Claims

1. A method for determining a state of operation of a domestic fluid heating system in a plurality of domestic fluid heating systems, comprising:

receiving, from the domestic fluid heating system, a time series of data relating to the operation of the domestic fluid heating system over a cycle of operation; and

determining the state of operation of the domestic fluid heating system based on comparing the received time series with a model of time series of data corresponding to the operation of the plurality of domestic fluid heating systems over a cycle of operation.

2. The method according to claim 1, wherein the comparing comprises matching a pattern of the received time series of data to a pattern of the model of time series of data, or wherein the comparing comprises retrieving the model of time series of data from a database.

3. The method according to claim 1 or claim 2, wherein the plurality of domestic fluid heating systems is connected to a network, and wherein the receiving of the time series comprises receiving the data over the network, or wherein the plurality of domestic fluid heating systems comprises different types of domestic fluid heating systems, and wherein the model of time series of data corresponds to a type of domestic fluid heating systems.

4. The method according to any one of claims 1 to 3, further comprising assembling the model of time series of data based on time series of data relating to the operation of the plurality of domestic fluid heating systems, received from the plurality of fluid heating systems, or further comprising storing a predetermined model of time series of data.

5. The method according to any one of claims 1 to 4, wherein the determining of the state of operation of the domestic fluid heating system comprises diagnosing normal operation of the domestic fluid heating system based on the comparing, or wherein the determining of the state of operation of the domestic fluid heating system comprises diagnosing a fault of the domestic fluid heating system based on the comparing,

6. The method according to any one of claims 1 to 5, further comprising detecting a trend of operation of the domestic fluid heating system, based on the determining of the state of operation of the domestic fluid heating system over at least two cycles of operation, or further comprising predicting a need for maintenance based on the detecting of the trend.

7. The method according to any one of claim 5 or claim 6 when dependent on claim 5, further comprising triggering maintenance of the domestic fluid heating system based on the predicting.

8. The method according to any one of claims 1 to 7, wherein the cycle of operation comprises a period of transient mode of operation and a period of steady mode of operation, or comprising defining a cycle of operation based on:
deriving from a duration taken from a first time series and from a portion of a second time series selected based on the first time series, and/or
using specific parameters in the data.

9. The method according to any one of claims 1 to 8, further comprising assembling the model of time series of data based on data received from the plurality of systems during a set up, or further comprising predefining the model of time series of data based on programming.

10. The method according to any one of claims 1 to 9, performed at least partly locally in the heating system.

11. The method according to any one of claims 1 to 10, wherein the domestic fluid heating system is a domestic boiler.

12. The method according to any one of claims 1 to 11, wherein the received time series of data relates to the operation of a component of the domestic fluid heating system over a cycle of operation, or wherein the time series of data comprises:
raw appliance data; and/or
enhanced data derived from the raw appliance data; and/or
at least a derived feature.

13. The method according to any one of claims 1 to 12, comprising displaying processed time series of data in an interface on a display screen of a device, enabling a user to navigate between different displays of time series of data, or comprising integrating input from external sources, or comprising regularly updating displays of the time series of data, or comprising validating and/or building reference data to train and/or develop an anomaly detector, or comprising defining and/or configuring additional, new, derived features and/or any associated parameters.

14. The method according to any one of the claims 2 to 13, wherein the pattern matching comprises defining groupings of one or more derived features to use against the model time series data.

15. The method according to any one of the claims 1 to 14, wherein the comparing comprises comparison between processed data from multiple fluid heating systems in order to characterise common behaviours and/or differences.

16. A device configured to determine a state of operation of a domestic fluid heating system in a plurality of domestic fluid heating systems, configured to:

receive, from the domestic fluid heating system, a time series of data relating to the operation of the domestic fluid heating system over a cycle of operation; and

determine the state of operation of the domestic fluid heating system based on comparing the received time series with a model of time series of data corresponding to the operation of the plurality of domestic fluid heating systems over a cycle of operation.

17. The device according to claim 16, further configured to perform a method according to any one of claims 2 to 15.

18. The device according to claim 16 or claim 17, further configured to retrieve the model of time series of data from a database.

19. The device according to any one of claims 16 to 18, wherein the domestic fluid heating system is a domestic boiler.

20. A computer program product comprising program instructions to program a processor to carry out data processing of a method according to any one of claims 1 to 15, or to program a processor to provide a device of any one of claims 16 to 19.