

TAMPER DETECTION SYSTEM

FIELD OF INVENTION

5 The present disclosure relates to a tamper detection system for use in a utility meter, and in particular for use in a utility meter such as a gas meter comprising a rotating dial-wheel. The disclosure also relates to a method of tamper detection.

BACKGROUND TO INVENTION

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Flow-based metering devices may be used to meter a consumption of a resource, such as gas or water. Such metering devices, which may be generally known in the art as utility meters, may be installed at residential, commercial and/or industrial premises for metering a consumption of a resource, for purposes of enabling a utility provider to charge a consumer based upon a level of resource consumption.

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Such known utility meters may, for example, comprise rotary or turbine meters, in which a measureable rotation of one or more mechanical components may be induced by a flow of fluid through the meter. In some known examples, one or more magnetic field sensors may be implemented to sense a rotation of the one or more mechanical components, enabling a derivation of a volume of fluid consumed. In some examples, such utility meters may either locally store data corresponding to a volume of fluid consumed or may transmit such data to a remote system.

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For accurate metering, it is essential that any such measurement of a volume of fluid that flows through the meter is precisely and accurately metered. Furthermore, since such utility meters may be installed in a large quantity of premises, e.g. residential applications, it is essential that such utility meters are relatively low-cost to implement, and exhibit high levels of reliability.

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It is also desirable to deter and, where possible, detect any tampering of the utility meter. In an example, consumers may tamper with a meter to reduce and or inhibit metering of a consumption of gas or water at a premises.

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In some cases, consumers may directly tamper with one or more sensors within the utility meter. In some instances, known steps may be taken to prevent such tampering, such as by making an enclosure of the utility meter robust and thereby difficult to open, and/or by providing means to detect an opening of the enclosure.

In some cases, consumers may indirectly tamper with one or more sensors within the utility meter, such as by interfering with a signal sensed by the one or more sensors. Such tampering may be more difficult to detect and/or prevent.

5 Thus, it is desirable to implement a system for detecting any tampering of a utility meter that may affect metering of consumption of a resource. It is particularly desirable that any such system is relatively low cost to implement, yet also highly reliable and accurate.

10 Furthermore, it is essential that any such system exhibits relatively low power consumption, since in some instances a metering portion of such utility meters may be battery operated.

It is therefore an object of at least one embodiment of at least one aspect of the present disclosure to obviate or at least mitigate at least one of the above identified shortcomings of the prior art.

15 SUMMARY OF INVENTION

20 The present disclosure relates to a tamper detection system for use in a utility meter, and in particular for use in a gas meter comprising a rotating dial-wheel. The disclosure also relates to a method of tamper detection. According to a first aspect of the disclosure, there is provided a tamper detection system for use in a utility meter, the system. The tamper detection system comprises at least one sensor configured to sense a magnetic field. The tamper detection system comprises a processing circuit coupled to the at least one sensor and configured to generate pulses for incrementing a pulse counter in response to a level of at least one signal from the at least one sensor being outside a first threshold range. When the processing circuit determines that the pulse counter has not incremented within the tamper detect interval, the processing circuit determines, based on the level of the at least one signal, whether the magnetic field sensed by the at least one sensor has varied by more than a second threshold range.

30 Advantageously, provision of a further determination of whether the magnetic field sensed by the at least one sensor has varied by more than the second threshold range may effectively enable detection of tampering due to a weak external magnet that may otherwise not be detected.

Furthermore, the disclosed tamper detection system may help avoid unnecessary tamper detections, thereby helping reduce an overall power consumption of the tamper detection system.

5 The processing circuit may be configured to determine that the magnetic field sensed by the at least one sensor has varied by more than a second threshold range by determining a difference between a maximum level and a minimum level of the at least one signal.

10 The processing circuit may be configured to increment an iteration counter when the processing circuit determines that the magnetic field sensed by the at least one sensor has not varied by more than the second threshold range, the processing circuit may be configured to increment an iteration counter.

15 The processing circuit may be configured to increase a sampling time when the processing circuit determines that the magnetic field sensed by the at least one sensor has not varied by more than the second threshold range, the processing circuit may be configured to increment an iteration counter.

20 The processing circuit may be configured to sample the at least one signal from the at least one sensor after the sampling time when the processing circuit determines that the magnetic field sensed by the at least one sensor has not varied by more than the second threshold range, the processing circuit may be configured to increment an iteration counter.

25 The processing circuit may be configured to make a further determination of whether the magnetic field sensed by the at least one sensor has varied by more than the second threshold range when the processing circuit determines that the magnetic field sensed by the at least one sensor has not varied by more than the second threshold range, the processing circuit may be configured to increment an iteration counter.

The processing circuit may be configured to determine that no tamper event has occurred when the iteration counter reaches a predefined maximum iteration value.

30 The processing circuit may be further configured to increase the sampling time when the processing circuit increments the iteration counter but when a value of the iteration counter has not reached a predefined maximum iteration value.

Increasing the sampling time may comprise doubling the sampling time.

Advantageously, increasing the sampling time, e.g. a time between samples, may reduce an overall power consumption of the system.

Between sampling the at least one signal level from the at least one sensor and determining whether the magnetic field has varied by more than a second threshold range, the processing circuit may be further configured to determine that a tamper event has occurred if the level of the sampled signal is outside a tamper threshold range larger than the second threshold range.

The processing circuit may be configured such that, when it has been determined by the processing circuit that the magnetic field sensed by the at least one sensor has varied by more than a second threshold range, the processing circuit is further configured to: set a tamper status to suspected if the tamper status is not set to suspected, or increment a suspected tamper counter if the tamper status is set to suspected.

The processing circuit may be configured to determine that a tamper event has occurred when the suspected tamper counter reaches a predefined maximum value.

The at least one sensor may comprises a first sensor and a second sensor. The at least one signal may comprise a first signal from the first sensor and a second signal from the second sensor.

The processing circuit may be configured to use the first signal to generate pulses for incrementing the pulse counter

The second sensor and/or the processing circuit may be configured to generate an interrupt if the processing circuit determines that the second signal is outside the tamper threshold range.

The at least one sensor may comprise at least one of: a Hall-effect sensor; a Tunnel Magnetoresistance (TMR) sensor; a giant Magnetoresistance (GMR) sensor; an Anisotropic Magnetoresistive (AMR) sensor; microelectromechanical systems (MEMS) magnetic sensor; an inductive coil.

According to a second aspect of the disclosure, there is provided a utility meter comprising: the tamper detection system of any preceding claim; and a dial-wheel configured such that rotation of the dial-wheel induces a varying magnetic field at the at least one sensor.

The utility meter may be configured for metering a flow of fluid, wherein the flow of fluid induces rotation of the dial-wheel.

According to a second aspect of the disclosure, there is provided a method of tamper detection. The method comprises configuring a processing circuit coupled to at least one magnetic field sensor to generate pulses when at least one signal from the at

least one sensor is outside a first threshold range. The method comprises counting pulses that are generated.

The method comprises determining that no pulses have been counted within a tamper detect interval.

5 The method may comprise sampling the at least one signal from the at least one sensor. The method comprises determining, based on a level of the at least one signal, whether the magnetic field sensed by the at least one sensor has varied by more than a second threshold range.

10 The above summary is intended to be merely exemplary and non-limiting. The disclosure includes one or more corresponding aspects, embodiments or features in isolation or in various combinations whether or not specifically stated (including claimed) in that combination or in isolation. It should be understood that features defined above in accordance with any aspect of the present disclosure or below relating to any specific embodiment of the disclosure may be utilized, either alone or in
15 combination with any other defined feature, in any other aspect or embodiment or to form a further aspect or embodiment of the disclosure.

BRIEF DESCRIPTION OF DRAWINGS

20 These and other aspects of the present disclosure will now be described, by way of example only, with reference to the accompanying drawings, which are:

- Figure 1** depicts an example of signals from magnetic field sensors in a prior art tamper detection system during normal operation;
- 25 **Figure 2** depicts an example of signals from magnetic field sensors in a prior art tamper detection system during exposure to a relatively strong external magnet;
- Figure 3a** depicts a first example of signals from magnetic field sensors in a prior art tamper detection system during exposure to a relatively weak
30 external magnet;
- Figure 3b** depicts a second example of signals from magnetic field sensors in a prior art tamper detection system during exposure to a relatively weak external magnet;
- Figure 4** depicts a flow diagram of operation of a tamper detection system,
35 according to an embodiment of the disclosure;

Figure 5 depicts a utility meter comprising a tamper detection system, according to an embodiment of the disclosure; and

Figure 6 a method of tamper detection, according to an embodiment of the disclosure.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 depicts an example of signals from magnetic field sensors in a prior art tamper detection system during normal operation. The prior art tamper detection system comprises a first magnetic field sensor and a second magnetic field sensor. Each sensor may be a Hall-effect magnetic field sensor. A signal from the first magnetic field sensors is denoted HEMS-U1 and a signal from the second magnetic field sensors is denoted HEMS-U2.

In a practical implementation of a utility meter, the first and second sensors may be disposed in relatively close proximity to a dial-wheel configured to be rotated by a flow of metered fluid. The dial-wheel may comprise a magnetic component, such as a permanent magnet such as a neodymium magnet or the like.

Rotation of the dial-wheel relative to the first and second sensors may induce a varying magnetic field that may be sensed by the first and second sensors, as shown in Figure 1.

In an example, the signal HEMS-U1 from the first sensor may be used to generate pulses. Such pulses may be counted to provide an indication of an amount of fluid consumed. In the depicted example, it can be seen that a first threshold range of approximately $\pm 3.2\text{mT}$ defines a pulse signal, denoted PULSE_CT. That is, when the signal HEMS-U1 exceeds $+3.2\text{mT}$, the signal HEMS-U1 transitions from low to high, and when the signal HEMS-U1 falls below -3.2mT , the signal HEMS-U1 transitions from high to low.

Due to rotation of the dial-wheel relative to the first and second sensors, the detected magnetic field around the first and second sensor may periodically switch from positive to negative, as can be seen from Figure 1. Thus the varying signal HEMS-U1 from the first sensor generates a series of pulses, indicated by signal PULSE_CT, wherein an amount of pulses is indicative of an amount of a consumed fluid.

That is, in some examples, the first sensor (or processing circuit coupled to the first sensor) may be operated in a "latch mode". In such a latch mode, there may be a

defined threshold range (e.g. two threshold values) for switching a digital output signal's logic level. This threshold range may be centered around the zero-axis. Once a sensed magnetic field value exceeds the positive threshold value of the threshold range, a digital output state (e.g. signal PULSE_CT) will stay in a particular state until the magnetic field value reduces below the negative threshold point. Thus, such latching requires both positive and negative magnetic fields to operate. As depicted in Figure 1, this cycle repeats and digital pulses may be generated corresponding to dial-wheel rotation. Such pulses may then be counted by a controller, and may be indicative of an amount of consumption of a fluid.

In the example, the signal HEMS-U2 from the second sensor may generally correspond to the signal HEMS-U1 from the first sensor during normal operation, as can be seen in Figure 1. A temporal offset between the signal HEMS-U1 from the first sensor and the signal HEMS-U2 from the second sensor may be due to a physical distance between said first and second sensors.

In the example, the signal HEMS-U2 from the second sensor may be used to detect a presence of any external magnetic field which may hamper the counting accuracy. In the example, the signal HEMS-U2 from the second sensor may additionally or alternatively be used to detect removal or opening of an enclosure of the utility meter. Use of the signal HEMS-U2 is described in more detail with reference to Figures 2 to 3b.

Figure 2 depicts an example of signals from magnetic field sensors in a prior art tamper detection system during exposure to a relatively strong external magnet.

In the example, due to the proximity of a relatively strong external magnet to the second sensor, the signal HEMS-U2 from the second sensor is saturated at approximately -21mT.

In an example usage, at a "tamper check" interval, a task may be executed (e.g. by a processor coupled to the sensors) to check for tampering. In an example, such an interval may be in the region of fifteen minutes, although this may be selectable.

At every tamper check interval, a magnetic field value of both the signal HEMS-U1 and the signal HEMS-U2 may be checked to determine whether either magnetic field value exceeds or equals a magnetic tamper threshold range of $\pm 20\text{mT}$, e.g. indicating a saturation condition.

If either signal meets or exceeds the magnetic tamper threshold, then in some instances a further check, such as after a period of 500ms or the like, may be scheduled to confirm whether the signal remains at or exceeding the magnetic tamper

threshold. If either signal is still saturated then a magnetic tamper event may be indicated.

However, in the case of a relatively weak external magnet (or more generally application of a relatively weak external magnetic field), one or both signals HEMS-U1 and HEMS-U2 may not be saturated, or may not be completely saturated. This is described below with reference to Figures 3a and 3b, which depict first and second examples of signals from magnetic field sensors in a prior art tamper detection system during exposure to a relatively weak external magnet.

In both Figure 3a and 3b, the externally applied magnetic field due to a weak external magnet is only strong enough to offset and partially saturate both signals HEMS-U1 and HEMS-U. Thus, the pulse counting is inhibited, because in both examples the signal HEMS-U1 fails to repeatedly cross the first threshold range of approximately $\pm 3.2\text{mT}$. In such a scenario, magnetic tamper will be detected only if it is checked at the saturated portion of the magnetic curve, e.g. when the magnetic tamper threshold range of $\pm 20\text{mT}$ is exceeded, otherwise it may be undetected.

Figure 4 depicts a flow diagram of operation of a tamper detection system, according to an embodiment of the disclosure. The tamper detection system described by Figure 4 may be for use in a utility meter, such as a gas or water meter, or the like. The tamper detection system may comprise at least one sensor configured to sense a magnetic field. In some embodiments, the tamper detection system may comprise two magnetic field sensors, e.g. as described above with reference to Figures 1 to 3b.

The one or more sensors may be coupled to a processing circuit (e.g. one or more processors, microcontrollers, or the like), wherein the processing circuit may be configured to determine that the pulse counter has not incremented within the tamper detect interval. That is, in operation, at a first decision point 405, a determination may be made of whether the pulse counter has incremented within a tamper detect interval. In the depicted non-limiting example, the tamper detect interval is set to 1 hour, however it will be appreciated that other times may alternatively be selected.

If it is determined at the first decision point 405 that the pulse counter has incremented within the tamper detect interval, then it may be assumed that no tampering has occurred during the tamper detect interval. In this instance, a magnetic tamper current status parameter may be reset and a suspected tamper count parameter may be reset. Use of the tamper status parameter and suspected tamper count parameter is described in more detail below. Such parameters may be stored in a memory, such as a local memory, which may be volatile or non-volatile.

If it is determined at the first decision point 405 that the pulse counter has not incremented within the tamper detect interval, then the magnetic field values sensed by the one or more sensors may be read, e.g. sampled.

5 At a second decision point 410, it may be determined whether the sampled signal is outside a magnetic tamper threshold range. The magnetic tamper threshold range may be larger than the second threshold range, wherein the second threshold range is described in more detail below. In the non-limiting example of Figure 4, and as described in the examples above, the magnetic tamper threshold range is $\pm 20\text{mT}$. Again, it will be appreciated that in other embodiments, the magnetic tamper threshold
10 range may be greater or less than $\pm 20\text{mT}$.

If at the second decision point 410 it is determined that the sampled signal is outside the magnetic tamper threshold range, then a magnetic tamper event may be indicated. This may be indicative of the presence of a strong external magnet.

If at the second decision point 410 it is determined that the sampled signal is
15 not outside the magnetic tamper threshold range, then at a third decision point 415 it may be determined whether the magnetic field sensed by the at least one sensor has varied by more than a second threshold range. In Figure 4, the second threshold range is referred to as the "MF_ChangeThreshold", and for purposes of non-limiting example is $\pm 2\text{mT}$. In some examples, it may be determined that the magnetic field sensed by
20 the at least one sensor has varied by more than a second threshold range by determining a difference between a maximum level and a minimum level of the at least one signal.

If at the third decision point 415 it is determined whether the magnetic field sensed by the at least one sensor has not varied by more than a second threshold
25 range, then at a fourth decision point 420 a iteration counter, denoted "itercount" may be incremented, and a determine may be made of whether a value of the iteration counter has reached a predefined maximum iteration value. In the non-limiting example of Figure 4, the predefined maximum iteration value is 10.

If at the fourth decision point 420 it is determined that the value of the iteration
30 counter has reached the predefined maximum iteration value, then it may be indicated that no magnetic tamper event has occurred. In this instance, the tamper interval (which in this non-limiting example was originally set to one hour) may be increased, such as to 6 hours or the like.

If at the fourth decision point 420 it is determined that the value of the iteration counter has not reached the predefined maximum iteration value, then the sampling time may be increased.

5 The sampling time may correspond to a time between samples of the one or more signals.

In the example of Figure 4, if at the fourth decision point 420 it is determined that the value of the iteration counter has not reached the predefined maximum iteration value, then the sampling time may be doubled.

10 In a non-limiting example embodiment wherein the predefined maximum iteration value is 12, a time interval between samples may be $2n$ seconds, where n is the n th read, e.g. 0, 1, 2, ..., 9, 10, 11. Following this approach, the magnetic field values may be sampled at the 0th, 1st, 3rd, 7th, 15th, 31st, 63rd, 127th, 255th, 511th, 1023rd and 2047th seconds.

15 If at the third decision point 415 it is determined whether the magnetic field sensed by the at least one sensor has varied by more than the second threshold range, then at a fifth decision point 425 a determination is made of whether the above-described magnetic tamper current status parameter is already set.

20 If at the fifth decision point 425 a determination is made that the magnetic tamper current status parameter was not already set, then the magnetic tamper current status parameter is set. The magnetic tamper current status parameter being set may indicate that tampering is suspected. After the tamper interval, the process described by Figure 4 is restarted. That is, after the tamper interval (1 hour in this non-limiting example) a determination at the first decision point 405 is made.

25 If at the fifth decision point 425 a determination is made that the magnetic tamper current status parameter was already set, then at a sixth decision point 430 a determination is made of whether the above-described suspected tamper count parameter has reached a predefined maximum value. In the non-limiting example of Figure 4, the predefined maximum value of the suspected tamper count parameter is 3, although it may be more than three or as few as 2 in other examples.

30 If at the sixth decision point 430 a determination is made that the suspected tamper count parameter has not yet reached the predefined maximum value, then the suspected tamper count parameter is incremented. After the tamper interval, the process described by Figure 4 is restarted. That is, after the tamper interval (1 hour in this non-limiting example) a determination at the first decision point 405 may again be made.

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If at the sixth decision point 430 a determination is made that the suspected tamper count parameter has reached the predefined maximum value, then a magnetic tamper event may be indicated.

Figure 5 depicts a utility meter 500 comprising a tamper detection system 510, according to an embodiment of the disclosure. The example tamper detection system comprises a first sensor 515 and a second sensor 520. The first and second sensors 515, 520 are magnetic field sensors. Each of the first sensor 515 and the second sensor 520 sensor may be a Hall-effect sensor, a Tunnel Magnetoresistance (TMR) sensor, a giant Magnetoresistance (GMR) sensor, an Anisotropic Magnetoresistive (AMR) sensor, microelectromechanical systems (MEMS) magnetic sensor, an inductive coil, or the like.

Each of the first sensor 515 and the second sensor 520 are coupled to a processing circuit 525. The processing circuit 525 may comprise at least one processor, microcontroller, or the like. In some other example embodiments, at least a portion of the processing circuit 525 may be physically remote from the utility meter 500, e.g. coupled via a network to the utility meter 500.

The first sensor 515 and the second sensor 520 and/or the processing circuit 525 may comprise an analog front end, e.g. one or more analog-to-digital converters or the like, for sampling a signal provided by the first sensor 515 and the second sensor 520.

The processing circuit 525, together with the first sensor 515 and the second sensor 520, may be configured to operate as the tamper detection system described above with reference to Figure 4. In some further example embodiments, the processing circuit 525 and/or the second sensor 525 may be configured to generate an interrupt if it is determined that the second signal is outside the tamper threshold range.

Also depicted is a dial-wheel 530. The dial-wheel may be configured such that rotation of the dial-wheel induces a varying magnetic field at the first and second sensors 515, 520. For example, the first and second sensors 515, 520 may be disposed in relatively close proximity to the dial-wheel 530, wherein the dial-wheel 530 is configured to be rotated by a flow of metered fluid. The example dial-wheel 530 comprises a magnetic component 535, such as a permanent magnet or the like, for inducing a measurable signal at the first and second sensors 515, 520.

For purposes of example only, the example utility meter 500 also comprises a communications module 540. The communications module 540 is communicatively coupled to the processing circuit 525, and is configured to communicate data to a

remote system, e.g. wirelessly or via wired network. In examples, the communications module 540 may be configured to communicate data corresponding to a tamper detection status.

5 Finally, Figure 6 depicts a method of tamper detection, according to an embodiment of the disclosure. In examples, the method of Figure 6 may be implemented on the utility meter 500 of Figure 5. In a first step 605, a processing circuit 525 coupled to at least one magnetic field sensor 515, 520 may be configured to generate pulses when at least one signal from the at least one sensor 515, 520 is outside a first threshold range, and to count pulses that are generated.

10 In a second step, the processing circuit 525 may determine that no pulses have been counted within a tamper detect interval.

In a third step the processing circuit 525 may determine, based on a level of the at least one signal, whether the magnetic field sensed by the at least one sensor 515, 520 has varied by more than a second threshold range, e.g. the above-described the
15 “MF_ChangeThreshold”.

Although the disclosure has been described in terms of particular embodiments as set forth above, it should be understood that these embodiments are illustrative only and that the claims are not limited to those embodiments. Those skilled in the art will be able to make modifications and alternatives in view of the disclosure, which are contemplated as falling within the scope of the appended claims. Each feature disclosed or illustrated in the present specification may be incorporated in any
20 embodiments, whether alone or in any appropriate combination with any other feature disclosed or illustrated herein.

25 **LIST OF REFERENCE NUMERALS**

- | | |
|--------|-------------------------|
| 405 | First decision point |
| 410 | Second decision point |
| 415 | Third decision point |
| 30 420 | Fourth decision point |
| 425 | Fifth decision point |
| 430 | Sixth decision point |
| 500 | utility meter |
| 510 | tamper detection system |
| 35 515 | first sensor |

	520	second sensor
	525	processing circuit
	530	dial-wheel
	535	magnetic component
5	540	communications module

CLAIMS

1. A tamper detection system (510) for use in a utility meter (500), the system comprising:
 - 5 at least one sensor (515, 520) configured to sense a magnetic field; and
 - a processing circuit (525) coupled to the at least one sensor and configured to generate pulses for incrementing a pulse counter in response to a level of at least one signal from the at least one sensor being outside a first threshold range,
 - 10 wherein, when the processing circuit determines that the pulse counter has not incremented within the tamper detect interval, the processing circuit determines, based on the level of the at least one signal, whether the magnetic field sensed by the at least one sensor has varied by more than a second threshold range.
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2. The tamper detection system (510) of claim 1, wherein the processing circuit (525) is configured to determine that the magnetic field sensed by the at least one sensor (515, 520) has varied by more than a second threshold range by determining a difference between a maximum level and a minimum level of the at least one signal.
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3. The tamper detection system (510) of claim 1 or 2 wherein, when the processing circuit (525) determines that the magnetic field sensed by the at least one sensor (515, 520) has not varied by more than the second threshold range, the processing circuit is configured to :
 - 25 increment an iteration counter;
 - increase a sampling time;
 - sample the at least one signal from the at least one sensor after the sampling time; and
 - 30 make a further determination of whether the magnetic field sensed by the at least one sensor has varied by more than the second threshold range.

4. The tamper detection system (510) of claim 3, wherein the processing circuit (525) is configured to determine that no tamper event has occurred when the iteration counter reaches a predefined maximum iteration value.
5. The tamper detection system (510) of claim 4, wherein the processing circuit (525) is configured to increase the sampling time when the iteration counter is incremented to a value less than the predefined maximum iteration value.
6. The tamper detection system (510) of claim 3, 4 or 5, wherein increasing the sampling time comprises doubling the sampling time.
7. The tamper detection system (510) of any preceding claim wherein, between sampling the at least one signal level from the at least one sensor (515, 520) and determining whether the magnetic field has varied by more than a second threshold range, the processing circuit (525) is further configured to:
 - determine that a tamper event has occurred if the level of the sampled signal is outside a tamper threshold range, wherein the tamper threshold range is larger than the second threshold range.
8. The tamper detection system (510) of any preceding claim wherein, when it has been determined by the processing circuit (525) that the magnetic field sensed by the at least one sensor (515, 520) has varied by more than a second threshold range, the processing circuit is further configured to:
 - set a tamper status to suspected if the tamper status is not set to suspected, or
 - increment a suspected tamper counter if the tamper status is set to suspected.
9. The tamper detection system (510) of claim 8, wherein the processing circuit (525) is configured to determine that a tamper event has occurred when the suspected tamper counter reaches a predefined maximum value.
10. The tamper detection system (510) of any preceding claim, wherein:
 - the at least one sensor (515, 520) comprises a first sensor (515) and a second sensor (520); and

the at least one signal comprises a first signal from the first sensor and a second signal from the second sensor.

- 5 11. The tamper detection system (510) of claim 10, when dependent on claim 7, wherein:
- the processing circuit (525) is configured to use the first signal to generate pulses for incrementing the pulse counter; and
- the second sensor (525) and/or the processing circuit is configured to generate an interrupt if the processing circuit determines that the second signal
- 10 is outside the tamper threshold range.
12. The tamper detection system (510) of any preceding claim, wherein the at least one sensor (515, 520) comprises a Hall-effect sensor.
- 15 13. A utility meter (500) comprising:
- the tamper detection system (510) of any preceding claim; and
- a dial-wheel (530) configured such that rotation of the dial-wheel induces a varying magnetic field at the at least one sensor (515, 520).
- 20 14. The utility meter (500) of claim 13, configured for metering a flow of fluid, wherein the flow of fluid induces rotation of the dial-wheel (535).
15. A method of tamper detection, the method comprising:
- configuring a processing circuit (525) coupled to at least one magnetic
- 25 field sensor (515, 520) to generate pulses when at least one signal from the at least one sensor is outside a first threshold range, and to count pulses that are generated;
- determining that no pulses have been counted within a tamper detect interval; and
- 30 determining, based on a level of the at least one signal, whether the magnetic field sensed by the at least one sensor has varied by more than a second threshold range.