CLAIMS

1. A dispensing system for dispensing viscous material on an electronic substrate, the dispensing system comprising:

a frame;

a support coupled to the frame, the support being configured to receive and support an electronic substrate during a dispense operation;

a dispensing unit configured to dispense viscous material including solder paste, the dispensing unit having a nozzle;

a gantry assembly coupled to the frame, the gantry assembly including a gantry configured to support the dispensing unit and to move the dispensing unit in x-axis, y-axis and z-axis directions and a tilt and rotate subassembly configured to tilt and rotate the dispensing unit; and

a controller configured to control the dispensing unit and the gantry assembly to perform a dispense operation to dispense viscous material on the electronic substrate, the controller being configured to simultaneously coordinate the movement of the gantry assembly in the x-axis, y-axis and z-axis directions and the tilt and rotate subassembly to position and orient the nozzle of the dispensing unit at a predetermined distance and orientation from the electronic substrate while dispensing material along a three-dimensional path,

wherein the predetermined distance is up to 5.0 mm,

wherein the controller further is configured to move the nozzle of the dispensing unit at a constant speed with respect to a component mounted on the electronic substrate, the controller being configured to move the nozzle to achieve a constant speed of 1000 mm/second, and

wherein the controller further is configured to dispense material from the nozzle of the dispensing unit at a flow rate configured to deposit a desired amount or density of material on the electronic substrate, the controller being configured to dispense material from the nozzle to achieve a flow rate of 2000 mg/second.

2. The dispensing system of claim 1, wherein the controller further is configured to maintain the nozzle of the dispensing unit at a predetermined angle with respect to a horizontal plane of the electronic substrate.

3. The dispensing system of claim 2, wherein the predetermined angle is between 0° and 90°.

4. The dispensing system of claim 1, wherein the tilt and rotate subassembly is configured to tilt the dispensing unit up to 360° and to rotate the dispensing unit up to 360°.

5. The dispensing system of claim 1, further comprising a vision system coupled to one of the frame and the gantry assembly to capture at least one image of the electronic substrate.

6. The dispensing system of claim 5, wherein the controller further is configured to control the vision system.

7. The dispensing system of claim 6, wherein the controller further is configured to calibrate the dispense location of the nozzle of the dispensing unit with respect to the vision system by dispensing on the electronic substrate provided on the support.

8. The dispensing system of claim 7, wherein the controller includes or has access to a database having a table of nozzle to vision system orientations.

9. The dispensing system of claim 8, wherein the controller is configured to calibrate the orientation of the nozzle based on in part an interpolation of known positions and orientations.

10. A method of dispensing viscous material on an electronic substrate with the dispensing system of claim 1, the method comprising:

delivering an electronic substrate to a dispense position in the dispensing system;

capturing at least one image of the electronic substrate;

analyzing the at least one image of the electronic substrate to determine a position of the electronic substrate; and

performing a dispense operation by moving, tilting, and rotating the dispensing unit coupled to the gantry configured to support the dispensing unit and to move the dispensing unit in x-axis, y-axis and z-axis directions and the tilt and rotate subassembly configured to tilt and rotate the dispensing unit,

wherein performing the dispense operation includes simultaneously coordinating the movement of the gantry assembly and the tilt and rotate subassembly to position and orient a nozzle of the dispensing unit at the predetermined distance and orientation from the electronic substrate while dispensing material along a three-dimensional path.

11. The method of claim 10, wherein performing the dispense operation includes maintaining the nozzle of the dispensing unit at a predetermined angle with respect to a horizontal plane of the electronic substrate.

12. The method of claim 10, wherein performing the dispense operation includes moving the nozzle of the dispensing unit at a constant speed with respect to the electronic substrate.

13. The method of claim 10, wherein performing the dispense operation includes dispensing material from the nozzle of the dispensing unit at a flow rate configured to deposit a desired amount or density of material on the electronic substrate.

14. The method of claim 10, further comprising calibrating the dispense location of the nozzle of the dispensing unit with respect to the vision system of the dispenser by dispensing on the electronic substrate provided on the support.

15. The method of claim 14, wherein the controller includes or has access to a database having a table of nozzle to vision system orientations.

16. The dispensing system of claim 1, wherein the gantry includes a support bracket and a movable bracket that is rotatably coupled to the support bracket by a first strain wave gear

system, the movable bracket being configured to rotate with respect to the support bracket about a generally vertical axis.

17. The dispensing system of claim 16, wherein the movable bracket includes a second strain wave gear system that is configured to support the dispensing unit, the second strain wave gear system being configured to rotate and tilt the dispensing unit to a desired position during a dispense operation about an axis, which is generally perpendicular to the generally vertical axis.