We claim:

1. A method for determining a process anomaly in a fluid flow system, the system having a meter with immersed elements immersed in a fluid of a fluid flow, the method comprising:

determining, using a data processing circuit, a measured density of the fluid in the fluid flow system;

determining, using the data processing circuit, whether the fluid flow system is experiencing a density anomaly based on a relationship between the measured density and an expected density of the fluid in the fluid flow system;

determining, using the data processing circuit, a measured phase difference of vibrations of the immersed elements of the meter;

determining, using the data processing circuit, whether the fluid flow system is experiencing a phase anomaly based on a relationship between the measured phase difference and a target phase difference of the vibrations of the immersed elements in the fluid flow; and

identifying, using the data processing circuit, an anomaly of the fluid flow system based on the determination of whether there is a density anomaly and the determination of whether there is a phase anomaly;

wherein the density anomaly is determined to be indicative of a gas entrainment anomaly if the measured density is less than the expected density by at least a threshold density difference;

wherein, if the anomaly of the fluid flow system is identified as a gas entrainment anomaly, determining, using the data processing circuit, whether a gas entrainment anomaly identification may be confused with an erosion anomaly identification by determining whether one or more of the fluid and elements entrained in the fluid are likely to erode the immersed elements based on data stored in the data processing circuit; and

identifying, using the data processing circuit, that the gas entrainment anomaly identification may be confused with an erosion anomaly if the data processing circuit has data indicating that the one or more of the fluid and elements entrained in the flow fluid are likely to erode the immersed elements.

~~2. A method as claimed in claim 1, further comprising:~~

~~identifying, using the data processing circuit, a density anomaly indicative of a gas entrainment anomaly,~~

~~wherein the relationship between the measured density and the expected density is the measured density is less than the expected density by at least a threshold density difference.~~

~~3. A method as claimed in claim 2, wherein the measured phase difference differs from the target phase difference by at least a threshold phase deviation.~~

~~4. A method as claimed in claim 3, wherein the measured phase difference is an average measured phase difference, and the threshold phase deviation is a difference between the average measured phase difference and the target phase difference.~~

~~5. A method as claimed in claims 3 and 4, wherein the anomaly of the fluid flow system identified is a gas entrainment anomaly.~~

~~6. A method as claimed in claim 5, further comprising:~~

~~determining, using the data processing circuit, whether a gas entrainment anomaly identification may be confused with an erosion anomaly identification by determining whether one or more of the fluid and elements entrained in the fluid are likely to erode the immersed elements based on data stored in the data processing circuit; and~~

~~identifying, using the data processing circuit, that the gas entrainment anomaly identification may be confused with an erosion anomaly if the data processing circuit has data indicating that the one or more of the fluid and elements entrained in the flow fluid are likely to erode the immersed elements.~~

~~7.~~2. A method as claimed in claim 1, further comprising:

identifying, using the data processing circuit, a density anomaly indicative of a build-up anomaly,

wherein the relationship between the measured density and the expected density is the measured density is greater than the expected density by at least a threshold density difference.

~~8.~~3. A method as claimed in claim ~~7~~2, further comprising:

determining, using the data processing circuit, the relationship between the measured phase difference and the target phase difference by determining one or more of;

the measured phase difference differs from the target phase difference by at least a threshold phase deviation;

a swinging behavior in which the measured phase difference swings above and below from the target phase difference; and

a triangulation behavior of the measured phase difference relative to the target phase difference; and

identifying, using the data processing circuit, a phase anomaly indicative of a build-up anomaly.

~~9.~~4. A method as claimed in claim ~~8~~3, wherein one or more of the swinging behavior and the triangulation behavior is determined as a number of consecutive cycle oscillations of the measured phase difference are above the target phase difference and/or another number of consecutive cycle oscillations of the measured phase difference are below the target phase difference.

~~10.~~5. A method as claimed in claim ~~8~~3, wherein the triangulation behavior is determined by a number of consecutive cycle oscillations of the measured phase difference create a triangular or circular pattern relative to the target phase.

~~11.~~6. A method as claimed in one of claim 1 and claims ~~8~~ 3 to ~~10~~5, the identifying the anomaly of the fluid flow system further comprising the anomaly of the fluid flow system ~~identified~~ classified as a build-up anomaly.

~~12.~~7. A method as claimed in ~~claims 7 to 11~~ claim 2, further comprising:

determining, using the data processing circuit, whether a build-up anomaly identification may be confused with a corrosion anomaly identification by determining whether one or more of the fluid and elements entrained in the fluid are likely to corrode the immersed elements based on data stored in the data processing circuit; and

identifying, using the data processing circuit, that the build-up anomaly identification may be confused with a corrosion anomaly if the data processing circuit has data indicating that the one or more of the flow fluid and elements entrained in the flow fluid are likely to corrode the immersed elements.

~~13.~~8. A method as claimed in ~~claims 2 to 12~~claim 1, wherein the threshold density difference is 1kg/m^3.

~~14.~~9. A method as claimed in ~~claims 3 to 6 and claims 8 to 13~~claim 3, wherein the threshold phase deviation is .02°.

~~15.~~10. A method as claimed in ~~claims 3 to 6 and claims 8 to 13~~claim 3, wherein the threshold phase deviation is .015°.

~~16.~~11. A method as claimed in ~~claims 1 to 15~~claim 1, further comprising:

responding to the anomaly, using the data processing circuit, by one or more of, notifying a user of the gas entrainment anomaly, indicating on a meter that the gas entrainment anomaly has occurred, changing the characteristics of the fluid or fluid flow in response to the gas entrainment anomaly, and storing data representing the gas entrainment anomaly.

~~17.~~12. A method as claimed in claim ~~16~~11, the changing flow characteristics of the fluid or fluid flow further comprising one or more of increasing a velocity of fluid flow and increasing a temperature of the fluid in the fluid flow.

~~18.~~13. A method as claimed in ~~claims 1 to 17~~claim 1, wherein the meter is one of a fork density meter and a fork viscosity meter.

~~19.~~14. A data processing circuit (132) communicatively coupled to and/or integrated into a meter electronics (20) of a meter, the meter having a vibratory element (104) with tines (112, 114) a driver (122) for driving vibrations in the tines (112, 114), and at least one sensor (124) to measure vibrations of tines (112, 114), the meter electronics (20) configured to determine a measured phase difference and a measured density, the data processing circuit (132) configured to:

determine a measured density of a fluid in the fluid flow system;

determine whether the fluid flow system is experiencing a density anomaly based on a relationship between the measured density and an expected density of the fluid in the fluid flow system;

determine a measured phase difference of vibrations of the tines (112, 114) of the meter;

determine whether the fluid flow system is experiencing a phase anomaly based on a relationship between the measured phase difference and a target phase difference of the vibrations of the tines (112, 114) in the fluid flow; and

identify an anomaly of the fluid flow system based on the determination of a density anomaly and the determination of a phase anomaly;

identify a density anomaly indicative of a gas entrainment anomaly if the measured density is less than the expected density by at least a threshold density difference;

determine, using the data processing circuit, whether a gas entrainment anomaly identification may be confused with an erosion anomaly identification by determining whether one or more of the fluid and elements entrained in the fluid are likely to erode the tines (112, 114) based on data stored in the data processing circuit; and

identify that the gas entrainment anomaly identification may be confused with an erosion anomaly if the data processing circuit (132) has data indicating that the one or more of the fluid and elements entrained in the flow fluid are likely to erode the tines (112, 114).

~~20. A data processing circuit (132) as claimed in claim 19, further configured to:~~

~~determine the relationship between the measured density and the expected density by determining the measured density is less than the expected density by at least a threshold density difference; and~~

~~identify a density anomaly indicative of a gas entrainment anomaly.~~

~~21. A data processing circuit (132) as claimed in claim 20, further configured to:~~

~~determine the relationship between the measured phase difference and the target phase difference by determining the measured phase difference differs from the target phase difference by at least a threshold phase deviation.~~

~~22. A data processing circuit (132) as claimed in claims 20 to 21, wherein the measured phase difference is an average measured phase difference, and the threshold phase deviation is a difference between the average measured phase difference and the target phase difference.~~

~~23. A data processing circuit (132) as claimed in claims 20 to 22, the identify an anomaly of the fluid flow system further comprising identifying the anomaly of the fluid flow system as a gas entrainment anomaly.~~

~~24. A data processing circuit (132) as claimed in claim 23, further configured to:~~

~~determine, using the data processing circuit, whether a gas entrainment anomaly identification may be confused with an erosion anomaly identification by determining whether one or more of the fluid and elements entrained in the fluid are likely to erode the tines (112, 114) based on data stored in the data processing circuit; and~~

~~identify that the gas entrainment anomaly identification may be confused with an erosion anomaly if the data processing circuit (132) has data indicating that the one or more of the fluid and elements entrained in the flow fluid are likely to erode the tines (112, 114).~~

~~25.~~15. A data processing circuit (132) as claimed in claim ~~19~~14, further configured to:

determine the relationship between the measured density and the expected density by determining the measured density is greater than the expected density by at least a threshold density difference; and

identify a density anomaly indicative of a build-up anomaly.

~~26.~~16. A data processing circuit (132) as claimed in claim ~~25~~15, further configured to:

determine the relationship between the measured phase difference and the target phase difference by determining one or more of;

the measured phase difference differs from the target phase difference by at least a threshold phase deviation;

a swinging behavior in which the measured phase difference swings above and below the target phase difference; and

a triangulation behavior of the measured phase difference relative to the target phase difference; and

identify a phase anomaly indicative of a build-up anomaly.

~~27.~~17. A data processing circuit (132) as claimed in claim ~~26~~16, wherein one or more of the swinging behavior and the triangulation behavior is determined by detecting one or both of a number of consecutive cycle oscillations of the measured phase difference being above the target phase difference and another of consecutive cycle oscillations of the measured phase difference being below the target phase difference.

~~28.~~18. A data processing circuit (132) as claimed in claim ~~26~~16, wherein the triangulation behavior is determined by a number of consecutive cycle oscillations of the measured phase difference creating a triangular or circular pattern relative to the target phase.

~~29.~~19. A data processing circuit (132) as claimed in one of claim ~~19~~ 14 and claims ~~26 to 28~~16 to 18 the identify an anomaly of the fluid system further comprising ~~identify~~ classifying the anomaly of the fluid flow system as a build-up anomaly.

~~30.~~20. A data processing circuit (132) as claimed in ~~claims 25 to 29~~ claim 15, further configured to:

determine whether a build-up anomaly identification may be confused with a corrosion anomaly identification by determining whether one or more of the fluid and elements entrained in the fluid are likely to corrode the tines (112, 114) based on data stored in the data processing circuit; and

identify that the build-up anomaly identification may be confused with a corrosion anomaly if the data processing circuit (132) has data indicating that the one or more of the flow fluid and elements entrained in the flow fluid are likely to corrode the tines (112, 114).

~~31.~~21. A data processing circuit (132) as claimed in ~~claims 19 to 30~~claim 14, wherein the threshold density difference is 1kg/m^3.

~~32.~~22. A data processing circuit (132) as claimed in ~~claims 21 to 24 and claims 26 to 31~~claim 14, wherein the threshold phase deviation is .02°.

~~33.~~23. A data processing circuit (132) as claimed in ~~claims 21 to 24 and claims 26 to 31~~claim 14, wherein the threshold phase deviation is .015°.

~~34.~~24. A data processing circuit (132) as claimed in ~~claims 19 to 33~~claim 14, further configured to:

respond to the anomaly by one or more of, notifying a user of the anomaly, indicating on a meter that the anomaly has occurred, changing the characteristics of the fluid or fluid flow in response to the anomaly, and storing data representing the anomaly.

~~35.~~25. A data processing circuit (132) as claimed in claim ~~34~~24, the changing flow characteristics of the fluid or fluid flow further comprising one or more of increasing a velocity of fluid flow and increasing a temperature of the fluid in the fluid flow.

~~36.~~26. A data processing circuit (132) as claimed in ~~claims 19 to 35~~claim 14, wherein the meter is one of a fork density meter and a fork viscosity meter.

~~37.~~27. A method as claimed in claim 1, wherein the data processing circuit determines the fluid flow system is not experiencing any density anomaly, but the fluid flow is experiencing at least one phase anomaly, the anomaly identified being one or more of a manufacturing anomaly and an installation anomaly.

~~38.~~28. A method as claimed in claim ~~9~~4, further comprising:

resetting the signal processing circuit or establishing a new phase lock with the data processing circuit;

determining, by the data processing circuit, whether the swinging behavior diminishes with time after the resetting the signal processing circuit or establishing a new phase lock;

if the swinging behavior diminishes with time, determining, by the signal processing circuit, the phase anomaly is not the phase anomaly indicative of a build-up anomaly, but is a phase anomaly indicative of an installation anomaly.

~~39.~~29. A method as claimed in claim ~~8~~3, wherein one or more of the swinging behavior and the triangulation behavior is determined by identifying a number of consecutive cycles of measured phase difference above or below the expected phase difference with increasing measured phase difference max cycle deviations from expected phase difference, followed by a potentially different number of consecutive measured phase difference cycles with decreasing max cycle deviations from expected phase difference perhaps.

~~40.~~30. A method as claimed in claim ~~39~~29, wherein the swinging behavior is further determined by the measured phase difference meeting the expected phase difference and crossing over to the other side of the expected phase difference after determining a number of consecutive cycles increasingly deviate and then consecutively another number of cycles consecutively and subsequently decreasingly deviate from the expected phase difference.

~~41.~~31. A method as claimed in claim ~~16~~11, the changing the characteristics of the fluid or fluid flow comprising increasing the temperature of the fluid if the data processing circuit has data stored to indicate that a build-up has a melting point lower than the melting point of the immersed elements.

~~42.~~32. A data processing circuit (132) as claimed in claim ~~19~~14, wherein the data processing circuit (132) determines the fluid flow system is not experiencing any density anomaly but the fluid flow is experiencing at least one phase anomaly, the anomaly identified being one or more of a manufacturing anomaly and an installation anomaly.

~~43.~~33. A data processing circuit (132) as claimed in claim ~~27~~17, the data processing circuit further configured to:

reset the signal processing circuit or establishing a new phase lock with the data processing circuit (132);

determine, by the data processing circuit (132), whether the swinging behavior diminishes with time after the resetting the signal processing circuit or establishing a new phase lock;

if the swinging behavior diminishes with time, determine, by the data processing circuit (132), the phase anomaly is not the phase anomaly indicative of a build-up anomaly but is a phase anomaly indicative of an installation anomaly.

~~44.~~34. A data processing circuit (132) as claimed in claim ~~26~~16, wherein one or more of the swinging behavior and the triangulation behavior is determined by identifying a number of consecutive cycles of measured phase difference above or below the expected phase difference with increasing measured phase difference max cycle deviations from expected phase difference, followed by a potentially different number of consecutive measured phase difference cycles with decreasing max cycle deviations from expected phase difference perhaps.

~~45.~~35. A data processing circuit (132) as claimed in claim ~~44~~34, wherein the swinging behavior is further determined by the measured phase difference meeting the expected phase difference and crossing over to the other side of the expected phase difference after determining a number of consecutive cycles increasingly deviate and then consecutively another number of cycles consecutively and subsequently decreasingly deviate from the expected phase difference.

~~46. A data processing circuit (132) as claimed in claim 34, the changing the characteristics of the fluid or fluid flow comprising increasing the temperature of the fluid if the data processing circuit has data stored to indicate that a build-up has a melting point lower than the melting point of the tines (112, 114), wherein the temperature is above the melting point of the build-up.~~

~~47.~~36. A data processing circuit (132) as claimed in ~~claims 19 to 35 and claims 42 to 46~~claim 14, wherein the data processing circuit is integral to the meter, wherein the meter is a dedicated fault detection element that is not configured to provide a user or external devices, data representing fluid or fluid flow characteristics other than data representing anomalies and/or responses to anomalies.

~~48.~~37. A method as claimed in ~~claims 1 to 18 and 37 to 41~~claim 1, further comprising:

determining, by the data processing circuit, at least one threshold or range for determining the anomaly based on an initially measured density of the fluid when the immersed elements are first immersed in the fluid.

~~49.~~38. A data processing circuit (132) as claimed in ~~claim 19 to 36 and claims 42 to 47~~claim 14, further configured to determine at least one threshold or range for determining the anomaly based on an initially measured density of the fluid when the tines (112, 114) are first immersed in the fluid.

~~50.~~39. A method as in ~~claims 1 to 18 and 37 to 41 and claim 48~~claim 1, wherein the anomaly is identified when the meter is one or more of installed, operating, and is not removed from operation.

~~51.~~40. A data processing circuit (132) as claimed in ~~claims 19 to 36 and claims 42 to 47 and claim 49~~ claim 14, wherein the anomaly is identified when the meter is one or more of installed, operating, and is not removed from operation.