Patent claims

1. An arrangement (1) for inspecting an object (2), in particular a construction (2), comprising
   - a mobile measuring unit (13) for determining a measurement value assigned to the object (2), in particular by a user on site (10), wherein the measuring unit (13) has an interface for data exchange with further units (12, 14-17) of the arrangement (1), in particular a base unit (3; 12),
   - an, in particular mobile, base unit (3; 12), in which data sets communicated by the measuring unit (13) are storable and preferably visually representable and which has an interface for data exchange with further units (13-17) of the arrangement (1), in particular at least the mobile measuring unit (13), and preferably a proprietary or public network,
   - a detection means (14) for detecting a measurement position (32) at which the measurement value is determined, and/or for detecting a measurement time at which the measurement value is determined,

   wherein a measurement value determined by the measuring unit (13) is communicatable at least together with a measurement position and/or measurement time detected by the detection means (14), preferably automatically, as a data set to the base unit (3; 12), and wherein the mobile measuring unit (13) is designed for nondestructively determining measurement values concerning an internal structure and/or an internal state of, in particular inaccessible, elements (8) of the object (2), in particular components (8) of the construction (2).

2. The arrangement (1) as claimed in claim 1, **characterized in that** the detection means (14) comprises an in particular mobile capture unit (17), which is designed and positionable before the determination of the measurement value at a measurement position (32) in such a way that the determination of the measurement value, in particular by the user on site, by means of the mobile measuring unit (13) is capturable photographically and/or on film by the capture device (17).

3. The arrangement (1) as claimed in claim 2, characterized in that the capture unit (17) comprises a buffer store that stores captured shots only during a predefined limited period of time.

4. The arrangement (1) as claimed in either of claims 2 and 3, **characterized in that** at least one field of view which encompasses at least the mobile measuring unit (13) and/or the user on site (10) during the determination of the measurement value and surroundings of the measurement position (32) is detectable with the in particular mobile capture unit (17).

5. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** it comprises a triangulation system.

6. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** the arrangement (1), in particular the mobile measuring unit (13), comprises a displacement capture system integrated in particular into the measuring unit (13).

7. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** a marking unit (15) is present, with which the measurement position is markable on the object (2), wherein the marking unit (15) is preferably integrated into the measuring unit (13), such that the measurement position (32) is markable during the determination of the measurement value.

8. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** a macro capture unit (16) is present, with which direct surroundings of the measurement position (32) are capturable photographically and/or on film, wherein the macro capture unit (16) is preferably integrated into the measuring unit (13), such that the direct surroundings of the measurement position (32) are capturable during the determination of the measurement value.

9. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** the arrangement (1) comprises an inertial navigation system integrated in particular into the macro capture unit (16) or into the capture unit (17).

10. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** it contains a recording device, which detects at least one acceleration value and/or a moisture value and/or a temperature value and/or a specific radiation value preferably together with the measurement time and/or the measurement position if at least one predefined threshold value of one of these values was exceeded.

11. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** the

interface of the base unit (12) is designed for linking to a public or proprietary external network, and the arrangement (1) comprises a server (3), to which the base unit (12) is linked or linkable for data exchange via the public or proprietary network, wherein the server (3) is accessible to an authorized user (7) via a, preferably public, network.

12. The arrangement (1) as claimed in claim 11, **characterized in that** the server (3) comprises at least one stored data structure which is assigned to the object (2) to be inspected, wherein the server (3) is designed to supplement the data structure with data communicated by the base unit (12) and to provide the supplemented data structure to the authorized user (7), in particular as a virtually accessible three-dimensional model (9) of the object (2) to be inspected, in particular in real time.

13. The arrangement (1) as claimed in either of claims 11 and 12, **characterized in that** the server (3) comprises a library (5) of programs with which data sets of the data structure that are selected in a targeted manner by the authorized user (7) are conditionable and/or retrievable.

14. The arrangement (1) as claimed in any of claims 11 to 13, **characterized in that** an instruction is communicatable by the authorized user (7) via the server (3), preferably in real time, wherein the instruction is in particular a measurement instruction or an instruction for determining at least one additional measurement value or a capture instruction.

15. The arrangement (1) as claimed in claim 14, **characterized in that** the instruction contains indications concerning the measurement position at which the measurement or capture is intended to be effected.

16. The arrangement (1) as claimed in claim 15, **characterized in that** the arrangement (1), in particular the mobile measuring unit (13) or the macro capture unit (16), is programmed in such a way that the measurement or the capture is effected automatically when the predefined measurement position is reached.

17. The arrangement (1) as claimed in any of claims 11 to 16, **characterized in that** the server (3) is provided as an information technology infrastructure that is dynamically adaptable to a demand, in particular as a cloud-based server (3).

18. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** the mobile measuring unit (13) is designed for carrying out at least one or a plurality of the following measurements:

- ultrasonic measurement,
- radiography,
- eddy current measurement,
- electrical resistance measurement,
- potential field measurement,
- rebound measurement,
- acoustic resonance analysis,
- inductive reinforcement locating,
- capacitive reinforcement locating,
- ground penetrating radar,
- strain gauge testing,
- tightness testing,
- radiographic testing,

- penetrant testing,
- resistive moisture measurement,
- impact echo method,
- infrared thermography,
- conductivity testing,
- magnetic-inductive method,
- magnetic powder testing,
- potential field measurement,
- rebound hammer method,
- acoustic emission analysis,
- shearography,
- leakage field measurement,
- ultrasonic testing,
- vibration testing/oscillation analysis,
- eddy current testing,
- time domain reflectometry,
- laser induced plasma spectroscopy,
- metal hardness measurement,
- magnetic resonance imaging,
- X-ray fluorescence measurement,
- microresistance method,
- beta backscatter method,
- coulometric measurement,
- linear polarization method.

19. The arrangement (1) as claimed in any of the preceding claims, **characterized in that**, for repeatedly determining a measurement value at a selected measurement position (32), a monitoring unit (18) fitted to the object (2) temporarily or permanently is present, said monitoring unit having an interface for data exchange with further units (3, 12-17) of the arrangement (1), in particular the base unit (12) and/or the server (3).

20. The arrangement (1) as claimed in claim 19, **characterized in that** the monitoring unit (18) is

designed for carrying out at least one or a plurality of the following measurements:

- ultrasonic measurement,
- radiography,
- eddy current measurement,
- electrical resistance measurement,
- potential field measurement,
- rebound measurement,
- acoustic resonance analysis,
- inductive reinforcement locating,
- capacitive reinforcement locating,
- ground penetrating radar,
- strain gauge testing,
- tightness testing,
- radiographic testing,
- penetrant testing,
- resistive moisture measurement,
- impact echo method,
- infrared thermography,
- conductivity testing,
- magnetic-inductive method,
- magnetic powder testing,
- potential field measurement,
- rebound hammer method,
- acoustic emission analysis,
- shearography,
- leakage field measurement,
- ultrasonic testing,
- vibration testing/oscillation analysis,
- eddy current testing,
- time domain reflectometry,
- laser induced plasma spectroscopy,
- metal hardness measurement,
- magnetic resonance imaging,
- X-ray fluorescence measurement,
- microresistance method,
- beta backscatter method,
- coulometric measurement,

- linear polarization method,
- moisture measurement,
- temperature measurement,
- radiation measurement (for example measurement of electromagnetic and/or radioactive radiation),
- acceleration measurement,
- linear displacement capture measurement,
- rotation measurement,
- measurement of optical fibers contained in the object.

21. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** the data set that is communicatable to the base unit (3; 12) and storable there furthermore contains at least one additional measurement value, such as, for example, a strain value and/or a moisture value and/or a temperature value and/or a specific radiation value and/or an acceleration value and/or a measurement value measured by one of the measurements as claimed in claim 20.

22. A method for inspecting an object (2), in particular a construction (2), in particular for implementation using an arrangement (1) as claimed in any of the preceding claims, comprising the following steps:
- nondestructively determining a measurement value concerning an internal structure and/or an internal state of, in particular inaccessible, components (8) of the object (2) by a mobile measuring unit (13), wherein in particular the measuring unit (13) is operated by a user,
- detecting a measurement position (32) at which the measurement value is determined, and/or a

measurement time at which the measurement value is determined, by a detection means (14),

- in particular automatically, communicating the measurement value determined by the measuring unit (13) at least together with the measurement position and/or measurement position detected by the detection means (14) as a data set via a data interface to a base unit (3; 12),
- storing the data set in the base unit (3; 12).

23. The method as claimed in claim 22, **characterized by** the following steps:

- communicating a data set from the base unit (12) to a server (3), in particular comprising measurement values concerning an internal structure and/or an internal state of, in particular inaccessible, components (8), preferably via a public or proprietary network, wherein the server (3) comprises at least one stored data structure assigned to the object (2) to be inspected,
- supplementing the data structure with the data set communicated by the base unit (12),
- providing, in particular in real time, the data structure, in particular on the server (3), in particular as a virtually accessible three-dimensional model (9) of the object (2) to be inspected, for an authorized user (7) and/or a user on site.

24. The method as claimed in claim 23, **characterized in that** an instruction is communicated by an authorized user (7) via the server (3), preferably in real time, wherein the instruction is in particular a measurement instruction or an instruction for determining at least one

additional measurement value or a capture instruction.

25. The method as claimed in any of claims 22 to 24, **characterized in that** the determination of the measurement value by means of the mobile measuring unit (13) is captured photographically and/or on film, in particular by a capture unit (17).

26. The method as claimed in any of claims 22 to 25, **characterized in that** a field of view is detected which encompasses at least the mobile measuring unit (13) and/or the user on site (10) during the determination of the measurement value and surroundings of the measurement position (32), wherein the detection is effected in particular with the capture unit (17).

27. The method as claimed in claim 26, **characterized in that** the detection of the field of view is stored only during a predefined limited period of time.

28. The method as claimed in any of claims 22 to 27, **characterized in that** the measurement position is marked on the object (2), in particular with a marking unit (15).

29. The method as claimed in any of claims 22 to 28, **characterized in that** direct surroundings of the measurement position (32) are captured photographically and/or on film, in particular by means of a macro capture unit (16).

30. The method as claimed in any of claims 22 to 29, **characterized in that** a measurement or a capture is effected automatically when a predefined measurement position is reached.

Patent claims

1. An arrangement (1) for inspecting an object (2), in particular a construction (2), comprising
   - a mobile measuring unit (13) for determining a measurement value assigned to the object (2), in particular by a user on site (10), wherein the measuring unit (13) has an interface for data exchange with further units (12, 14-17) of the arrangement (1), in particular a base unit (3; 12),
   - an, in particular mobile, base unit (3; 12), in which data sets communicated by the measuring unit (13) are storable and preferably visually representable and which has an interface for data exchange with further units (13-17) of the arrangement (1), in particular at least the mobile measuring unit (13), and preferably a proprietary or public network,
   - a detection means (14) for detecting a measurement position (32) at which the measurement value is determined, and/or for detecting a measurement time at which the measurement value is determined,

   wherein a measurement value determined by the measuring unit (13) is communicatable at least together with a measurement position and/or measurement time detected by the detection means (14), preferably automatically, as a data set to the base unit (3; 12), and wherein the mobile measuring unit (13) is designed for nondestructively determining measurement values concerning an internal structure and/or an internal state of, in particular inaccessible, elements (8) of the object (2), in particular components (8) of the construction (2).

2. The arrangement (1) as claimed in claim 1, **characterized in that** the detection means (14) comprises an in particular mobile capture unit (17), which is designed and positionable before the determination of the measurement value at a measurement position (32) in such a way that the determination of the measurement value, in particular by the user on site, by means of the mobile measuring unit (13) is capturable photographically and/or on film by the capture device (17).

3. The arrangement (1) as claimed in claim 2, characterized in that the capture unit (17) comprises a buffer store that stores captured shots only during a predefined limited period of time.

4. The arrangement (1) as claimed in either of claims 2 and 3, **characterized in that** at least one field of view which encompasses at least the mobile measuring unit (13) and/or the user on site (10) during the determination of the measurement value and surroundings of the measurement position (32) is detectable with the in particular mobile capture unit (17).

5. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** it comprises a triangulation system.

6. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** the arrangement (1), in particular the mobile measuring unit (13), comprises a displacement capture system integrated in particular into the measuring unit (13).

7. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** a marking unit (15) is present, with which the measurement position is markable on the object (2), wherein the marking unit (15) is preferably integrated into the measuring unit (13), such that the measurement position (32) is markable during the determination of the measurement value.

8. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** a macro capture unit (16) is present, with which direct surroundings of the measurement position (32) are capturable photographically and/or on film, wherein the macro capture unit (16) is preferably integrated into the measuring unit (13), such that the direct surroundings of the measurement position (32) are capturable during the determination of the measurement value.

9. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** the arrangement (1) comprises an inertial navigation system integrated in particular into the macro capture unit (16) or into the capture unit (17).

10. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** it contains a recording device, which detects at least one acceleration value and/or a moisture value and/or a temperature value and/or a specific radiation value preferably together with the measurement time and/or the measurement position if at least one predefined threshold value of one of these values was exceeded.

11. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** the

interface of the base unit (12) is designed for linking to a public or proprietary external network, and the arrangement (1) comprises a server (3), to which the base unit (12) is linked or linkable for data exchange via the public or proprietary network, wherein the server (3) is accessible to an authorized user (7) via a, preferably public, network.

12. The arrangement (1) as claimed in claim 11, **characterized in that** the server (3) comprises at least one stored data structure which is assigned to the object (2) to be inspected, wherein the server (3) is designed to supplement the data structure with data communicated by the base unit (12) and to provide the supplemented data structure to the authorized user (7), in particular as a virtually accessible three-dimensional model (9) of the object (2) to be inspected, in particular in real time.

13. The arrangement (1) as claimed in either of claims 11 and 12, **characterized in that** the server (3) comprises a library (5) of programs with which data sets of the data structure that are selected in a targeted manner by the authorized user (7) are conditionable and/or retrievable.

14. The arrangement (1) as claimed in any of claims 11 to 13, **characterized in that** an instruction is communicatable by the authorized user (7) via the server (3), preferably in real time, wherein the instruction is in particular a measurement instruction or an instruction for determining at least one additional measurement value or a capture instruction.

15. The arrangement (1) as claimed in claim 14, **characterized in that** the instruction contains indications concerning the measurement position at which the measurement or capture is intended to be effected.

16. The arrangement (1) as claimed in claim 15, **characterized in that** the arrangement (1), in particular the mobile measuring unit (13) or the macro capture unit (16), is programmed in such a way that the measurement or the capture is effected automatically when the predefined measurement position is reached.

17. The arrangement (1) as claimed in any of claims 11 to 16, **characterized in that** the server (3) is provided as an information technology infrastructure that is dynamically adaptable to a demand, in particular as a cloud-based server (3).

18. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** the mobile measuring unit (13) is designed for carrying out at least one or a plurality of the following measurements:

- ultrasonic measurement,
- radiography,
- eddy current measurement,
- electrical resistance measurement,
- potential field measurement,
- rebound measurement,
- acoustic resonance analysis,
- inductive reinforcement locating,
- capacitive reinforcement locating,
- ground penetrating radar,
- strain gauge testing,
- tightness testing,
- radiographic testing,

- penetrant testing,
- resistive moisture measurement,
- impact echo method,
- infrared thermography,
- conductivity testing,
- magnetic-inductive method,
- magnetic powder testing,
- potential field measurement,
- rebound hammer method,
- acoustic emission analysis,
- shearography,
- leakage field measurement,
- ultrasonic testing,
- vibration testing/oscillation analysis,
- eddy current testing,
- time domain reflectometry,
- laser induced plasma spectroscopy,
- metal hardness measurement,
- magnetic resonance imaging,
- X-ray fluorescence measurement,
- microresistance method,
- beta backscatter method,
- coulometric measurement,
- linear polarization method.

19. The arrangement (1) as claimed in any of the preceding claims, **characterized in that**, for repeatedly determining a measurement value at a selected measurement position (32), a monitoring unit (18) fitted to the object (2) temporarily or permanently is present, said monitoring unit having an interface for data exchange with further units (3, 12-17) of the arrangement (1), in particular the base unit (12) and/or the server (3).

20. The arrangement (1) as claimed in claim 19, **characterized in that** the monitoring unit (18) is

designed for carrying out at least one or a plurality of the following measurements:

- ultrasonic measurement,
- radiography,
- eddy current measurement,
- electrical resistance measurement,
- potential field measurement,
- rebound measurement,
- acoustic resonance analysis,
- inductive reinforcement locating,
- capacitive reinforcement locating,
- ground penetrating radar,
- strain gauge testing,
- tightness testing,
- radiographic testing,
- penetrant testing,
- resistive moisture measurement,
- impact echo method,
- infrared thermography,
- conductivity testing,
- magnetic-inductive method,
- magnetic powder testing,
- potential field measurement,
- rebound hammer method,
- acoustic emission analysis,
- shearography,
- leakage field measurement,
- ultrasonic testing,
- vibration testing/oscillation analysis,
- eddy current testing,
- time domain reflectometry,
- laser induced plasma spectroscopy,
- metal hardness measurement,
- magnetic resonance imaging,
- X-ray fluorescence measurement,
- microresistance method,
- beta backscatter method,
- coulometric measurement,

- linear polarization method,
- moisture measurement,
- temperature measurement,
- radiation measurement (for example measurement of electromagnetic and/or radioactive radiation),
- acceleration measurement,
- linear displacement capture measurement,
- rotation measurement,
- measurement of optical fibers contained in the object.

21. The arrangement (1) as claimed in any of the preceding claims, **characterized in that** the data set that is communicatable to the base unit (3; 12) and storable there furthermore contains at least one additional measurement value, such as, for example, a strain value and/or a moisture value and/or a temperature value and/or a specific radiation value and/or an acceleration value and/or a measurement value measured by one of the measurements as claimed in claim 20.

22. A method for inspecting an object (2), in particular a construction (2), in particular for implementation using an arrangement (1) as claimed in any of the preceding claims, comprising the following steps:
- nondestructively determining a measurement value concerning an internal structure and/or an internal state of, in particular inaccessible, components (8) of the object (2) by a mobile measuring unit (13), wherein in particular the measuring unit (13) is operated by a user,
- detecting a measurement position (32) at which the measurement value is determined, and/or a

measurement time at which the measurement value is determined, by a detection means (14),

- in particular automatically, communicating the measurement value determined by the measuring unit (13) at least together with the measurement position and/or measurement time detected by the detection means (14) as a data set via a data interface to a base unit (3; 12),
- storing the data set in the base unit (3; 12).

23. The method as claimed in claim 22, **characterized by** the following steps:

- communicating a data set from the base unit (12) to a server (3), in particular comprising measurement values concerning an internal structure and/or an internal state of, in particular inaccessible, components (8), preferably via a public or proprietary network, wherein the server (3) comprises at least one stored data structure assigned to the object (2) to be inspected,
- supplementing the data structure with the data set communicated by the base unit (12),
- providing, in particular in real time, the data structure, in particular on the server (3), in particular as a virtually accessible three-dimensional model (9) of the object (2) to be inspected, for an authorized user (7) and/or a user on site.

24. The method as claimed in claim 23, **characterized in that** an instruction is communicated by an authorized user (7) via the server (3), preferably in real time, wherein the instruction is in particular a measurement instruction or an instruction for determining at least one

additional measurement value or a capture instruction.

25. The method as claimed in any of claims 22 to 24, **characterized in that** the determination of the measurement value by means of the mobile measuring unit (13) is captured photographically and/or on film, in particular by a capture unit (17).

26. The method as claimed in any of claims 22 to 25, **characterized in that** a field of view is detected which encompasses at least the mobile measuring unit (13) and/or the user on site (10) during the determination of the measurement value and surroundings of the measurement position (32), wherein the detection is effected in particular with the capture unit (17).

27. The method as claimed in claim 26, **characterized in that** the detection of the field of view is stored only during a predefined limited period of time.

28. The method as claimed in any of claims 22 to 27, **characterized in that** the measurement position is marked on the object (2), in particular with a marking unit (15).

29. The method as claimed in any of claims 22 to 28, **characterized in that** direct surroundings of the measurement position (32) are captured photographically and/or on film, in particular by means of a macro capture unit (16).

30. The method as claimed in any of claims 22 to 29, **characterized in that** a measurement or a capture is effected automatically when a predefined measurement position is reached.