

Claims

1. A module for selectively attaching to a rotatable turret, comprising,
an arm which comprises a first end which can be fixed to a rotatable turret, and a second free end;
5 a tip holder which is configured such that it can hold a tip member, wherein said tip member is tubular, and wherein the tip holder further comprises an inlet which can be fluidly connected to a vacuum generator, wherein said inlet is fluidly connected to the tip member when the tip holder holds said tip member;
10 a shaft member which is arranged such that it can be moved linearly along an axis which is parallel to a longitudinal axis of said shaft member, wherein the shaft member comprises a first end to which an actuator can apply a force to move the shaft member along linearly along said axis, and a second opposite end,
15 a force sensor which is located between said tip holder and the second end of said shaft member.
2. A module according to claim 1, wherein the module further comprises,
a first attachment means which attaches the force sensor to
20 the second end of the shaft member, and a second attachment means which attaches the force sensor to the tip holder.
3. A module according to claim 1 or 2, wherein the module further comprises a tip member which is held in the tip holder.
4. A module according to any one of the preceding claims
25 wherein the tip holder comprises a socket which can receive at least a portion of a tip member, wherein said socket is in fluid communication with the inlet.

5. A module according to any one of the preceding claims wherein the tip holder comprises a means for clamping the tip member in said socket so that the tip member is held in the socket of the tip holder.
6. A module according to any one of the preceding claims
5 wherein the second free end of the arm comprise a guide member which guides the linear movement of the shaft member along said axis.
7. A module according to any one of the preceding claims wherein the module further comprises a height adjustment mechanism which can be used to change the position of the first end of the shaft.
- 10 8. A module according to claim 7 wherein the height adjustment mechanism comprises a screw member which is arranged to screw into a fixed part of the arm along a direction which is parallel to the longitudinal axis of the shaft, and a intermediary member which connects the screw member to the shaft, so that when the screw member is screwed into the
15 fixed part of the arm the first end of the shaft is moved to a lower position, and when the screw member is screwed out of the fixed part of the arm the first end of the shaft is moved to a higher position.
9. A module according to any one of the preceding claims wherein the arm further comprises a means to adjust the position of the
20 second free end of the arm.
10. A component handling assembly comprising,
a rotatable turret,
a plurality of radial arms, each having a respective component handling head which can hold a respective component by
25 vacuum;
a plurality of actuators each of which can apply a force to a respective component handling head which causes the respective component handling head to move the component which is holds towards a surface located below the component handling head;

at least one module according to claim 1 attached to the turret.

11. A component handling assembly according to claim 10 wherein the module is attached to the turret at a location which would
5 otherwise be occupied by a radial arm.

12. A component handling assembly according to claim 10 or 11 further comprising a controller which can control the force which an actuator applies to the shaft member of the module.

13. A component handling assembly according to claim 12
10 wherein the controller is configured to control the force which an actuator applies to the shaft member of the module, to cause the actuator to decrease the force it applies to the first end of the shaft member as the component, which is held by the tip member, approaches said surface.

14. A component handling assembly according to any one of
15 claims 10-13 wherein each component handling head comprises a respective shaft having a first end to which an actuator can apply said force; and wherein the height of the first end of the shaft of the module above a surface on which the component is to be delivered onto, is at the same height as the first end of the shaft of a component handling head
20 above said surface when said component handling head is aligned above said surface.

15. A method of determining the force applied by a component handling head on a turret, to a component, when the component handling head is delivering a component onto a surface, the method comprising the
25 steps of,

providing a module according to claim 1 on the turret,
wherein said module further comprise a tip member held in the tip holder;
holding a component by vacuum on the tip member of the
module;
30 moving the turret so that the component is arranged above a

surface onto which the component can be delivered;
moving the component onto the surface;
measuring the force applied to the component using said
force sensor of the module.

5 16. A method according to claim 15 wherein the step of
measuring the force applied to the component using said force sensor of
the module, comprises at least measuring the force applied to the
component when the component impacts the surface.

10 17. A method according to claim 15 or 16 further comprising the
steps of, adjusting setting and/or parameters of the actuator which applies
a force to the shaft of the module, to identify the setting and/or
parameters which result in the component being moved onto the surface at
a speed which ensures that the force applied to the component when the
component impacts the surface, is below a predefined threshold force, and
15 recording said settings and/or parameters.

18. A method according to claim 17 further comprising the step
of adjusting each of a plurality of actuators to have said recorded settings
and/or parameters.

19. A method according to any one of claims 15-18 comprising
20 first moving the component at a first speed in the direction of the surface,
and then moving the component at a second speed in the direction of the
surface, wherein the second speed is slower than the first speed.

20. A method according to any one of claims 15-19 comprising
moving the component at a first speed in the direction of the surface, and
25 when the component has been moved to within a predefined distance
from the surface moving the component at a second speed in the direction
of the surface, wherein the second speed is slower than the first speed.