CLAIMS

1. A fluid sampling device comprising:

a first conduit configured to couple an outlet of a fluid source to a sample inlet port;

a second conduit configured to couple a sample outlet port to an inlet of the fluid source;

an expansion chamber comprising an inlet and an outlet coupled to the first and second conduits by a valve assembly; and

a pressure relief valve configured to couple the outlet of the expansion chamber to the inlet of the fluid source, wherein the first conduit is further configured to be coupled to an inert gas source, such that:

inert gas from the inert gas source pushes fluid within the first and second conduits toward the inlet of the fluid source when the valve assembly is in a first position, thereby purging the first and second conduits, and

inert gas from the inert gas source pushes fluid within the expansion chamber towards the inlet of the fluid source when the valve assembly is in a second position and the pressure relief valve is opened, thereby purging the expansion chamber, and

wherein the valve assembly comprises a tandem valve including a pair of three-way valves, a first of the three-way valves coupling the inlet of the expansion chamber to the second conduit, and a second of the three-way valves coupling the outlet of the expansion chamber to first conduit.

2. The fluid sampling device of claim 1, further comprising a portable housing supporting the first and second conduits, the expansion chamber and the pressure relief valve.

3. The fluid sampling device of claim 1, further comprising a booster pump configured to be coupled to the first conduit, wherein operation of the booster pump induces fluid from the outlet of the fluid source to flow through the first conduit towards the sample inlet port.

4. The fluid sampling device of claim 3, wherein the booster pump comprises a

gas drive, and wherein an intake port of the gas drive is configured to be coupled to the inert gas source.

5. The fluid sampling device of claim 4, further comprising an inert-gas routing valve configured to modulate coupling of the inert gas source between the first conduit and the intake port of the gas drive of the booster pump.

6. The fluid sampling device of claim 3, further comprising a booster-pump valve configured to modulate coupling of the first conduit with a high-pressure outlet of the booster pump.

7. A fluid sampling device comprising:

a first conduit configured to couple an outlet of a fluid source to a sample inlet port;

a second conduit configured to couple a sample outlet port to an inlet of the fluid source;

an expansion chamber comprising an inlet and an outlet coupled to the first and second conduits by a valve assembly;

a booster pump configured to be coupled to the first conduit, such that operation of the booster pump induces fluid from the outlet of the fluid source to flow through the first conduit towards the sample inlet port; and

a portable housing supporting the first and second conduits, the expansion chamber and the booster pump,

wherein the booster pump comprises a gas drive, and wherein an intake port of the gas drive is configured to be coupled to an inert gas source, and further comprising an inert-gas routing valve configured to modulate coupling of the inert gas source between the first conduit and the intake port of the gas drive of the booster pump.

8. The fluid sampling device of claim 7, further comprising a sample vessel coupled to the sample inlet port and the sample outlet port.

9. The fluid sampling device of claim 8, wherein fluid from the fluid source flows

in a closed loop between the sample vessel and the fluid source when the valve assembly is in a first position, thereby flushing the sample vessel, and

wherein the fluid flows in a closed loop between the sample vessel and the expansion chamber when the valve assembly is in a second position, thereby expanding a portion of the fluid in the sample vessel.

10. The fluid sampling device of claim 7, further comprising a booster-pump valve configured to modulate coupling of the first conduit with a high-pressure outlet of the booster pump.

11. A method of purging a fluid sampling device, the method comprising:

coupling a fluid conduit of the fluid sampling device to an inert gas source;

circulating the inert gas through the fluid conduit;

circulating the inert gas through an expansion chamber of the fluid sampling device;

circulating the inert gas through a valve assembly comprising a tandem valve including a pair of three-way valves, a first of the three-way valves coupling an inlet of the expansion chamber to the fluid conduit, and a second of the three-way valves coupling an outlet of the expansion chamber to the fluid conduit; and

depositing at least a portion of the inert gas and at least a portion of any sample fluid purged from the fluid conduit and the expansion chamber directly from the fluid sampling device to a source of the sample fluid coupled to the fluid sampling device.

12. The method of claim 11, further comprising:

modulating the valve assembly between first and second positions to cause discrete portions of inert gas to circulate through the expansion chamber.

13. The method of claim 11, further comprising:

engaging an override device of a pressure relief valve coupled to the outlet of the expansion chamber, thereby fluidically coupling the expansion chamber with the source of the sample fluid.

14. A fluid sampling device comprising:

a first conduit configured to couple an outlet of a fluid source to a sample inlet port;

a second conduit configured to couple a sample outlet port to an inlet of the fluid source;

an expansion chamber comprising an inlet and an outlet coupled to the first and second conduits by a valve assembly;

a pressure relief valve configured to couple the outlet of the expansion chamber to the inlet of the fluid source; and

a booster pump configured to be coupled to the first conduit, wherein operation of the booster pump induces fluid from the outlet of the fluid source to flow through the first conduit towards the sample inlet port, and wherein the booster pump comprises a gas drive, and wherein an intake port of the gas drive is configured to be coupled to an inert gas source, and

wherein the first conduit is further configured to be coupled to the inert gas source, such that:

inert gas from the inert gas source pushes fluid within the first and second conduits toward the inlet of the fluid source when the valve assembly is in a first position, thereby purging the first and second conduits, and

inert gas from the inert gas source pushes fluid within the expansion chamber towards the inlet of the fluid source when the valve assembly is in a second position and the pressure relief valve is opened, thereby purging the expansion chamber.

15. The fluid sampling device of claim 14, further comprising a portable housing supporting the first and second conduits, the expansion chamber, and the pressure relief valve.

16. The fluid sampling device of claim 14, further comprising an inert-gas routing valve configured to modulate coupling of the inert gas source between the first conduit and the intake port of the gas drive of the booster pump.

17. The fluid sampling device of claim 14, further comprising a booster-pump

valve configured to modulate coupling of the first conduit with a high-pressure outlet of the booster pump.

18. A fluid sampling device comprising:

a first conduit configured to couple an outlet of a fluid source to a sample inlet port;

a second conduit configured to couple a sample outlet port to an inlet of the fluid source;

an expansion chamber comprising an inlet and an outlet coupled to the first and second conduits by a valve assembly;

a booster pump configured to be coupled to the first conduit, such that operation of the booster pump induces fluid from the outlet of the fluid source to flow through the first conduit towards the sample inlet port; and

a portable housing supporting the first and second conduits, the expansion chamber, and the booster pump,

wherein the valve assembly comprises a tandem valve including a pair of three-way valves, a first of the three-way valves coupling the inlet of the expansion chamber to the second conduit, and a second of the three-way valves coupling the outlet of the expansion chamber to first conduit.

19. The fluid sampling device of claim 18, further comprising a sample vessel coupled to the sample inlet port and the sample outlet port.

20. The fluid sampling device of claim 19, wherein fluid from the fluid source flows in a closed loop between the sample vessel and the fluid source when the valve assembly is in a first position, thereby flushing the sample vessel, and

wherein the fluid flows in a closed loop between the sample vessel and the expansion chamber when the valve assembly is in a second position, thereby expanding a portion of the fluid in the sample vessel.

21. The fluid sampling device of claim 18, further comprising a booster-pump valve configured to modulate coupling of the first conduit with a high-pressure outlet of the booster pump.