CLAIMS

1. A method, comprising:

coupling a flow cell having a plurality of channels to a flow cell interface, the flow cell interface fluidically coupled to a pump manifold assembly;

moving a first pump valve of a plurality of pump valves of the pump manifold assembly to a first position to fluidically connect a first channel of the plurality of channels with a first pump of a plurality of pumps, the first pump fluidically connected to the first channel via a first pump-channel fluidic line;

pumping a first volume of a first reagent through the first channel using the first pump via the first pump-channel fluidic line;

moving the first pump valve of the plurality of pump valves to a second position to fluidically connect the pump and the first pump-channel fluidic line with a shared fluidic line in fluid communication with a waste reservoir;

pumping the first volume of the first reagent into the waste reservoir through the shared fluidic line;

moving a second pump valve of a plurality of pump valves to a first position to fluidically connect a second channel of the plurality of channels with a second pump of the plurality of pumps, the second pump fluidically connected to the second channel via a second pump-channel fluidic line;

pumping a second volume of the first reagent into the second channel using the second pump via the second pump-channel fluidic line;

moving the second pump valve of the plurality of pump valves to a second position to fluidically connect the second pump and the second pump-channel fluidic line with the shared fluidic line in fluid communication with the waste reservoir;

pumping the second volume of the first reagent into the waste reservoir through the shared fluidic line; and

operating one or more of the plurality of pump valves and one or more of the plurality of pumps of the pump manifold assembly to load one or more of the plurality of channels of the flow cell with a sample of interest,

wherein operating the one or more of the plurality of pumps to load one or more of the channels of the plurality of channels of the flow cell with the sample of interest includes flowing the sample of interest in a first direction, further comprising operating one or more of the plurality

of pumps of the pump manifold assembly to control a flow of reagent through the channels of the flow cell in a second direction opposite the first direction.

2. The method of claim 1, further comprising moving a bypass valve to a first position to fluidically couple a bypass fluidic line and a cache of the pump manifold assembly, and pumping a third volume of the first reagent or another reagent through the bypass fluidic line and into the cache.

3. The method of claim 2, further comprising actuating one or more of the plurality of pump valves, one or more of the plurality of pumps, or a cache valve of the pump manifold assembly and pumping reagent between at least one of the shared fluidic line and a primary waste fluidic line in fluidic communication with the waste reservoir or the bypass fluidic line and the primary waste fluidic line.

4. The method of claim 1, further comprising operating one or more of the plurality of pumps of the pump manifold assembly to flow the sample of interest out of the one or more channels of the flow cell and into an auxiliary waste fluidic line, the auxiliary waste fluidic line being upstream of the flow cell interface.

5. An apparatus, comprising:

a flow cell including a plurality of channels, a front, and a rear;

a flow cell interface adapted to be coupled to the flow cell;

a pump manifold assembly carrying a plurality of pump valves and a plurality of pumps and comprising a plurality of pump-channel fluidic lines, a plurality of pump fluidic lines, and a shared fluidic line, the pump valves and the pumps are operable to individually control fluid flow through each channel of the plurality of channels of the flow cell via the corresponding pump-channel fluidic lines, each pump valve being coupled to a corresponding pump-channel fluidic line, a corresponding pump fluidic line, and the shared fluidic line and being movable between a first position fluidically coupling a corresponding channel of the plurality of channels, a corresponding pump-channel fluidic line, and a corresponding pump fluidic line and a second position fluidically coupling a corresponding pump fluidic line, the shared fluidic line, and a waste reservoir, each pump coupled to a corresponding pump fluidic line;

a reagent reservoir positioned upstream of the flow cell interface and fluidly connected to the front of the flow cell interface; and

a sample cartridge comprising a plurality of sample wells and positioned downstream of the flow cell interface, fluidically between the flow cell interface and the pump manifold assembly, and fluidly connected to the rear of the flow cell interface,

wherein, when the flow cell interface is coupled to the flow cell, the front of the flow cell is fluidly connected to the reagent reservoir, and the rear of the flow cell is fluidly connected to the sample cartridge, the plurality of pumps is operable to load one or more of the channels of the plurality of channels of the flow cell with a sample of interest from the sample cartridge by flowing the sample of interest in a first direction into the one or more channels of the flow cell, and the plurality of pumps is operable to flow reagent from the reagent reservoir through the channels of the flow cell in a second direction, opposite the first direction; and

wherein the waste reservoir is fluidly connected to the front of the flow cell by an auxiliary waste fluidic line to the rear of the flow cell by a primary waste fluidic line.

6. The apparatus of claim 5,

wherein the pump manifold assembly further comprises a cache;

wherein the cache is adapted to temporarily store one or more reaction components;

wherein the apparatus further comprises a bypass valve and a bypass fluidic line; and

wherein the bypass fluidic line couples the bypass valve and the cache.

7. The apparatus of claim 6, wherein the pump manifold assembly further comprises a cache valve and a cache fluidic line, the cache valve being coupled to the cache fluidic line and the shared fluidic line.

8. The apparatus of claim 7, wherein the pump manifold assembly further comprises a primary waste fluidic line coupled to the waste reservoir, the cache valve coupled to the primary waste fluidic line.

9. The apparatus of any one of claims 5 – 8, wherein the pump manifold assembly further comprises a plurality of sensors adapted to determine one or more of a pressure value or a flow rate value of one or more of: at least one of the pump-channel fluidic lines or the shared fluidic line.

10. The apparatus of any one of claims 5 – 9, further comprising a pair of pump drive assemblies that are operable to drive the plurality of pumps.

11. The apparatus of any one of claims 5 – 10, further comprising a sample cartridge interface adapted to be coupled to a sample cartridge, the sample cartridge interface positioned downstream of the flow cell interface.

12. The apparatus of claim 11, further comprising a sample loading manifold assembly positioned between the flow cell interface and the sample cartridge interface and comprising a body carrying a plurality of sample valves and defining a plurality of sample ports, a plurality of flow cell ports, and a plurality of pump ports, each sample port coupled to a corresponding port of the sample cartridge interface via a sample fluidic line, each flow cell port coupled to a corresponding port of the flow cell interface and associated with one of the channels of the plurality of channels of the flow cell via a flow cell fluidic line, and each pump port coupled to a corresponding pump-channel fluidic line of the plurality of pump-channel fluidic lines.

13. The apparatus of claim 12, wherein the sample valves of the sample loading manifold assembly and pumps of the pump manifold assembly are operable to individually load each channel of the plurality of channels of the flow cell with a sample of interest.

14. The apparatus of any one of claims 12 – 13, wherein each sample valve is operable to fluidly communicate a port of the sample cartridge and a corresponding pump of the plurality of pumps of the pump manifold assembly and to fluidly communicate a pump of the plurality of pumps of the pump manifold assembly and a corresponding channel of the plurality of channels of the flow cell.

15. The apparatus of any one of claims 5 – 14, further comprising a central valve and an auxiliary waste fluidic line coupled to the central valve and adapted to be coupled to the waste reservoir, the auxiliary waste fluidic line being positioned upstream of the flow cell interface.

16. The apparatus of claim 15, further comprising a shared line valve, a bypass valve, a plurality of dedicated reagent fluidic lines, and a shared reagent fluidic line, the shared reagent fluidic line coupling the shared line valve and the central valve and adapted to flow one or more reagents to the flow cell via the central valve, each dedicated reagent fluidic line

coupling the bypass valve and the central valve and adapted to flow a reagent to the flow cell via the central valve.

17. An apparatus, comprising:

one or more valves adapted to be coupled to corresponding reagent reservoirs;

a flow cell including a plurality of channels, a front, and a rear;

a flow cell interface adapted to be coupled to the flow cell having a plurality of channels;

a pump manifold assembly having a plurality of pumps, a plurality of pump valves, and a cache,

wherein the cache is adapted to temporarily store one or more reaction components; and

wherein each pump and each pump valve is operable to individually control fluid flow for each channel of the plurality of channels of the flow cell;

a bypass fluidic line operatively coupled between the one or more valves and the cache;

one or more of the reagent reservoirs positioned upstream of the flow cell interface and fluidly connected to the front of the flow cell interface;

a sample cartridge comprising a plurality of sample wells and positioned downstream of the flow cell interface, fluidically between the flow cell interface and the pump manifold assembly, and fluidly connected to the rear of the flow cell interface; and

a sample of interest, the sample of interest being disposed in the sample cartridge,

wherein when the flow cell interface is coupled to the flow cell, the front of the flow cell is fluidly connected to one or more of the plurality of reagent reservoirs, and the rear of the flow cell is fluidly connected to the sample cartridge, the plurality of pumps is operable to load one or more of the channels of the plurality of channels of the flow cell with the sample of interest from the sample cartridge by flowing the sample of interest in a first direction into the one or more channels, and the plurality of pumps is operable to flow reagent from the reagent reservoirs through the channels of the flow cell in a second direction, opposite the first direction.

18. The apparatus of claim 17, further comprising a sample loading manifold assembly having a plurality of sample valves, wherein each sample valve and a corresponding pump of the pump manifold assembly is operable to individually load each channel of the plurality of channels of the flow cell, the sample loading manifold assembly being positioned downstream of the flow cell.

19. The apparatus of any one of claims 17 – 18, further comprising a flow cell assembly including the flow cell having the plurality of channels and a flow cell manifold, wherein the flow cell manifold includes an inlet, a plurality of fluidic lines, and a plurality of outlets, wherein each outlet of the flow cell manifold is coupled to a corresponding channel of the flow cell.