Claims

What is claimed is:

1. A system comprising: a reagent selector valve controllable to select a reagent flow path from a plurality of reagent flow paths; a pump fluidically coupled to the reagent flow path to draw a fluid through the selected reagent flow path in accordance with a prescribed test protocol and to then discharge the drawn fluid via a discharge flow path fluidically coupled with the pump; a flow meter to measure liquid flow rates caused by displacement of any liquid in the pump through the discharge flow path during discharge of the drawn fluid from the pump and to generate data representative of the measured liquid flow rates; and control circuitry operatively coupled to the reagent selector valve, the pump, and the flow meter, the control circuitry having one or more processors and a memory to store machine-executable instructions which, upon being executed by the one or more processors, control the one or more processors to access the data and to determine a volume of the liquid discharged by the pump from the data, wherein the memory is to store further machine-executable instructions which, upon being executed by the one or more processors, further control the one or more processors to control operation of the reagent selector valve and of the pump to perform multiple reagent displacement tests, wherein for each reagent displacement test, the one or more processors are controlled to: a) cause the reagent selector valve to select a different one of the reagent flow paths as a selected reagent flow path, b) cause the pump to aspirate a predetermined quantity of fluid while fluidically connected with the selected reagent flow path, c) cause the pump to expel the fluid from (b) through a discharge flow path, d) obtain data from the flow meter regarding the measured liquid flow rate of any liquid flowing through the discharge flow path as a result of (c), e) determine whether a fault condition exists responsive to the data obtained in (d) indicating that a total amount of liquid flowed through the discharge flow path in (c) is outside of a first predetermined threshold amount of the predetermined quantity of fluid of (b), and f) provide a

notification when it is determined upon the determination that the fault condition exists for one or more of the reagent displacement tests.

2. The system of claim 1, wherein the pump comprises a syringe pump.

3. The system of claim 1, wherein the flow meter is fluidically in-line with the discharge flow path.

4. The system of claim 1, wherein the memory is to store further machine-executable instructions which, upon being executed by the one or more processors, further control the one or more processors to cause the one or more processors to determine a steady-state flow rate using data starting a predetermined amount of time after a pumping cycle begins and ending a predetermined amount of time before the pumping cycle ends.

5. The system of claim 4, wherein the memory is to store further machine-executable instructions which, upon being executed by the one or more processors, further control the one or more processors to cause the one or more processors to integrate the measured liquid flow rates to obtain the total volume of the liquid displaced by the pump.

6. The system of claim 1, wherein the memory is to store further machine-executable instructions which, upon being executed by the one or more processors, further control the one or more processors to cause the one or more processors to perform low-pass filtering of the measured liquid flow rates.

7. The system of claim 1, wherein the pump is to draw and discharge between about 2000 microliters and about 4000 microliters of fluid.

8. The system of claim 1, wherein the pump is to draw and discharge the fluid at a fluid flow rate of between about 1000 microliters per minute and about 10000 microliters per minute.

9. A system comprising: a flow cell through which reagents from a plurality of reagent recipients are to be pumped during a genetic sequencing operation; a reagent selector valve controllable to select a selected reagent from the plurality of reagent recipients; a common line selector valve fluidically connected with the reagent selector valve and controllable to selectively direct the selected reagent through the flow cell or through a bypass line; a discharge flow path; a flow meter fluidically coupled to the discharge flow path to measure liquid flowed through the discharge flow path and to generate data representative of the measured liquid flow; a pump fluidically interposed between i) the discharge flow path and ii) the flow cell and the bypass line, the pump to draw the selected reagent through a flow path defined by positions of the reagent selector valve and the common line selector valve and to expel the selected reagent through the discharge flow path; and control circuitry operatively coupled to the reagent selector valve, the common line selector valve, the pump, and the flow meter, the control circuitry having one or more processors and a memory to store machine-executable instructions which, upon being executed by the one or more processors, control the one or more processors to access the data and to determine a volume of the liquid expelled by the pump, wherein the memory is to store further machine-executable instructions which, upon being executed by the one or more processors, further control the one or more processors to perform multiple reagent displacement tests, wherein for each reagent displacement test, the one or more processors are controlled to: a) cause the reagent selector valve to select a different reagent and the common line selector valve to select between the flow cell or the bypass line to define a selected flow path, b) cause the pump to aspirate a predetermined quantity of fluid through the selected flow path, c) cause the pump to expel the fluid from (b) through the discharge flow path, d) obtain data from the flow meter regarding the measured liquid flow rate of any liquid reagent flowing through the discharge flow path resulting from (c), e) determine, for each displacement test,

whether a fault condition exists responsive to the data obtained in (d) indicating that a total volume of liquid flowed through the discharge flow path in (c) is outside of a first predetermined threshold amount of the predetermined quantity of fluid of (b), and f) provide a notification when it is determined upon the determination that the fault condition exists for one or more of the reagent displacement tests.

10. The system of claim 9, wherein the memory is to store further machine-executable instructions which, upon being executed by the one or more processors, further control the one or more processors cause the reagent selector valve and the common line selector valve to define a desired flow path.

11. The system of claim 9, wherein the memory is to store further machine-executable instructions which, upon being executed by the one or more processors, further control the one or more processors to integrate the measured liquid flow rate from (d) to obtain the total volume of the fluid expelled by the pump in (c).

12. A method comprising: implementing a stored test protocol for performing one or more reagent displacement tests, wherein each reagent displacement test includes: a) selecting, with a reagent selector valve, a reagent flow path from a plurality of reagent flow paths; b) actuating a pump to draw a predetermined amount of fluid through the selected reagent flow path in accordance with the stored test protocol; c) discharging the drawn fluid from the pump and through a discharge flow path; d) measuring, with a flow meter, flow rates of any liquid discharged through the discharge flow path during (c) and generating data representative of the flow rates; e) processing, with control circuitry having one or more processors and a memory, the data to determine a quality of the selected reagent flow path, f) determining, as part of (e), a total volume of the liquid flowed through the discharge flow path during (c) using the data; g) determining that the total volume of the liquid flow through the discharge path during (c) is outside of a first threshold amount from the predetermined amount of fluid that the selected reagent flow

path of (a) has a fault; and h) responsive to (g), producing a notification regarding the fault.

13. The method of claim 12, wherein (a) through (e) are repeated for different reagent flow paths.

14. The method of claim 12, wherein (e) comprises low-pass filtering the data.

15. The method of claim 12, wherein (f) comprises integrating the data to obtain the total volume of the liquid flowed through the discharge flow path during (c).