CLAIMS

1. An apparatus for performing lung performance measurements on a user, comprising:

a flow generator that is operable to generate a flow of gases in a flow path;

a measurement device that is in fluid communication with the flow path to receive the flow of gases;

a controller that is operable to control the flow generator to generate a flow of gases into the measurement device to provide a controlled pneumatic resistance in the flow path to user exhaled breath as the user performs one or more forced expiratory manoeuvres into the measurement device; and

one or more sensors that are configured to sense one or more characteristics of the flow of gases in the flow path as the user performs the forced expiratory manoeuvres into the measurement device and generates representative sensor data from which one or more lung performance measurements can be obtained.

2. An apparatus for performing lung performance measurements on a user, comprising:

a flow generator that is operable to generate a flow of gases in a flow path;

a measurement device that is in fluid communication with the flow path to receive the flow of gases;

a controller that is operable to control the flow generator to generate a flow of gases into the measurement device to provide a controlled pneumatic resistance in the flow path to user exhaled breath as the user performs restful or tidal breathing into the measurement device; and

one or more sensors that are configured to sense one or more characteristics of the flow of gases in the flow path as the user performs the restful or tidal breathing into the measurement device and generates representative sensor data from which one or more lung performance measurements can be obtained.

3. An apparatus according to claim 1 or claim 2 wherein the controller is configured to:

determine a user flow rate signal representing the flow the user is able to induce against the flow of gases via the measurement device based on a function of at least a user

pressure signal representing the pressure exerted by the user during exhalation into the measurement device; and/or

determine a user flow rate signal representing the flow the user is able to induce against the flow of gases via the measurement device based on a function of at least a flow resistance parameter relating to the measurement device; and/or

determine a user flow rate signal representing the flow the user is able to induce against the flow of gases via the measurement device based on a function of at least a flow conductance parameter; and/or

determine a user flow rate signal representing the flow the user is able to induce against the flow of gases via the measurement device based on a function of at least a flow rate signal representing the flow rate of the flow of gases generated by the flow generator and a leak flow signal representing the leak flow through one or more exhaust openings of the measurement device.

4. An apparatus according to claim 3 wherein the controller is configured to determine the flow conductance parameter based on a function of at least a flow rate signal representing the flow rate of the flow of gases generated by the flow generator and a user pressure signal representing the pressure exerted by the user during exhalation into the measurement device.

5. An apparatus according to claim 3 or claim 4 wherein the controller is configured to determine the leak flow signal based on a function of at least a flow conductance parameter and a user pressure signal representing the pressure exerted by the user during exhalation into the measurement device.

6. An apparatus according to any one of claims 3-5 wherein the controller is configured to determine the user pressure signal based on a function of at least a pressure signal representing the pressure at the outlet of the flow generator, a resistance to flow parameter, and a flow rate signal representing the flow rate of the flow of gases generated by the flow generator.

7. An apparatus according to any one of claims 3-6 wherein the controller is configured to determine a respiratory rate signal or parameter for the user based at least partly on or as a function of at least the determined user flow rate signal, as the user performs tidal breathing into the measurement device.

8. An apparatus according to any one of claims 1-7 wherein the controller is configured to determine a tidal volume signal or parameter for the user based at least partly on or as a function of at least a determined user flow rate signal representing the flow the user is able to induce against the flow of gases via the measurement device, as the user performs tidal breathing into the measurement device.

9. An apparatus according to claim 8 wherein the controller is configured to determine a respiratory rate signal or parameter for the user based at least partly on or as a function of at least the determined user flow rate signal, as the user performs tidal breathing into the measurement device, and wherein the controller is configured to determine a minute ventilation signal or parameter for the user based at least partly on or as a function of at least the determined respiratory rate signal and the determined tidal volume signal.

10. An apparatus according to any one of claims 3-7 wherein the controller is configured to determine a signal or parameter representing the inspiratory time to total breath time ratio based at least partly on or as a function of at least the determined user flow rate signal, as the user performs tidal breathing into the measurement device.

11. An apparatus according to any one of claims 1-10 wherein the one or more sensors are configured to measure or determine any one or more of the following characteristics of the flow of gases: flow rate, pressure, temperature, humidity.

12. An apparatus according to any one of claims 1-11 wherein the one or more sensors are external or separate to the measurement device.

13. An apparatus according to any one of claims 1-12 wherein the one or more sensors are located in the flow path upstream of the measurement device or configured to sense the flow of gases upstream of the measurement device.

14. An apparatus according to any one of claims 1-13 wherein the flow generator is enclosed or contained in a main housing of the apparatus, and wherein the one or more sensors are located within the main housing of the apparatus.

15. An apparatus according to any one of claims 1-14 wherein the apparatus further comprises a humidifier that is operable to heat and humidify the flow of gases generated by the flow generator.

16. An apparatus according to claim 15 wherein the humidifier is provided in a main housing of the apparatus, the main housing further comprising the flow generator.

17. An apparatus according to any one of claims 1-16 wherein the controller comprises a patient diagnostic mode that is operable to control the flow of gases to provide the controlled pneumatic resistance when the measurement device is connected to the flow path.

18. An apparatus according to any one of claims 1-17 wherein the controller comprises one or more operating modes, including at least a first mode that is operable to control the apparatus when the measurement device is not connected to the flow path and a second mode that is operable to control the apparatus when the measurement device is connected to the flow path.

19. An apparatus according to any one of claims 1-18 wherein the controller comprises a plurality of operating modes, including at least a therapy mode that is operable to control the apparatus to provide the flow of gases to user for respiratory therapy, and a patient diagnosis mode that is operable to control the flow of gases to provide a pneumatic resistance for performing lung performance measurements when the measurement device is connected to the flow path.

20. An apparatus according to any one of claims 1-19 wherein the apparatus further comprises a gases outlet for the flow of gases, and wherein the measurement device is a component or attachment that is directly connected to the gases outlet, or indirectly connected to the gases outlet via a breathing conduit.

21. An apparatus according to any one of claims 1-20 wherein the measurement device comprises a main body extending between a connector end and a mouthpiece end, the main body comprising a main lumen or lumens extending between the connector end and mouthpiece end for the flow of gases.

22. An apparatus according to claim 21 wherein the main body is a conduit or tubular component with an opening or openings at each end.

23. An apparatus according to claim 21 or claim 22 wherein the connector end of the main body is configured to be releasably connected to an end of a breathing conduit, the breathing conduit providing delivery of the flow of gases to a user.

24. An apparatus according to claim 21 or claim 22 wherein the connector end of the main body is integrally or permanently connected to an end of a breathing conduit, the breathing conduit providing delivery of the flow of gases to a user.

25. An apparatus according to any one of claims 21-24 wherein the connector end of the main body comprises one or more openings or ports for fluidly connecting to an end of a breathing conduit, the breathing conduit providing delivery of the flow of gases to a user.

26. An apparatus according to any one of claims 21-25 wherein the main body of the measurement device further comprises one or more exhaust openings that are in fluid communication with the main lumen or lumens.