

CLAIMS

We Claim:

1. A connection system comprising:

an interface comprising a housing and a sensor disposed within the housing, the sensor being configured to be displaced between a first position, a second position, and a third position;

a multi-use fitting comprising at least one engaging surface and a slot, the multi-use fitting being configured to be at least partially secured within the housing so that the at least one engaging surface displaces the sensor between the first position and the second position;

a single-use fitting comprising a flange, the single-use fitting being configured to be at least partially secured within the multi-use fitting such that the flange is received within and extends through the slot and displaces the sensor between the second position and the third position,

wherein the sensor is configured to detect displacement between the first position and the second position, thereby sensing at least partial engagement between the multi-use fitting and the interface, and

wherein the sensor is configured to detect displacement between the second position and the third position, thereby sensing at least partial engagement between the single-use fitting and the multi-use fitting.

2. The connection system of claim 1, wherein upon being displaced to the second position, the sensor detects full engagement between the multi-use fitting and the interface and wherein upon being displaced to the third position, the sensor detects full engagement between the single-use fitting and the multi-use fitting.

3. The connection system of claim 2, wherein upon being displaced between the first position and the second position, the sensor detects partial engagement between the multi-use fitting and the interface and wherein upon being displaced between the second position and the third position, the sensor detects partial engagement between the single-use fitting and the multi-use fitting.

4. The connection system of claims 1-3, wherein the sensor comprises a lever, an arm, and a spring extending about the arm, wherein the lever is configured to be rotated about the arm by

engaging with the at least one engagement surface and the flange, and wherein the spring is configured to bias the lever toward the first position.

5. The connection system of claim 4, wherein the sensor further comprises a magnet disposed within the arm and a circuit board located a distance away from the magnet, the circuit board being configured to sense the rotation of the magnet when the lever is rotated about the arm.

6. The connection system of claims 1-5, wherein the multi-use fitting further comprises at least one wing extending from a body and wherein the at least one wing is configured to engage with the housing to secure the multi-use fitting to the interface.

7. The connection system of claim 6, wherein the at least one wing comprises a tapered leading edge and a retention rib, the tapered leading edge being configured to deform upon engagement and disengagement with the housing, and wherein the housing defines a lip, the lip being configured to contact the retention rib, thereby securing the multi-use fitting to the housing.

8. The connection system of claims 1-7, wherein the single-use fitting comprises a body and a connector extending from the body, the connector configured to mate with a bore of the body of the multi-use fitting and wherein the body of the single-use fitting and the connector at least partially define a second fluid flow path configured to be aligned with the first fluid flow path when the connector is mated with the bore, and wherein the flange extends from the connector.

9. The connection system of claim 8, wherein the single-use fitting comprises a locking lever extending from the body of the single-use fitting, and the body of the multi-use fitting defines a socket, and wherein the locking lever is configured to engage with the socket, thereby at least partially securing the single-use fitting within the multi-use fitting.

10. A connection system comprising:
an interface comprising:

a housing defining a first space and an inlet; and

a sensor disposed within the housing and at least partially exposed to the first space;

a multi-use fitting comprising:

- a body defining a bore and at least a first portion of a slot, the bore defining a first fluid flow path; and
- at least one engaging surface extending from the body;

a single-use fitting comprising:

- a body defining an outlet at a first end;
- a connector extending from a second end of the body opposing the outlet, the connector defining a second fluid flow path in fluid communication with the outlet; and
- a flange extending from the connector,

wherein the multi-use fitting is configured to be secured within the first space of the housing, such that the at least one engaging surface contacts the sensor,

wherein, when the multi-use fitting is secured to the housing, the first fluid flow path is in fluid communication with the inlet,

wherein the single-use fitting is configured to be secured to the multi-use fitting, such that the flange extends through the slot and contacts the sensor,

wherein, when the single-use fitting is secured to the multi-use fitting, the second fluid flow path is in fluid communication with the first fluid flow path, thereby defining a single fluid flow path from the inlet to the outlet, and

wherein the sensor is configured to detect: (1) a lack of contact, corresponding to the multi-use fitting not being secured within the housing; (2) contact by the at least one engaging surface, corresponding to the multi-use fitting being at least partially secured within the housing; and (3) contact by the flange, corresponding to the single-use fitting being at least partially secured within the multi-use fitting.

11. The connection system of claim 10, wherein the sensor comprises:

- an arm;
- a lever extending from the arm and configured to be at least partially exposed within the first space; and
- a spring extending about the arm,

wherein the lever is configured to contact the at least one engaging surface and the flange to rotate the arm in a first direction, and

wherein the spring is configured to bias the arm in a second direction, opposite the first direction.

12. The connection system of claim 11, wherein the contact between the at least one engagement surface and the lever rotates the arm a first distance in the first direction and wherein contact between the flange and the lever rotates the arm a second distance in the first direction, the second distance extending beyond the first distance.

13. The connection system of claim 12, wherein the sensor further comprises:
a magnet disposed within the arm; and
a circuit board located a distance away from the magnet,
wherein the circuit board is configured to sense the rotation of the magnet when the arm is rotated due to the lever contacting the at least one engagement surface or the flange.

14. The connection system of claims 10-13, wherein the at least one engaging surface comprises a flat portion extending from the body and a curved portion extending from the flat portion.

15. The connection system of claim 14, wherein the at least one engaging surface comprises a first engaging surface and a second engaging surface, the first and second engaging surfaces defining at least a second portion of the slot therebetween.

16. A multi-use fitting comprising:
a body defining a fluid flow path and at least a first portion of a slot; and
at least one engaging surface extending from the body, the at least one engaging surface configured to displace a sensor.

17. The multi-use fitting of claim 16, wherein the at least one engaging surface comprises a flat surface extending from the body and a curved surface extending from the body along an end of the flat surface.

18. The multi-use fitting of claim 17, wherein the curved surface is configured to displace the sensor.

19. The multi-use fitting of claims 16-18, further comprising at least one wing extending from the body, the at least one wing defining at least one retaining rib configured to secure the at least one wing to an interface.

20. The multi-use fitting of claim 19, wherein the at least one wing comprises a finger press configured to flex the at least one wing to secure the at least one wing within the interface and to remove the at least one wing from the interface.

21. The multi-use fitting of claim 19 or claim 20, wherein the at least one wing comprises a first wing and a second wing, and the at least one retaining rib comprises a first retaining rib disposed on the first wing and a second retaining rib disposed on the second wing.

22. A single-use fitting comprising:
a body defining an outlet at a first end;
a connector extending from a second end of the body opposing the outlet, the connector defining an inlet, and
a flange extending from the connector,
wherein a fluid flow path is defined between the inlet and the outlet and wherein the flange is configured to displace a sensor.

23. The single-use fitting of claim 22, wherein the flange defines an edge, and the edge comprises a vertical portion extending from the connector and a slanted portion extending from the vertical portion.

24. The single-use fitting of claim 23 wherein the slanted portion of the edge is configured to displace the sensor.

25. The single-use fitting of claim 22 or claim 23, wherein the vertical portion of the edge extends from the connector to define an orthogonal angle therebetween, and the slanted portion of the edge extends from the vertical portion at an angle that is not orthogonal relative to the connector.

26. The single-use fitting of claims 22-25, further comprising a locking lever configured to connect the single-use fitting to a multi-use fitting.

27. The single-use fitting of claim 26, wherein the locking lever comprises a tapered leading edge configured to be secured within a portion of the multi-use fitting.

28. A connection system comprising:

a multi-use fitting comprising:

a body comprising a bore defining a fluid flow path and at least a first portion of a slot; and

at least one engaging surface extending from the body and being configured to displace a sensor;

a single-use fitting comprising:

a body defining an outlet at a first end;

a connector extending from a second end of the body opposing the outlet, the connector defining an inlet;

a flange extending from the connector and being configured to displace the sensor;

and

a fluid flow path extending from the first end to the second end,

wherein the at least one engaging surface is configured to displace the sensor a first distance, and the flange is configured to displace the sensor a second distance beyond the first distance, and

wherein the connector is configured to mate with the bore to connect the single-use fitting to the multi-use fitting, thereby connecting the fluid flow path of the multi-use fitting with the fluid flow path of the single-use fitting.

29. The connection system of claim 28, wherein when the single-use fitting is connected to the multi-use fitting, the flange is configured to extend through the slot to displace the sensor.

30. The connection system of claim 28 or claim 29, wherein the at least one engaging surface comprises a flat surface extending from the body and a curved surface extending from the body along an end of the flat surface

wherein the curved surface is configured to displace the sensor.

31. The connection system of claims 28-30, wherein the at least one engaging surface comprises a first engaging surface and a second engaging surface, the first and second engaging surfaces defining at least a second portion of the slot therebetween.

32. The connection system of claims 28-31, further comprising at least one wing extending from the body of the multi-use connector, the at least one wing defining at least one retaining rib configured to secure the at least one wing to an interface.

33. The connection system of claims 28-32, wherein the flange defines an edge, and the edge comprises a vertical portion extending from the connector and a slanted portion extending from the vertical portion

wherein the slanted portion of the edge is configured to displace the sensor.

34. The connection system of claims 28-33, wherein the body of the multi-use fitting further defines a socket, and the single-use fitting comprises a locking lever configured to be received within the socket, further connecting the single-use fitting to the multi-use fitting.