CLAIMS

1. ~~An~~A system comprising an auto injector for administering a medicament and a cartridge assembly~~, the auto injector comprising:~~

~~a housing;~~

~~a cartridge receiver configured to receive a cartridge assembly~~;

the cartridge assembly comprising a cartridge and a cartridge code feature, the cartridge comprising:

- a first stopper;
- a cartridge compartment containing the medicament, the cartridge compartment having a first cartridge subcompartment containing a first medicament component of the medicament and a second cartridge subcompartment containing a second medicament component of the medicament;
- a second stopper movable inside the cartridge compartment; and
- a bypass section providing fluid communication between the first cartridge subcompartment and the second cartridge subcompartment;

the auto injector comprising:

a housing;

a cartridge receiver comprising the cartridge assembly;

an orientation sensor configured to detect an orientation of the cartridge and/or an orientation of the auto injector; and

a drive module coupled to move a plunger rod between a retracted plunger rod position and an extended plunger rod position, the plunger rod being configured to move the first stopper;

wherein the auto injector further comprises

a processing unit coupled to the drive module, wherein the processing unit is configured to:

- control the drive module to move the plunger rod from a first plunger rod position to a mix plunger rod position with a mix plunger rod speed, wherein the mix plunger rod position is selected to position the first stopper in a position wherein the first medicament component is mixed with the second medicament component;

- provide an onset signal after a number of completed inversions of the auto injector has been performed, and

wherein the cartridge assembly comprises the cartridge and the cartridge code feature, and the auto injector comprising a code sensor configured to read the cartridge code feature, and wherein the processing unit is coupled to the code sensor and further configured to receive from the code sensor a code signal indicative of the cartridge code feature, wherein the cartridge code feature defines the number of completed inversions required for the medicament in the cartridge;

wherein an inversion is deemed a completed inversion by the auto injector if it spans an angle above a default threshold, wherein the default threshold for the angle is at least 90 degrees.

2. ~~Auto injector~~The system according to any of the preceding claims, wherein the onset signal is generated after the number of completed inversions of the auto injector has been performed and when the second cartridge subcompartment is pointing upwards compared to the first cartridge subcompartment.

3. ~~Auto injector~~The system according to any of the preceding claims, wherein a detecting of the auto injector inversions is implemented using the orientation sensor.

4. ~~Auto injector~~The system according to any of the preceding claims, wherein the orientation sensor comprises one or more accelerometers~~, such as one accelerometer or a plurality of accelerometers~~.

5. ~~Auto injector~~The system according to any of the preceding claims, wherein the orientation sensor comprises a tilt sensor, a tri-axial accelerometer, a single axis accelerometer, a magnetometer and/or any combination thereof.

6. ~~Auto injector~~The system according to any of the preceding claims, wherein the orientation sensor comprises a tri-axial accelerometer.

7. ~~Auto injector~~The system according to any of the preceding claims, wherein the orientation sensor comprises a single or a multi axis gyroscope sensor.

8. ~~Auto injector~~The system according to claim 7, wherein the multi axis gyroscope sensor is a tri-axial gyroscope sensor.

9. ~~Auto injector~~The system according to any of the preceding claims, wherein the processing unit is further configured to control the drive module to move the plunger rod from the mix plunger rod position to a second plunger rod position when receiving the onset signal.

10. ~~Auto injector~~The system according to any of the preceding claims, wherein the processing unit is further configured to determine a first movement parameter based on a cumulative measure of an orientation signal over time, since completion of movement of the plunger rod to the mix plunger rod position, and/or a preceding predetermined time.

11. ~~Auto injector~~The system according to claim 10, wherein the first movement parameter is indicative of the number of completed inversions of the auto injector.

12. ~~Auto injector~~The system according to any of the preceding claims 10-11, wherein the first movement parameter is indicative of a frequency of movement of the auto injector.

13. ~~Auto injector~~The system according to any of the preceding claims, wherein an inversion is deemed a completed inversion by the auto injector if it is performed with an angular velocity above a default threshold.

14. ~~Auto injector~~The system according to claim 13, wherein the default threshold for the angular velocity is defined as an inversion frequency of at least 0.3 inversions per second~~, such as at least 0.5 inversions per second~~.

15. ~~Auto injector~~The system according to any of the claims 13-14, wherein the orientation sensor is configured to provide an angular velocity signal indicative of the angular velocity of the cartridge when the cartridge is received in the cartridge receiver.

16. ~~Auto injector~~The system according to any of the preceding claims, wherein ~~an~~the inversion is an inversion around an axis in a horizontal plane.

17. ~~Auto injector~~The system according to any of the preceding claims, wherein a rotational motion of the auto injector from a start angular position to an end angular position is deemed a completed inversion by the auto injector if:

- the start angular position is between a first vertical orientation with a distal end of the auto injector pointing upwards and a first horizontal position with the distal end of the auto injector pointing sideward along a horizontal axis;
- the end angular position is between a second horizontal position with the distal end of the auto injector pointing sideward along a horizontal axis in a direction opposite that in the first horizontal position and second vertical orientation with the distal end of the auto injector pointing downwards, and
- the default threshold for the angle between the first angular position and the second angular position is at least 90 degrees~~, such as at least 120 degrees preferably at least 135 degrees, more preferably at least 150 degrees, even more preferably at least 165 degrees, such as e.g. 180 degrees~~.

18. ~~Auto injector~~The system according to any of the claims 1-16, wherein a rotational motion of the auto injector from a start angular position to an end angular position is deemed a completed inversion by the auto injector if:

- the start angular position is between a first vertical orientation with a distal end of the auto injector pointing downwards and a first horizontal position with the distal end of the auto injector pointing sideward along a horizontal axis;
- the end angular position is between a second horizontal position with the distal end of the auto injector pointing sideward along a horizontal axis in a direction opposite that in the first horizontal position and second vertical orientation with the distal end of the auto injector pointing upwards, and
- the default threshold for the angle between the first angular position and the second angular position is at least 90 degrees~~, such as at least 120 degrees preferably at least 135 degrees, more preferably at least 150 degrees, even more preferably at least 165 degrees, such as e.g. 180 degrees~~.

19. ~~Auto injector~~The system according to any of the preceding claims, wherein the processing unit further is configured to provide visible feedback and/or acoustic feedback to the user when the number of completed inversions has been performed, and/or for every completed inversion.

20. ~~Auto injector~~The system according to any of the preceding claims, wherein the processing unit further is configured to perform an air-shot after the number of inversions has been performed, wherein the air-shot is only performed when the second cartridge subcompartment is pointing upwards compared to the first cartridge subcompartment.

21. ~~Auto injector~~The system according to any of the preceding claims, wherein the threshold of an angular velocity and/or an threshold of the angle is defined by the auto injector or the cartridge code feature.

22. ~~Auto injector~~The system according to any of the preceding claims, wherein the number of completed inversions depends on the measured inversion angles and the angular velocity at which the inversions are executed manually by a user.

23. Use of an auto injector in a system according to any of the claims 1-22, the system comprising a cartridge assembly comprising a cartridge and a cartridge code feature, the cartridge comprising:

- a first stopper;
- a cartridge compartment containing the medicament, the cartridge compartment having a first cartridge subcompartment containing a first medicament component of the medicament and a second cartridge subcompartment containing a second medicament component of the medicament;
- a second stopper movable inside the cartridge compartment; and
- a bypass section providing fluid communication between the first cartridge subcompartment and the second cartridge subcompartment;

the auto injector comprising:

a housing;

a cartridge receiver configured to receive the cartridge assembly;

an orientation sensor configured to detect an orientation of the cartridge and/or an orientation of the auto injector; and

a drive module coupled to move a plunger rod between a retracted plunger rod position and an extended plunger rod position, the plunger rod being configured to move the first stopper;

wherein the auto injector further comprises a processing unit coupled to the drive module, wherein the processing unit is configured to:

- control the drive module to move the plunger rod from a first plunger rod position to a mix plunger rod position with a mix plunger rod speed, wherein the mix plunger rod position is selected to position the first stopper in a position wherein the first medicament component is mixed with the second medicament component;
- provide an onset signal after a number of completed inversions of the auto injector has been performed, wherein an inversion is deemed a completed inversion by the auto injector if it spans an angle above a default threshold and

wherein the auto injector comprising a code sensor configured to read the cartridge code feature, and wherein the processing unit is coupled to the code sensor and further configured to receive from the code sensor a code signal indicative of the cartridge code feature, wherein the cartridge code feature defines the number of completed inversions required for the medicament in the cartridge.

24. Use of a cartridge assembly in a system according to any of the claims 1-22, the cartridge assembly comprising a cartridge and a cartridge code feature, the cartridge comprising:

- a first stopper;
- a cartridge compartment containing the medicament, the cartridge compartment having a first cartridge subcompartment containing a first medicament component of the medicament and a second cartridge subcompartment containing a second medicament component of the medicament;
- a second stopper movable inside the cartridge compartment; and
- a bypass section providing fluid communication between the first cartridge subcompartment and the second cartridge subcompartment.

25. An auto injector for use in a system according to any of the claims 1-22, the system comprising a cartridge assembly comprising a cartridge and a cartridge code feature, the cartridge comprising:

- a first stopper;
- a cartridge compartment containing the medicament, the cartridge compartment having a first cartridge subcompartment containing a first medicament component of the medicament and a second cartridge subcompartment containing a second medicament component of the medicament;
- a second stopper movable inside the cartridge compartment; and
- a bypass section providing fluid communication between the first cartridge subcompartment and the second cartridge subcompartment;

the auto injector comprising:

a housing;

a cartridge receiver configured to receive the cartridge assembly;

an orientation sensor configured to detect an orientation of the cartridge and/or an orientation of the auto injector; and

a drive module coupled to move a plunger rod between a retracted plunger rod position and an extended plunger rod position, the plunger rod being configured to move the first stopper;

wherein the auto injector further comprises a processing unit coupled to the drive module, wherein the processing unit is configured to:

- control the drive module to move the plunger rod from a first plunger rod position to a mix plunger rod position with a mix plunger rod speed, wherein the mix plunger rod position is selected to position the first stopper in a position wherein the first medicament component is mixed with the second medicament component;
- provide an onset signal after a number of completed inversions of the auto injector has been performed, wherein an inversion is deemed a completed inversion by the auto injector if it spans an angle above a default threshold and

wherein the auto injector comprising a code sensor configured to read the cartridge code feature, and wherein the processing unit is coupled to the code sensor and further configured to receive from the code sensor a code signal indicative of the cartridge code

feature, wherein the cartridge code feature defines the number of completed inversions required for the medicament in the cartridge.

26. A cartridge assembly for use in a system according to any of the claims 1-22, the cartridge assembly comprising a cartridge and a cartridge code feature, the cartridge comprising:

- a first stopper;
- a cartridge compartment containing the medicament, the cartridge compartment having a first cartridge subcompartment containing a first medicament component of the medicament and a second cartridge subcompartment containing a second medicament component of the medicament;
- a second stopper movable inside the cartridge compartment; and
- a bypass section providing fluid communication between the first cartridge subcompartment and the second cartridge subcompartment.