (22c).

6. The apparatus (100) according to any one of the preceding claims, further comprising

a loading bay (150) where the printed circuit board (10) is placed thereon;

at least one unloading bay (170a, 170b, 170c, 170d) for unloading the bare printed circuit (10) from the apparatus (100); and

a conveyor mechanism (160) connecting the loading bay (150), the image capturing area and the unloading bays (170a, 170b, 170c, 170d).

7. A system for conducting solder printing on a printed circuit board (10), comprising

an apparatus (100) for determining the condition of the printed circuit board (10), including

a stencil database (140) for storing a plurality of stencil data files (21) corresponding to stencils (20) of different dimensions,

an image capturing device (110) having an area where the printed circuit board (10) is laid thereon for a surface profile of the printed circuit board to be captured for generating a surface data file (11) of the printed circuit board;

a condition determination module (121) that compares data from the surface data file (11) with data from one or more stencil data file (21) as a nominal reference via matching to determine the condition of the printed circuit board (10) based on a set of categories, the condition includes at least one match-successful condition and at least one match-failure condition

a knowledge database for storing the surface data file of at least one printed circuit board, and a knowledge module interfaced therewith; and

a solder printing machine (802) for applying solder paste over one or more pads of the printed circuit board (10)

wherein the condition determination module compares diagonal length dimension data of the surface data file of the printed circuit board with diagonal length dimension data of each stencil data file, for one stencil data file that falls within a diagonal length tolerance to then be further compared with the surface data file of the printed circuit board in terms of position offset between aperture coordinate data of the stencil data file and the pad coordinate data of the surface data file;

wherein the match-successful condition is determined when the aperture coordinate data of the stencil data file and the pad coordinate data of the surface data

file of the printed circuit board are within an offset tolerance, in which the printed circuit board is matched with the corresponding stencil of the stencil data file for solder printing therewith by the solder printing machine; and

wherein the match-failure condition is determined when the aperture coordinate data of the stencil data file and the pad coordinate data of the surface data file of the printed circuit board fail to be within the offset tolerance, in which the surface data file of the printed circuit board with the match-failure condition is stored in the knowledge database and then be used by the knowledge module to generate a new stencil data file that is in correspondence therewith, for the new stencil data file to be stored in the stencil database for a future matching.

8. The system according to claim 7, further comprising a solder paste inspection machine (803) for inspecting the solder paste applied on the printed circuit board (10).

9. The system according to claim 7 or 8, further comprising a solder reflow machine (805) for reflowing the solder paste for a solder joint to be formed between the pads of the printed circuit board (10) and electronic components on the printed circuit board (10).

10. The system according to any one of claims 7 to 9, further comprising either or both an automatic optical inspection machine (806) and an automatic X-ray inspection machine (807) for inspecting the solder joint formed between the pads of the bare printed circuit board (10) and the electronic components.

11. The system according to any one of claims 7 to 10, further comprising either or both a loading machine (801) for loading the printed circuit board (10) to the system, and an unloading (808) machine for unloading the printed circuit board (10) from the system.

12. The system according to any one of claims 7 to 11, wherein the stencil data files (21) of the apparatus (100) each comprises diagonal length dimension data and the aperture coordinate data, based on a stencil specification image (22) having an aperture layout (23) of the stencil (20).

13. The system according to claim 12, wherein the surface data file (11) comprises diagonal length dimension data and the pad coordinate data, based on a surface profile image (12) having a pad layout (13) of the printed circuit board (10).

14. The system according to any one of claims 7 to 13, wherein the categories for the match-successful condition includes any one or a combination of normal, elongated or shrunk.

15. The system according to claim 12, wherein the stencil specification images (22) of the stencil data files (21) include any one or a combination of a normal diagonal length stencil specification image (22a), an enlarged diagonal length stencil specification image (22b), and a reduced diagonal length stencil specification image (22c).

16. The system according to any one of claims 7 to 15, further comprising a conveyor mechanism (160) that directs the printed circuit board (10) to be moved throughout the system.

17. A method for determining condition of a printed circuit board (10), comprising the steps of

capturing a surface profile of the printed circuit board (10) by an image capturing device (110) for generating a surface data file (10) of the printed circuit board (10);

comparing data from the surface data file (11) with data from one or more stencil

data files (21) stored in a stencil database (140) as a nominal reference via matching executed by a condition determination module (121), each stencil data file (21) corresponding to stencils (20) of different dimensions;

determining the condition of the printed circuit board (10) based on a set of categories by the condition determination module (121), the condition includes at least one match-successful condition and at least one match-failure condition; and

storing the surface data file of at least one printed circuit board, by a knowledge database, in which a knowledge module is interfaced with the knowledge database;

wherein the condition determination module compares diagonal length dimension data of the surface data file of the printed circuit board with diagonal length dimension data of each stencil data file, for one stencil data file that falls within a diagonal length tolerance to then be further compared with the surface data file of the printed circuit board in terms of position offset between aperture coordinate data of the stencil data file and the pad coordinate data of the surface data file;

wherein the match-successful condition is determined when the aperture coordinate data of the stencil data file and the pad coordinate data of the surface data file of the printed circuit board are within an offset tolerance, in which the printed circuit board is matched with the corresponding stencil of the stencil data file for solder printing therewith; and

wherein the match-failure condition is determined when the aperture coordinate data of the stencil data file and the pad coordinate data of the surface data file of the printed circuit board fail to be within the offset tolerance, in which the surface data file of the printed circuit board with the match-failure condition is stored in the knowledge database and then be used by the knowledge module to generate a new stencil data file that is in correspondence therewith, for the new stencil data file to be stored in the stencil database for a future matching.

18. The method according to claim 17, wherein the stencil data files (21) of the apparatus (100) each comprises diagonal length dimension data and the aperture

coordinate data, based on a stencil specification image (22) having an aperture layout (23) of the stencil (20).

19. The method according to claim 17 or 18, wherein the surface data file (11) comprises diagonal length dimension data and the pad coordinate data, based on a surface profile image (12) having a pad layout (13) of the printed circuit board (10).

20. The method according to any one of claims 17 to 19, wherein the categories for the match-successful condition includes any one or a combination of normal, elongated or shrunk.

21. The method according to claim 18, wherein the stencil specification images (22) include any one or a combination of a normal diagonal length stencil specification image (22a), an enlarged diagonal length stencil specification image (22b), and a reduced diagonal length stencil specification image (22c).