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 claim 1-5, wherein the multi-use fitting comprises a body defining a bore and at least a first portion of the slot, wherein the bore at least partially defines a first fluid flow path, and wherein the at least one engaging surface extends from the body.~~

~~7. The connection system of claim 6, wherein the at least one engaging surface comprises a flat portion extending from the body and a curved portion extending from the flat portion.~~

~~8. The connection system of claim 7, 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.~~

~~9~~6. The connection system of ~~claims 6-8~~claims 1-5, wherein the multi-use fitting further comprises at least one wing extending from ~~the~~ 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.

~~10~~7. The connection system of claim ~~9~~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.

~~11~~8. The connection system of ~~claims 6-10~~claims 1-7, wherein the single-use fitting comprises a body and a connector extending from the body, the connector configured to mate with ~~the~~ 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.

~~12~~9. The connection system of claim ~~11~~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.

~~13. The connection system of claims 1-12, when the single-use fitting is secured within the multi-use fitting and the multi-use fitting is secured within the housing, the single-use fitting, and the multi-use fitting are configured such that the single-use fitting remains secured within the multi-use fitting when the multi-use fitting is removed from the housing.~~

~~14~~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.

~~15~~11. The connection system of claim ~~14~~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.

~~16~~12. The connection system of claim ~~15~~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.

~~17~~13. The connection system of claim ~~16~~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.

~~18. The connection system of claim 17, wherein the lever, arm, spring, and magnet are disposed in a second space defined within the housing, and the circuit board is disposed in a third space defined within the housing fluidly sealed from the first space.~~

~~19~~14. The connection system of ~~claims 14-18~~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.

~~20~~15. The connection system of claim ~~19~~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.

~~21~~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.

~~22~~17. The multi-use fitting of claim ~~21~~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.

~~23~~18. The multi-use fitting of claim ~~22~~17, wherein the curved surface is configured to displace the sensor.

~~24. The multi-use fitting of claim 22 or 23, 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.~~

~~25~~19. The multi-use fitting of ~~claims 21-24~~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.

~~26. The multi-use fitting of claim 25, wherein the at least one wing comprises a tapered leading edge, the tapered leading edge being configured to fit within the interface.~~

~~27~~20. The multi-use fitting of claim 19~~25 or 26~~, 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.

~~28~~21. The multi-use fitting of ~~claims 25-27~~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.

~~29. The multi-use fitting claim 28, wherein the first retaining rib and the second retaining rib correspond, respectively, to a first retaining lip and a second retaining lip on the interface to secure, respectively, the first wing and the second wing within the interface.~~

~~30. The multi-use fitting of claims 21-29, wherein the body further defines an inner bore, the inner bore comprising an inlet and an outlet and wherein the inner bore defines the fluid flow path between the inlet and the outlet.~~

~~31. The multi-use fitting of claim 30, wherein the inlet is configured to be connected to a tubing, the tubing being configured to provide a medicament through the flow path.~~

~~32. The multi-use fitting of claim 30 or 31, wherein the outlet is configured to be connected to a single-use fitting.~~

~~33. The multi-use fitting of claim 32, wherein the single-use fitting is configured to provide the medicament to a patient.~~

~~34. The multi-use fitting of claim 33, wherein the body further defines a socket configured to engage a portion of the single-use fitting to connect the single-use fitting to the multi-use fitting.~~

~~35. The multi-use fitting of claims 30-34, wherein the body further defines an outer bore at least partially surrounding the inner bore, the outer bore defining the at least a first portion of the slot.~~

~~36~~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.

~~37~~23. The single-use fitting of claim ~~36~~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.

~~38~~24. The single-use fitting of claim ~~37~~ 23 wherein the slanted portion of the edge is configured to displace the sensor.

~~39~~25. The single-use fitting of claim 22 or claim 23~~36 or 37~~, 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.

~~40. The single-use fitting of claims 36-39, further comprising a stop extending from the body.~~

~~41. The single-use fitting of claim 40, wherein the stop extends a distance from the body beyond the flange.~~

~~42~~26. The single-use fitting of ~~any of claims 36-41~~claims 22-25, further comprising a locking lever configured to connect the single-use fitting to a multi-use fitting.

~~43~~27. The single-use fitting of claim ~~42~~26, wherein the locking lever comprises a tapered leading edge configured to be secured within a portion of the multi-use fitting.

~~44. The single-use fitting of claim 42 or 43, wherein the locking lever further comprises a finger press configured to flex the locking lever to facilitate the connection to the multi-use fitting.~~

~~45. The single-use fitting of claims 36-44, wherein the outlet is configured to be connected to a tubing, the tubing being configured to receive a medicament from the fluid flow path.~~

~~46. The single-use fitting of claim 45, wherein the connector is configured to mate with a bore of a multi-use fitting.~~

~~47. The single-use fitting of claim 46, wherein the fluid flow path is configured to receive the medicament from the multi-use fitting via the inlet.~~

~~48. The single-use fitting of claims 36-47, further comprising an outer shell extending around the outlet, the outer shell defining a rear opening.~~

~~49. The single-use fitting of claim 48, wherein the outer shell further defines a bottom opening.~~

~~50. A dust cap comprising:~~

~~a body comprising a connector extending in a first direction and a closed end extending in a second direction, opposite the first direction; and~~

~~a flange extending from the connector, the flange being configured to displace a sensor.~~

~~51. The dust cap of claim 50, wherein the flange defines an edge, the edge defining a vertical portion extending from the connector and a slanted portion extending from the front portion.~~

~~52. The dust cap of claim 51, wherein the slanted portion of the edge is configured to displace the sensor.~~

~~53. The dust cap of claim 51 or 52, wherein the front portion of the edge comprises a notch.~~

~~54. The dust cap of any of claims 51-53, 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.~~

~~55. The dust cap of claims 50-54, further comprising a locking lever configured to connect the dust cap to the multi-use fitting.~~

~~56. The dust cap of claim 55, wherein the locking lever comprises a tapered leading edge configured to be secured within a portion of the multi-use fitting.~~

~~57. The dust cap of claim 55 or 56, wherein the locking lever further comprises a finger press configured to flex the locking lever to facilitate the connection to the multi-use fitting.~~

~~58. The dust cap of claims 50-57, wherein the connector is configured to mate with a bore of a multi-use fitting.~~

~~59. The dust cap of claim 58, wherein the closed end of the dust cap is configured to terminate a fluid flow path defined at least partially by the bore of the multi-use fitting.~~

~~60~~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.

~~61~~29. The connection system of claim ~~60~~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.

~~62~~30. The connection system of claim 28 or claim 29~~60 or 61~~, 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.

~~63. The connection system of claim 62, wherein the curved surface is configured to displace the sensor.~~

~~64~~31. The connection system of ~~claims 60-63~~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.

~~65~~32. The connection system of ~~claims 60-64~~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.

~~66. The connection system of claim 65, wherein the at least one wing comprises a tapered leading edge, the tapered leading edge being configured to fit within the interface.~~

~~67. The connection system of claims 65 or 66, 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.~~

~~68. The connection system of claims 65-67, 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.~~

~~69. The connection system of claims 68, wherein the first retaining rib and the second retaining rib correspond, respectively, to a first retaining lip and a second retaining lip on the interface to secure, respectively, the first wing and the second wing within the interface.~~

~~70~~33. The connection system of ~~claims 60-69~~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.

~~71. The connection system of claim 70, wherein the slanted portion of the edge is configured to displace the sensor.~~

~~72. The single-use fitting of claim 70 or 71, 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.~~

~~73. The single-use fitting of any of claims 70-72, further comprising a stop extending from the body, the stop being configured to at least partially impede the connection of the single-use fitting to the multi-use fitting.~~

~~74~~34. The connection system of ~~claims 60-73~~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.

~~75. The connection system of claims 60-74, wherein the bore defines an inlet and an outlet, the inlet of the bore being configured to be connected to a first tubing and the outlet of the bore being configured to mate with the connector of the single-use fitting,~~

~~wherein the outlet of the single-use fitting is configured to be connected to a second tubing, thereby defining a system fluid flow path from the first tubing, through the fluid flow path of the multi-use fitting and the flow path of the single-use fitting, to the second tubing, and~~

~~wherein the system fluid flow path is configured to receive a medicament and deliver the medicament to a patient downstream of the second tubing.~~