**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); and

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 a matching process to determine the condition of the printed circuit board (10) based on a set of categories;

wherein the printed circuit board (10) is sent for further processing upon being determined to be in a match-successful condition where data from the surface data file (11) falls within a tolerance of the nominal reference.

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

3. The apparatus according to claim 1 or 2, wherein the surface data file (11) comprises diagonal length dimension data, pad coordinate data, or both, based on a surface profile image (12) having a pad layout (13) of the printed circuit board (10).

4. The apparatus according to any of the preceding claims, further comprising a knowledge database (140) for storing the surface data file (11) of the printed circuit board (10) with a match-failure condition when the data from the surface data file (11) falls out of the tolerance of the nominal reference for all stencil data files (21).

5. The apparatus according to claim 4, further comprising a knowledge module that is interfaced with the knowledge database (140) for generating a new stencil data file based on the surface data file (11) of the printed circuit board (10) with the match-failure condition, wherein the new stencil data file is stored as one of the stencil data files for future matching process.

6. 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.

7. 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).

8. 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).

9. A system for conducting solder printing on a printed circuit board, comprising

an apparatus (100) for determining the condition of a 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 a matching process to determine the condition of the printed circuit board (10) based on a set of categories; and

a solder printing machine (802) for applying solder paste over one or more pads of the printed circuit board (10) that is determined to be in a match-successful condition using a stencil (20), the match successful condition being where data from the surface data file (11) falls within a tolerance of the nominal reference of the data from the stencil data file (21) that corresponds to the stencil (20).

10. The system according to claim 9, further comprising a solder paste inspection machine (803) for inspecting the solder paste applied on the printed circuit board (10).

11. The system according to claim 9 or 10, 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).

12. The system according to any one of claims 9 to 11, 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.

13. The system according to any one of claims 9 to 12, 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.

14. The system according to any one of claims 9 to 13, wherein the stencil data file (21) of the apparatus (100) comprises diagonal length dimension data, aperture coordinate data, or both, based on a stencil specification image (22) having an aperture layout (23) of the stencil (20).

15. The system according to any one of claims 9 to 14, wherein the surface data file (11) comprises diagonal length dimension data, pad coordinate data, or both, based on a surface profile image (12) having a pad layout (13) of the printed circuit board (10).

16. The system according to any one of claims 9 to 15, wherein the apparatus (100) further comprises a knowledge database (140) for storing the surface data file (11) of the printed circuit board (10) with a match-failure condition when the data from the surface data file (11) falls out of the tolerance of the nominal reference for all stencil data files (20).

17. The system according to claim 16, wherein the apparatus (100) further comprises a knowledge module that is interfaced with the knowledge database (140) for generating a new stencil data file based on the surface data file (11) of the printed circuit board (10) with the match-failure condition, the new stencil data file is stored as one of the stencil data files for future matching process.

18. The system according to any one of claims 9 to 17, wherein the categories for the match-successful condition includes any one or a combination of normal, elongated or shrunk.

19. The system according to claim 14, 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).

20. The system according to any one of claims 9 to 19, further comprising a conveyor mechanism (160) that directs the printed circuit board (10) to be moved throughout the system.

21. A method for determining condition of a printed circuit board (100), 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 it;

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 a matching process executed by a condition determination module (121), each stencil data file (21) corresponding to stencils (20) of different dimensions; and

determining the condition of the printed circuit board (10) based on a set of categories by the condition determination module (121);

wherein the printed circuit board (10) is sent for further processing upon being determined to be in a match-successful condition where data from the surface data file (11) falls within a tolerance of the nominal reference.

22. The method according to claim 21, wherein the stencil data file (21) of the apparatus (100) comprises diagonal length dimension data, aperture coordinate data, or both, based on a stencil specification image (22) having an aperture layout (23) of the stencil (20).

23. The method according to claim 21 or 22, wherein the surface data file (11) comprises diagonal length dimension data, pad coordinate data, or both, based on a

surface profile image (12) having a pad layout (13) of the printed circuit board (10).

24. The method according to claim 23, wherein the step of comparing data from the surface data file (11) with data from one or more stencil data files (21) further comprises the steps of

comparing the diagonal length data of the surface data file (11) with the diagonal length data of the stencil data file (21) as the nominal reference; and

comparing the pad coordinate data of the surface data file (11) with the aperture coordinate data of the stencil data file (21) as the nominal reference.

25. The method according to any one of claims 21 to 24, further comprising the step of storing, in a knowledge database (140), the surface data file (11) of the printed circuit board (10) with a match-failure condition when the data from the surface data file (11) falls out of the tolerance of the nominal reference for all stencil data files (21).

26. The method according to claim 25, further comprising the step of generating, by a knowledge module interfaced with the knowledge database (140), a new stencil data file based on the surface data file (11) of the printed circuit board (10) with the match-failure condition, wherein the new stencil data is stored as one of the stencil data files for future matching process

27. The method according to any one of claims 21 to 26, wherein the categories for the match-successful condition includes any one or a combination of normal, elongated or shrunk.

28. The method according to claim 22, 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).