CLAIMS

What is claimed is:

1. An injection device, comprising:

a housing;

a container disposed within the housing, the container enclosing a fluid and having a first end and a second end;

a conduit movable relative to the container, wherein the conduit is not in fluid communication with the fluid enclosed by the container while in a first position, and is in fluid communication with the fluid enclosed by the container and configured to deliver the fluid from the container to a patient while in a second position;

a lock that is removable from the housing, the lock having a first portion and a second portion, wherein:

in a first configuration where the lock is coupled to the housing, the first portion of the lock is disposed exterior of the housing and the second portion of the lock is disposed within the housing between the container and the conduit;

in the first configuration, the conduit is prevented from moving into fluid communication with the fluid enclosed by the container by the second portion of the lock; and

in a second configuration where the lock is removed from the injection device, the conduit is able to move into fluid communication with the fluid enclosed by the container.

2. The injection device of claim 1, further including:

an adhesive disposed exterior of the housing; and

a cover disposed over the adhesive, wherein the cover is removable from the injection device to expose the adhesive,

wherein the lock is coupled to the cover such that the lock is removed from the injection device when the cover is removed from the injection device.

3. The injection device of claim 1, further including a controller and a skin sensor coupled to the controller, wherein:

the skin sensor is configured to detect when skin is in contact with an outer surface of the housing adjacent to the skin sensor;

the controller is configured to cause the conduit to move into fluid communication with the fluid enclosed by the container; and

when the lock is coupled to the housing in the first configuration, the first portion of the lock is configured to prevent skin from contacting the outer surface of the housing adjacent to the skin sensor.

4. The injection device of claim 1, wherein, while in the first configuration, the lock is configured to prevent inadvertent activation of the injection device when the injection device is dropped or subject to vibration.

5. An injection device, comprising:

a housing;

a plunger coupled to the housing and movable relative to the housing;

one or more electronics components used during an injection performed by the injection device, the one or more electronics components being formed within an electrical circuit, wherein:

in a first configuration, a first portion of the plunger is disposed within the housing, the electrical circuit is open, and the one or more electronics components are in a low-power sleep mode;

in a second configuration, the plunger moves outward relative to the housing, and the first portion of the plunger extends exterior of the housing; and

in the second configuration, the electrical circuit is closed, and the one or more electronics components are transitioned from the low-power sleep mode, to an active mode.

6. The injection device of claim 5, further comprising a biasing member movable from a resting position to a stressed position, wherein:

in the first configuration, the biasing member is in the stressed position; and

in the second configuration, the biasing member is in the resting position.

7. The injection device of claim 6, further including a stop configured to maintain the biasing member in the stressed position and the plunger in the first configuration when the stop is in a blocking position, wherein movement of the stop from the blocking position allows the biasing member to move to the resting position and the plunger to move to the second configuration.

8. The injection device of claim 7, wherein the stop includes a packaging of the injection device.

9. The injection device of claim 5, wherein the one or more electronics components include a switch, and transition of the plunger from the first configuration to the second configuration moves the switch to close the electrical circuit.

10. The injection device of claim 5, wherein:

the plunger is movable from the second configuration toward the housing to a third configuration; and

the injection device is configured to initiate an injection by the injection device only after the plunger is moved to the third configuration and the one or more electronics components are in the active mode.

11. The injection device of claim 10, wherein:

the one or more electronics components include a skin sensor and the injection device further includes a controller configured to initiate the injection by the injection device;

the skin sensor is configured to detect a presence of skin in contact with an outer surface of the housing adjacent to the skin sensor only after the plunger has moved to the third configuration; and

the controller is configured to initiate the injection only after detection of skin by the skin sensor.

12. The injection device of claim 11, further including a motor configured to dispense medicament from the injection device during the injection, wherein:

during the injection, the plunger is movable from the third configuration, away from the housing, to a fourth configuration; and

the controller is configured to cease operation of the motor while the motor is operating and the controller senses the plunger has moved from the third configuration to the fourth configuration.

13. The injection device of claim 12, wherein the controller is configured to:

determine that skin has remained in contact with the outer surface of the housing adjacent to the skin sensor, while the plunger is in the fourth configuration; and

resume operation of the motor when the plunger moves from the fourth configuration to the third configuration, after the controller determines that skin has remained in contact with the outer surface of the housing adjacent to the skin sensor while the plunger was in the fourth configuration.

14. An injection device, comprising:

a housing, wherein the housing includes a curved bottom surface that is concave when viewed from a point external to the housing that is closer to the bottom surface of the housing than a top surface of the housing;

a circuit board positioned adjacent to the bottom surface of the housing, wherein the circuit board includes a skin sensor configured to sense a presence of skin in contact with the bottom surface of the housing; and

a controller coupled to the circuit board, wherein the controller is configured to initiate an injection by the injection device only after the skin sensor senses the presence of skin in contact with the bottom surface of the housing.

15. The injection device of claim 14, wherein the skin sensor is configured to sense the presence of skin in contact with the bottom surface of the housing without skin directly contacting the skin sensor.

16. The injection device of claim 14, wherein the skin sensor is a capacitance sensor.

17. The injection device of claim 14, wherein:

the housing further includes an opening in the curved bottom surface;

the injection device further includes a needle extendable out of the housing through the opening; and

the skin sensor is positioned adjacent to the opening.

18. The injection device of claim 14, wherein the circuit board is the only circuit board disposed within the housing.

19. A method of manufacturing an injection device, the method comprising:

depositing a first material onto a mold, the first material having a first opacity;

depositing a second material around the mold and the first material, the second material having a second opacity that is higher than the first opacity; and

positioning a container enclosing a medicament within the injection device and adjacent to a first portion of the injection device formed by the first material.

20. The method of claim 19, further including positioning one or more LEDs within the injection device and adjacent to one or more second portions of the injection device, separate from the first portion of the injection device, the one or more second portions of the injection device being formed by the first material.

21. An injection device, comprising:

a container disposed within a housing, the container having a first end and a second end;

a piston configured to move from the first end of the container toward the second end of the container to dispense a medicament from the container;

a drive member configured to drive the piston through the container;

an emitter configured to emit a beam of light toward the container;

a detector positioned on an opposing side of the container from the emitter, wherein the detector is configured to receive the beam of light emitted from the emitter; and

a controller coupled to the drive member, the emitter, and the detector, the controller being configured to:

receive a first signal from the detector while the emitter is off, the first signal corresponding to an ambient level of light surrounding the injection device;

receive a second signal from the detector while the emitter is on;

calculate a difference between light values represented by the first signal and the second signal; and

cease operation of the drive member when the difference is less than a threshold value.

22. An injection device, comprising:

a container disposed within a housing, the container having a first end and a second end;

a piston configured to move from the first end of the container toward the second end of the container to dispense a medicament from the container;

a drive member configured to drive the piston through the container;

an emitter configured to emit a beam of light toward the container;

a detector positioned on an opposing side of the container from the emitter, wherein the detector is configured to receive the beam of light emitted from the emitter; and

a controller coupled to the drive member, the emitter, and the detector, the controller being configured to:

initiate the drive member and the emitter;

receive a first signal from the detector while the emitter is on, the first signal being representative of an amount of light received by the detector;

allow for continued operation of the drive member for a first period of time immediately after initiation of the drive member; and

cease operation of the drive member upon determining (1) that the amount of light received by the detector is less than a first threshold light value and (2) before the amount of light received by the detector subsequently rises to or above the first threshold light value, that a current of the drive member is greater than a first threshold current value.

23. The injection device of claim 22, wherein the controller is further configured to:

continue operation of the drive member if the determined amount of light received by the detector is less than the first threshold value and, before the current of the drive member exceeds the first threshold current value, the amount of light received by the detector rises to or above the first threshold light value.

24. An injection device, comprising:

a container disposed within a housing, the container having a first end and a second end;

a piston configured to move from the first end of the container toward the second end of the container to dispense a medicament from the container;

a drive member configured to drive the piston through the container; and

a controller coupled to the drive member, the controller being configured to:

maintain a speed of the drive member until a current of the drive member exceeds a first threshold; and

after the current of the drive member exceeds the first threshold, reduce a voltage of the drive member to maintain the current of the drive member below a second threshold that is greater than or equal to the first threshold.

25. The injection device of claim 1, further including a controller and a skin sensor coupled to the controller, wherein:

the skin sensor is configured to detect when skin is in contact with an outer surface of the housing adjacent to the skin sensor;

the controller is configured to cause the conduit to move into fluid communication with the fluid enclosed by the container; and

the injection device further comprises a removable cover configured to prevent skin from contacting the outer surface of the housing adjacent to the skin sensor.

26. The method of claim 19, further comprising:

positioning a conduit movable relative to the container within the injection device such that the conduit is not in fluid communication with the fluid enclosed by the container;

wherein the first portion includes a first transparent window through which an interior of the injection device is visible; and

wherein the container is visible through the transparent window.

27. The method of claim 26, wherein the first portion further includes a plurality of second transparent windows arranged on a top surface of the injection device, wherein at least one LED is visible through each of the plurality of second transparent windows; and

wherein the first transparent window and the plurality of second transparent windows are collectively formed of a contiguous portion of the first material.

28. A device, comprising:

a housing;

a cartridge disposed within the housing, the cartridge enclosing a fluid and having a first end and a second end;

a drive member configured to apply force against the cartridge and cause the cartridge to translate relative to the housing;

a lock that is removable from the housing, the lock having a first portion and a second portion, wherein:

in a first configuration where the lock is coupled to the housing, the first portion of the lock is disposed exterior of the housing and the second portion of the lock is disposed within the housing adjacent the cartridge;

in the first configuration, the cartridge is prevented from translating relative to the housing; and

in a second configuration where the lock is removed from the housing, the cartridge is permitted to translate relative to the housing.

29. A device, comprising:

a housing;

a plunger coupled to the housing and movable relative to the housing;

one or more electronics components being formed within an electrical circuit, wherein:

in a first configuration, a first portion of the plunger is disposed within the housing, the electrical circuit is open, and the one or more electronics components are in a low-power sleep mode;

in a second configuration, the plunger moves outward relative to the housing, and the first portion of the plunger extends exterior of the housing; and

in the second configuration, the electrical circuit is closed, and the one or more electronics components are transitioned from the low-power sleep mode, to an active mode.

30. A device, comprising:

a housing;

a cartridge disposed within the housing;

a piston configured to move within the cartridge;

a drive member configured to apply force against the piston;

a plurality of indicator lights;

a controller configured to:

cause the drive member to apply force against the piston such that the piston moves within the cartridge; and

cause, upon movement of the piston within the cartridge, a first set of the plurality of indicator lights to illuminate.

31. An injection device, comprising:

a cartridge disposed within a housing, the cartridge having a first end and a second end;

a piston configured to move from the first end of the cartridge toward the second end of the cartridge to dispense a medicament from the cartridge;

a drive member configured to apply a force to move the piston through the cartridge; and

a controller coupled to the drive member, the controller being configured to:

maintain a speed of the drive member until a current of the drive member exceeds a first current threshold;

reduce, in response to the current of the drive member exceeding the first current threshold, a voltage applied to the drive member to maintain the current of the drive member below a second current threshold that is greater than or equal to the first current threshold.

32. The injection device of claim 31, wherein the controller is further configured to:

maintain the current of the drive member below the second current threshold until the voltage applied to the drive member decreases below a first voltage threshold; and

cease, in response to the voltage applied to the drive member decreasing below the first voltage threshold, applying the voltage to the drive member for a first time interval.

33. The injection device of claim 32, wherein the controller is further configured to:

resume, after expiration of the first time interval, applying the voltage to the drive member.

34. The injection device of claim 33, wherein the controller is further configured to:

determine, within a second time interval after resumption of applying the voltage to the drive member, whether the voltage applied to the drive member decreases below the first voltage threshold; and

cease, in response to the voltage applied to the drive member decreasing below the first voltage threshold within the second time interval, applying the voltage to the drive member and terminating an injection sequence.

35. An injector, comprising:

a needle moveable from a retracted configuration in which the needle is disposed entirely within a housing to a deployed configuration in which the needle extends outwardly from the housing;

a cartridge configured to contain a medicament and to come into fluid communication with the needle;

a wireless communication module configured to communicate with an application of a mobile device; and

a controller configured to:

cause the needle to move from the retracted configuration to the deployed configuration; and

transmit, upon movement of the needle from the retracted configuration to the deployed configuration, via the wireless communication module to the application, an indication of the movement of the needle from the retracted configuration to the deployed configuration.

36. The injector of claim 35, wherein the controller is further configured to:

receive, prior to causing the needle to move from the retracted configuration to the deployed configuration, via the wireless communication from the application, an indication authenticating an identity of a user of the injector; and

cause, in response to the indication, the needle to move from the retracted configuration to the deployed configuration.

37. The injector of claim 35, wherein the controller is further configured to:

cause the needle to retract within the housing; and

transmit, upon retraction of the needle, via the wireless communication to the application, an indication of an end of an injection sequence.

38. A controller for an injection device, comprising:

one or more memories storing instructions; and

one or more processors operatively connected to the one or more memories, the one or more processors configured to execute the instructions to:

cause a needle to move from a retracted configuration in which the needle is disposed entirely within a housing to a deployed configuration in which the needle extends outwardly from the housing; and

transmit, upon movement of the needle from the retracted configuration to the deployed configuration, via a wireless communication module to an application of a mobile device, an indication of the movement of the needle from the retracted configuration to the deployed configuration.

39. A method of manufacturing a housing for an injection device, the method comprising:

depositing a transparent material into a first mold having a first core and a first cavity, wherein the first mold is configured to form the transparent material into a first portion including a plurality of windows of the housing;

moving the first core and the first portion into a second cavity to form a second mold, wherein the second mold is configured to form an upper portion of the housing; and

depositing an opaque material into the second cavity and onto the first portion to form the upper portion of the housing, wherein the upper portion is configured to be assembled with a remainder of the housing to enclose a vial containing a medicament.

40. The method of claim 39, wherein at least one of the plurality of windows is configured to make the vial or the medicament visible from outside the housing.

41. The method of claim 39, wherein the first portion including the plurality of windows is contiguously formed of the transparent material.

42. An injector, comprising:

a housing including an opening;

a medicament container disposed within the housing, the medicament container having a first end and a second end;

a seal coupled to the second end of the medicament container; and

a fluid conduit having a moveable distal end and a container end, the moveable distal end configured to extend from within the housing outside of the housing through the opening, and the container end configured to pierce the seal to bring the fluid conduit into fluid communication with an interior of the medicament container;

wherein the container end of the fluid conduit includes a sharp needle tip and a side port configured to allow fluid to enter the fluid conduit.

43. The injector of claim 42, wherein the sharp needle tip is positioned between the second end of the medicament container and the side port.

44. The injector of claim 42, wherein the side port is defined by at least one wall inclined at an angle relative to a longitudinal axis of the container end of the fluid conduit.

45. The injector of claim 44, wherein the at least one wall is inclined at an angle between about 20° and about 60° relative to the longitudinal axis.

46. An injection device, comprising:

a cartridge disposed within a housing, the cartridge having a first end and a second end;

a piston configured to move from the first end of the cartridge toward the second end of the cartridge to dispense a medicament from the cartridge;

a drive member configured to apply force against the piston;

an emitter configured to emit a beam of light toward the cartridge;

a detector positioned on an opposing side of the cartridge from the emitter, wherein the detector is configured to receive the beam of light emitted from the emitter; and

a controller coupled to the drive member, the emitter, and the detector, the controller being configured to:

cause the drive member to apply force against the piston in a first direction extending from the first end toward the second end;

receive a first signal from the detector while the emitter is off, the first signal corresponding to an ambient level of light surrounding the injection device;

receive a second signal from the detector while the emitter is on;

determine whether a difference between light values represented by the first signal and the second signal is less than a threshold value; and.

cause, in response to a determination that the difference is less than the threshold value, the drive member to cease applying force against the piston in the first direction.

47. The injection device of claim 46, wherein the controller is further configured to:

cause, in response to a determination that the difference is not less than the threshold value, the drive member to continue applying force against the piston in the first direction.

48. An injection device, comprising:

a cartridge disposed within a housing, the cartridge having a first end and a second end;

a piston configured to move from the first end of the cartridge toward the second end of the cartridge to dispense a medicament from the cartridge;

a drive member configured to apply force against the piston;

an emitter configured to emit a beam of light toward the cartridge;

a detector positioned on an opposing side of the cartridge from the emitter, wherein the detector is configured to receive the beam of light emitted from the emitter; and

a controller coupled to the drive member, the emitter, and the detector, the controller being configured to:

cause the drive member to apply force against the piston in a first direction extending from the first end toward the second end for a first period of time;

receive a first signal from the detector while the emitter is on, the first signal being representative of an amount of light received by the detector;

determine, after the first period of time, (1) whether the amount of light received by the detector is less than a first threshold light value and (2) before the amount of light received by the detector subsequently rises to or above the first threshold light value, whether a current of the drive member is greater than a first threshold current value; and

cause, in response to a determination that (1) the amount of light received by the detector is less than the first threshold value and (2) before the amount of light received by the detector subsequently rises to or above the first threshold light value, that a current of the drive member is greater than a first threshold current value, the drive member to cease applying force against the piston in a first direction.

49. The injection device of claim 48, wherein the controller is further configured to:

cause, in response to a determination that the amount of light received by the detector is not less than the first threshold light value, the drive member to continue applying force against the piston in the first direction.

50. The injection device of claim 49, wherein the controller is further configured to:

determine, in response to a determination that the amount of light received by the detector is less than a first threshold light value, whether the amount of light received by the detector subsequently rises to or above the first threshold light value; and

cause, in response to a determination that the amount of light received by the detector subsequently rises to or above the first threshold light value, the drive member to continue applying force against the piston in the first direction.

51. The injection device of claim 50, wherein the controller is further configured to:

determine, in response to a determination that the amount of light received by the detector subsequently rises to or above the first threshold light value, whether the current of the drive member is greater than the first threshold current value; and

cause, in response to a determination that the a current of the drive member is greater than the first threshold current value, the drive member to continue applying force against the piston in the first direction.

52. An injector, comprising:

a housing including a top surface and a tissue-engaging surface having an opening;

a container disposed within the housing, the container configured to enclose a medicament; and

a fluid conduit having a piercing end, wherein the piercing end is configured to move from an undeployed position where the fluid conduit is entirely contained within the housing, to a deployed position where the piercing end of the fluid conduit extends through the opening; and

an electronics board disposed within the housing, the electronics board including a first board segment positioned adjacent the tissue-engaging surface and the opening, and a

second board segment positioned between the first board segment and the top surface, wherein the first board segment and the second board segment are electrically connected.

53. The injector of claim 52, wherein the first board segment includes a touch sensor incorporated therein, and wherein the touch sensor is positioned adjacent the opening.

54. The injector of claim 52, wherein the first board segment includes a cutout, and wherein the piercing end is configured to pass through the cutout when moving from the undeployed position to the deployed position.