EXPERIMENTAL VALIDATION OF WATER VITALIZATION WITHOUT EXTERNAL ENERGY

Evaluation of the capability of Pranan passive technology to induce water vitalization through physicochemical parameter analysis

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***Abstract* — his study evaluates the ability of the passive Pranan device, developed by Pranan Technologies, to induce measurable physicochemical modifications in water. The research was conducted within the framework of a joint research and development (R&D) program between Pranan Technologies S.L. and the Department of Applied Physics at the Universitat Politècnica de Catalunya (UPC). The experimental approach is based on an operational definition of water vitalization as the reproducible and quantifiable modification of physicochemical parameters associated with enhanced equilibrium and stability of the aqueous system.**

To this end, samples of commercially available bottled water, including Bezoya and Lanjarón, were analyzed before and after exposure to the Pranan device using calibrated and certified instrumentation for the measurement of pH and electrical conductivity. In parallel, control samples were maintained under identical environmental conditions without exposure to the device. The experimental methodology was specifically designed to objectively assess the existence of device-induced modifications generated by a completely passive technology, characterized by the absence of external power supply, chemical reagents, or electrochemical processes acting on the water.

The results revealed reproducible variations in both physicochemical parameters following exposure to the device. Relative pH increases of up to 3.45% were observed, while electrical conductivity increased by as much as 14.44% under the most advanced experimental configurations, substantially exceeding the variations recorded in the control samples. The concurrent modification of both pH and electrical conductivity, together with the consistency of the results obtained across different experimental trials and configurations, supports the hypothesis that exposure to the Pranan device induces a measurable physicochemical reorganization of water.

Within the operational framework adopted in this study, these findings constitute experimental evidence consistent with a process of water vitalization mediated by a completely passive technology and provide an objective foundation for future investigations aimed at elucidating the underlying physical mechanisms and their potential technological applications.

Of particular significance is the fact that these effects were achieved without the use of chemical reagents, external electrical power, batteries, or active electronic systems, representing one of the most innovative and distinctive features of the technology under investigation.

The study also sought to establish general theoretical conclusions regarding both the observed changes in the physicochemical properties of water and the temporal stability of these effects, specifically addressing the persistence of the induced modifications following treatment.

Overall, the results demonstrate that exposure of water to the Pranan device induces measurable and reproducible changes in fundamental physicochemical parameters, consistent with the operational concept of water vitalization adopted throughout the research project.

I. Introduction

Water is the primary constituent of biological systems and plays a direct role in a wide range of physical, chemical, and biochemical processes. Beyond its biological significance, its physicochemical properties are fundamental to numerous industrial, environmental, and technological applications.

Although the water molecule possesses a relatively simple chemical structure, the collective behavior of aqueous systems remains an active area of research across multiple scientific disciplines. Numerous studies have investigated the influence of external physical factors on properties such as pH, electrical conductivity, surface tension, dielectric properties, and the molecular organization of water, with the aim of improving the understanding of the mechanisms capable of modifying its macroscopic behavior.

Within this context, there is growing interest in the investigation of technologies capable of inducing measurable changes in the physicochemical properties of water through non-invasive physical processes. Such studies are of particular interest when the observed modifications occur without the addition of chemical reagents or the direct application of external energy to the medium under investigation.

In this framework, the concept of *water vitalization* is used to describe the occurrence of objective and quantifiable modifications in specific physicochemical parameters associated with enhanced equilibrium and stability of the aqueous system. From an experimental perspective, water vitalization is not defined by subjective criteria or by changes in the chemical composition of water, but rather by the observation of reproducible changes in physical variables that can be objectively quantified using calibrated and standardized instrumentation.

The technology developed by Pranan Technologies falls within this line of research. The system investigated consists of a completely passive device designed to interact with its surrounding environment without the need for an external power supply. Its physical architecture is based on nanotechnology-enabled passive autotransformers composed of multilayer thin films, the geometric configuration of a double-spiral flow channel, and the generation of high-intensity compensated static magnetic fields.

To experimentally evaluate the capability of this technology to induce water vitalization processes, Pranan Technologies and the Department of Applied Physics at the Universitat Politècnica de Catalunya established a joint research and development program aimed at characterizing potential device-induced modifications in water through the measurement of quantifiable physical parameters.

The present investigation focuses on the analysis of two physicochemical variables widely employed in water characterization: pH and electrical conductivity. Both parameters provide objective indicators for assessing potential changes associated with exposure of the water samples to the investigated device and constitute the experimental foundation of the present study.

From this perspective, the observed variations in pH and electrical conductivity are not interpreted merely as isolated changes in two individual physical parameters, but rather as potential indicators of an overall process of physicochemical reorganization and enhanced equilibrium within the aqueous system. Consequently, the experimental evaluation of these parameters constitutes the primary

analytical approach employed in this study to objectively investigate and characterize the water vitalization phenomenon associated with Pranan technology.

II. Pranan–UPC R&D Program

On October 15, 2015, Pranan Technologies S.L. and the Universitat Politècnica de Catalunya (UPC) established a joint research and development (R&D) agreement to experimentally investigate the interaction between the passive technology developed by Pranan Technologies and the physicochemical properties of water.

The study was conducted within the framework of a collaborative R&D program carried out by Pranan Technologies and the Department of Applied Physics at UPC. The agreement established a research program aimed at the experimental characterization of the effects produced by the Pranan device on quantifiable physical parameters, as well as the development of theoretical models capable of interpreting the observed phenomena.

The research program integrates fundamental research, technological development, and experimental validation. Its objectives include the design and optimization of different device configurations, the analysis of the physicochemical response of water following exposure to the Pranan system, the evaluation of physicochemical parameters such as pH and electrical conductivity, the assessment of the temporal stability of the observed effects, and the exploration of potential technological applications derived from the experimental findings.

The experimental methodology combines the formulation of physical hypotheses with the acquisition of experimental data using calibrated and standardized instrumentation. This approach enables an objective assessment of modifications induced by a completely passive technology characterized by the absence of an external power supply, chemical reagents, or electrochemical processes applied to the water.

The scientific direction of the project is led by Dr. Fidel Franco González, Ph.D. in Physics and researcher in the Department of Applied Physics at the Universitat Politècnica de Catalunya, who is responsible for the methodological supervision, experimental design, and interpretation of the experimental results.

The research program has generated a comprehensive set of experimental evidence obtained from different technological configurations developed by Pranan Technologies. The progressive evolution of the prototypes, together with the repetition of the experimental measurements, has made it possible to evaluate the consistency and reproducibility of the observed effects, thereby providing an experimental basis for investigating the physical mechanisms associated with the technology under study.

The collaboration between Pranan Technologies and the Universitat Politècnica de Catalunya combines complementary expertise in technological development and applied scientific research, establishing a research framework aimed at generating experimentally verifiable results through recognized physical parameters and reproducible measurement methodologies.

III. Pranan Passive Technology

The technology developed by Pranan Technologies is based on a completely passive device characterized by the absence of an external electrical power supply, batteries, electronic generators, or any other active energy source.

This feature distinguishes the device from other physical water treatment technologies, which typically rely on electrical currents, electrically generated electromagnetic fields, or externally powered electronic systems to induce modifications in the properties of the treated medium.

From an experimental standpoint, the passive nature of the device represents a significant methodological advantage because it eliminates the influence of variables associated with electrically powered equipment. These variables include electrical harmonics, transient disturbances, electromagnetic noise, and fluctuations originating from power supply systems, all of which may introduce additional uncertainty into the interpretation of the experimental results.

Consequently, the modifications observed throughout the investigation occur in the absence of any direct external energy input to the experimental system. This makes it possible to evaluate the interaction between water and the device solely on the basis of its physical architecture and structural configuration while minimizing the influence of factors associated with energized systems.

This characteristic is particularly relevant to the objectives of the present study, which seeks to determine whether a completely passive system is capable of inducing measurable changes in the physicochemical properties of water. These changes are assessed through quantifiable variables, specifically pH and electrical conductivity, which constitute the primary experimental indicators employed throughout this investigation.

IV. Concept of Water Vitalization and Evaluation Criteria

The concept of water vitalization has attracted considerable interest in several research fields over recent decades. Various authors have proposed that specific physical influences may modify aspects related to the internal organization and physicochemical behavior of water without altering its fundamental chemical composition.

Among the most widely known contributions are the studies conducted by Masaru Emoto, who suggested that different environmental stimuli could influence the formation of crystalline structures during the freezing of water. Although these observations have been the subject of scientific debate because of the challenges associated with their experimental reproducibility, they stimulated further research into the possibility that external physical factors may induce structural and functional modifications in water.

Within this context, the present research program adopts an experimental approach based exclusively on objectively measurable and quantifiable physical variables. The concept of water vitalization employed in this study is not based on qualitative observations or subjective interpretations, but rather on the identification of reproducible modifications in recognized physicochemical parameters measured using calibrated and standardized instrumentation.

From this perspective, water vitalization is operationally defined as the stable and quantifiable modification of specific physicochemical properties of water following exposure to the Pranan device. This operational definition translates a concept traditionally associated with qualitative descriptions into an experimental framework supported by measurable evidence and amenable to statistical analysis.

The experimental evaluation of this phenomenon is based on the analysis of two physicochemical parameters widely used in water characterization: pH and electrical conductivity. The pH provides information regarding the acid-base equilibrium of the system, whereas electrical conductivity serves as a sensitive indicator of the medium's ability to transport electrical charge and of the physicochemical dynamics associated with dissolved constituents.

In addition, the study evaluates the temporal stability of the observed changes and the evolution of the measured parameters relative to reference samples that were not exposed to the device. This approach makes it possible to distinguish spontaneous fluctuations inherent to the system from modifications associated with the experimental treatment.

The results obtained throughout the R&D program revealed concurrent variations in both pH and electrical conductivity, consistently observed across different experimental configurations and different types of water. The simultaneous occurrence of changes in both variables suggests an overall modification of the physicochemical behavior of the aqueous system and provides an objective basis for evaluating the water vitalization phenomenon investigated in this study.

Within this framework, vitalized water is not defined by the incorporation of new substances or by alterations in its chemical composition, but rather by the presence of measurable changes in physical parameters that reflect the evolution of the aqueous system

toward states of enhanced equilibrium and stability. Accordingly, water vitalization is interpreted as a phenomenon that can be experimentally evaluated through quantifiable, reproducible, and comparable variables, thereby establishing a direct link between the theoretical concept and the experimental evidence obtained in the laboratory.

V. Experimental methodology

The present investigation was designed to experimentally evaluate whether exposure of water to the passive Pranan device is capable of inducing measurable modifications in selected physicochemical parameters. The working hypothesis proposes that, if the interaction between the device and the aqueous system produces a physicochemical reorganization of the medium, this interaction should be reflected by objective, detectable, and quantifiable changes in the properties of the water.

To test this hypothesis, an experimental methodology was established based on the measurement of physicochemical parameters widely used in water characterization. Among the various parameters that could potentially be evaluated, pH and electrical conductivity were selected because they are sensitive indicators of changes in the equilibrium state of the aqueous system and can be determined using standardized procedures and calibrated measurement instruments.

The experimental methodology was designed and supervised by the Department of Applied Physics at the Universitat Politècnica de Catalunya, ensuring the application of appropriate quality control and reproducibility criteria for obtaining reliable and comparable results.

The experiments were performed using several types of commercially available bottled water, including Lanjarón and Bezoya, both characterized by low or very low mineralization. Bezoya water was selected as the primary experimental model because of its exceptionally low mineral content and its slightly acidic pH resulting from the presence of dissolved silica. Although the observed pH variations were relatively small, they were considered to reflect a substantial increase in the internal energetic state of the aqueous system.

A second noteworthy observation concerns the variation in electrical conductivity. Despite the inherently low electrical conductivity of this weakly mineralized water, exposure to the Pranan device produced marked increases in conductivity that were proportionally greater than the corresponding changes observed in pH. Previous experimental observations have shown that when conventional vector magnetic fields are applied, the energy of the magnetic field is primarily reflected in increased electrical conductivity, while pH may even exhibit a slight decrease. In contrast, the compensated magnetic field configuration implemented in the Pranan technology produces simultaneous increases in both electrical conductivity and pH.

For each experiment, an initial reference measurement (T0) was obtained to characterize the physicochemical state of the sample prior to exposure to the Pranan device. A second measurement (T1) was subsequently performed after a predefined exposure period. This procedure allowed the evolution of each sample to be monitored and the physicochemical variations occurring during the experimental period to be quantified.

To distinguish the effects potentially associated with the device from the natural variability of water, each experiment included a control sample maintained under identical environmental and temporal conditions as the treated sample, with the sole exception that it was not exposed to the Pranan device. This experimental design enabled direct comparison between treated and control samples and allowed assessment of whether the observed modifications exceeded the spontaneous fluctuations expected under normal conditions.

The use of T0 and T1 measurements is particularly important in the present study because the observed changes occur without the addition of chemical reagents, without modification of the chemical composition of the water, and without any external energy input. Consequently, the experimental evaluation relies on the ability to detect subtle physicochemical variations using high-sensitivity instrumentation and to compare these changes with the natural evolution of the control samples.

The experimental data were analyzed in both absolute and relative terms, with percentage variations calculated between the initial and final measurements. This approach facilitates comparison among water samples with different physicochemical characteristics and provides an objective assessment of the magnitude of the observed effects.

The repetition of the experiments using different device configurations and different types of water also made it possible to evaluate the consistency of the results and to investigate the potential relationship between the technological evolution of the prototypes developed by Pranan Technologies and the magnitude of the experimentally observed modifications.

Within the framework of the present investigation, the observation of simultaneous and reproducible changes in both pH and electrical conductivity constitutes the principal experimental criterion used to evaluate the occurrence of water vitalization processes. Accordingly, the concept of water vitalization is associated with quantifiable physical variables that can be investigated through objective, reproducible, and experimentally verifiable procedures.

VI. Results and analysis

The results obtained throughout the research program revealed consistent modifications in the two physicochemical parameters selected for the experimental evaluation of the water vitalization phenomenon: pH and electrical conductivity. The simultaneous observation of changes in both variables is particularly significant, as these are independent physicochemical parameters that reflect different properties of the aqueous system.

Water samples exposed to the Pranan device consistently exhibited greater pH variations than the corresponding control samples. Among the most representative results were increases from an initial pH of 6.37 to 6.59, corresponding to a relative increase of 3.45%, as well as increases from 6.37 to 6.56 (+2.98%), from 6.60 to 6.68 (+1.21%), and from 5.84 to 5.89 (+0.86%). In contrast, control samples maintained under identical environmental and temporal conditions exhibited substantially smaller variations and, in some experiments, slight decreases in pH.

From a physicochemical perspective, these findings suggest that exposure to the device does not produce random pH fluctuations but rather a systematic response that differs from the natural evolution observed in the reference samples. It is particularly noteworthy that the largest pH increases occurred in samples with the lowest initial pH values, whereas the magnitude of the changes progressively decreased as the system approached near-neutral conditions.

This behavior is consistent with the hypothesis that the observed phenomenon does not simply correspond to an alkalinization process but rather reflects a tendency toward enhanced physicochemical equilibrium. Within this interpretation, the pH modification represents an indirect manifestation of a broader process of physicochemical reorganization within the aqueous system.

A similar trend was observed for electrical conductivity. Treated samples consistently exhibited increases relative to their initial values, with measured variations of 3.25%, 5.12%, 12.66%, and 14.44% under different experimental configurations. By comparison, the control samples displayed only minimal variations, generally below 1%, consistent with the normal fluctuations expected within the experimental system.

The magnitude of the conductivity changes is particularly relevant because this parameter is highly sensitive to modifications in the overall physicochemical behavior of the aqueous system. The repeated observation of conductivity increases substantially greater than those measured in the control samples indicates that the recorded variations cannot be attributed solely to the spontaneous temporal evolution of the water samples.

Another noteworthy finding is the relationship observed between the technological evolution of the device and the magnitude of the measured effects. As the R&D program progressed and successive improvements were incorporated into the different Pranan device configurations, progressively larger increases in electrical conductivity were observed, reaching values exceeding 14% in the most advanced prototypes. This correlation between technological optimization and experimental response provides additional internal consistency to the overall body of experimental evidence.

When considered collectively, the pH and electrical conductivity data exhibit a pattern consistent with the initial research hypothesis. The simultaneous occurrence of modifications in both variables, their reproducibility across independent experiments, and their systematic difference relative to the control samples constitute experimental evidence compatible with a global modification of the physicochemical state of water following exposure to the Pranan device.

According to the operational definition adopted in the present study, these modifications may be interpreted as indicators of a water vitalization process. Within this framework, water vitalization is not associated with changes in the chemical composition of the medium but rather with the appearance of quantifiable variations in physical parameters that reflect the evolution of the aqueous system toward states of enhanced equilibrium and stability. Consequently, the results provide an objective experimental basis for evaluating this phenomenon through measurable, reproducible, and comparable physical variables.

The experimental findings further indicate that the effects induced by compensated magnetic fields differ from those produced by conventional vector magnetic fields, despite both acting on water, a diamagnetic material whose physicochemical properties are modified by magnetic field treatment.

Overall, the results are interpreted within the current scientific understanding of the physical structure of water, water–material interactions, and molecular organization phenomena described in the specialized literature, providing an experimental approach based on quantifiable physicochemical parameters for investigating the phenomenon of water vitalization.

VII. Scientific framework and references

The references selected provide the scientific framework used to contextualize the results obtained throughout the joint R&D program conducted by Pranan Technologies and the Universitat Politècnica de Catalunya. They include studies addressing the structure and physicochemical properties of water, water–material interactions, applied nanotechnology, and various scientific approaches to the concept of water vitalization.

The experimental evidence presented in this study is based exclusively on pH and electrical conductivity measurements performed using calibrated and standardized instrumentation, together with the experimental results obtained during the collaborative research program carried out with the Department of Applied Physics at the Universitat Politècnica de Catalunya.

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VIII. Appendix

Technical documentation and experimental traceability

Introduction

This appendix compiles the technical documentation associated with the experimental components employed throughout the joint research program conducted by Pranan Technologies S.L. and the Department of Applied Physics at the Universitat Politècnica de Catalunya (UPC).

To ensure maximum scientific traceability of the experimental results, this appendix includes photographic documentation of the device used during the experimental trials, technical drawings illustrating its structural architecture, the evolution toward an industrialized configuration, and the specifications of the instrumentation used to determine the physicochemical parameters evaluated in this study.

The information presented complements the experimental results described in the main body of the paper and enables identification of both the technological configuration investigated and the instrumental conditions under which the pH and electrical conductivity measurements were performed.

A.1 Experimental Prototype Used During the Investigation

Figure A.1. Experimental prototype employed in the water vitalization experiments.

The figure shows the experimental device used throughout the R&D program for the exposure of the water samples investigated in this study.

This prototype represents the technological configuration on which the physicochemical characterization experiments described in the present work were conducted. Its design incorporates the functional architecture developed by Pranan Technologies to investigate the interaction between the device and the physicochemical properties of water, enabling the experimental evaluation of parameters such as pH and electrical conductivity under controlled conditions.

A.2 Technical representation and structural architecture of the device

Figure A.2. Technical Representation and Structural Architecture of the Device

The technical documentation presented in this figure includes multiple engineering views and sectional representations of the device used throughout the investigation.

These drawings illustrate the overall geometric configuration of the system, together with the relative arrangement of its internal structural components. This documentation forms part of the engineering development carried out during the research program and constitutes the technical reference used for the manufacture and validation of the experimental prototypes evaluated in the present study.

For reasons of technological protection and intellectual property, certain specific functional aspects of the system are not described in detail in this document.

A.3 Metrological certification and instrument calibration

Figure A.3. Metrological certification and calibration of the measurement equipment.

To ensure the reliability and traceability of the experimental measurements, the equipment used was accompanied by manufacturer-issued certificates covering calibration, quality control, and metrological verification provided by Hanna Instruments. These documents certify the functional verification of the HI2020 instrument together with the dedicated probes used for pH, temperature, and electrical conductivity measurements.

The certificates indicate that the instruments were manufactured, calibrated, and tested using reference standards traceable to internationally recognized measurement standards. Verification procedures included the assessment of parameters such as accuracy, linearity, response time, temperature compensation, and measurement stability. In addition, the quality control procedures were performed in accordance with quality management practices compatible with ISO 9001 requirements.

The use of certified instrumentation is particularly important in the context of the present study, since the observed variations in pH and electrical conductivity fall within ranges that require high measurement sensitivity and precision for their reliable detection and quantification.

A.4 Instrumentation used for the experimental measurements

Figure A.4. Multiparameter measurement system used for the determination of pH and electrical conductivity.

The experimental measurements were performed using the professional Hanna Instruments Edge® HI2020 multiparameter system, designed for laboratory applications and the physicochemical characterization of liquid samples.

The system enables the determination of pH, electrical conductivity, and dissolved oxygen through dedicated digital probes while incorporating automatic temperature compensation, advanced calibration procedures, and integrated data storage capabilities. The instrument provides a resolution of up to 0.001 pH units and 0.01 µS/cm for electrical conductivity, making it well suited for detecting subtle variations in the physicochemical properties of water.

A.5 Industrialized conceptual representation of the Pranan system

Figure A.5. Representation of the industrial evolution of the device developed by Pranan Technologies.

The figure presents an industrialized representation of the system derived from the technological architecture validated during the research program.

This configuration preserves the fundamental physical principles experimentally evaluated throughout the investigation while incorporating improvements related to engineering design, manufacturing processes, mechanical integration, and industrial optimization. The evolution from the experimental prototype to an industrial implementation represents a natural stage in the technology transfer process and reflects the level of maturity achieved by the technology following the successive phases of research, experimental validation, and technological development.

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Figure A.1.

Figure A.2.

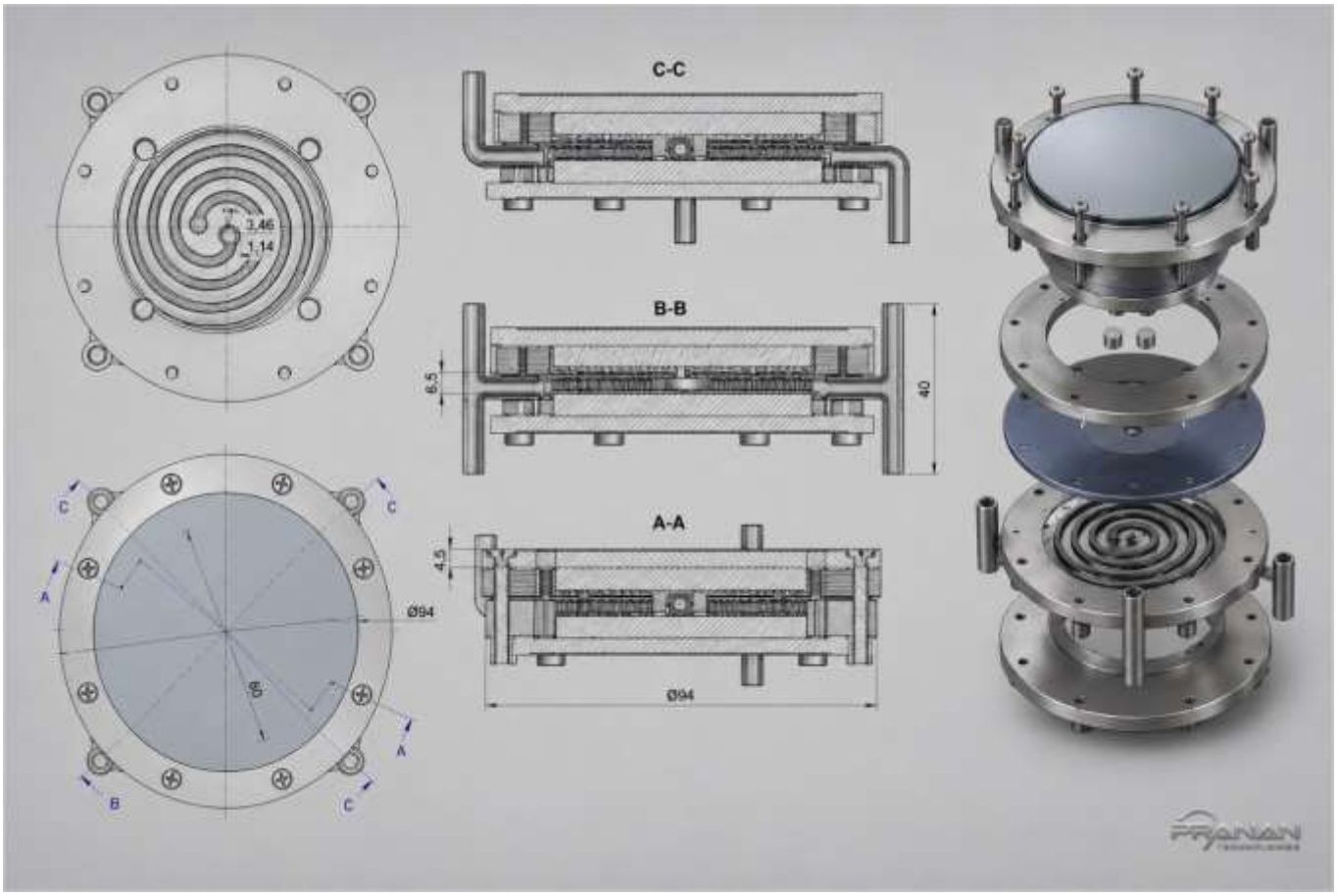
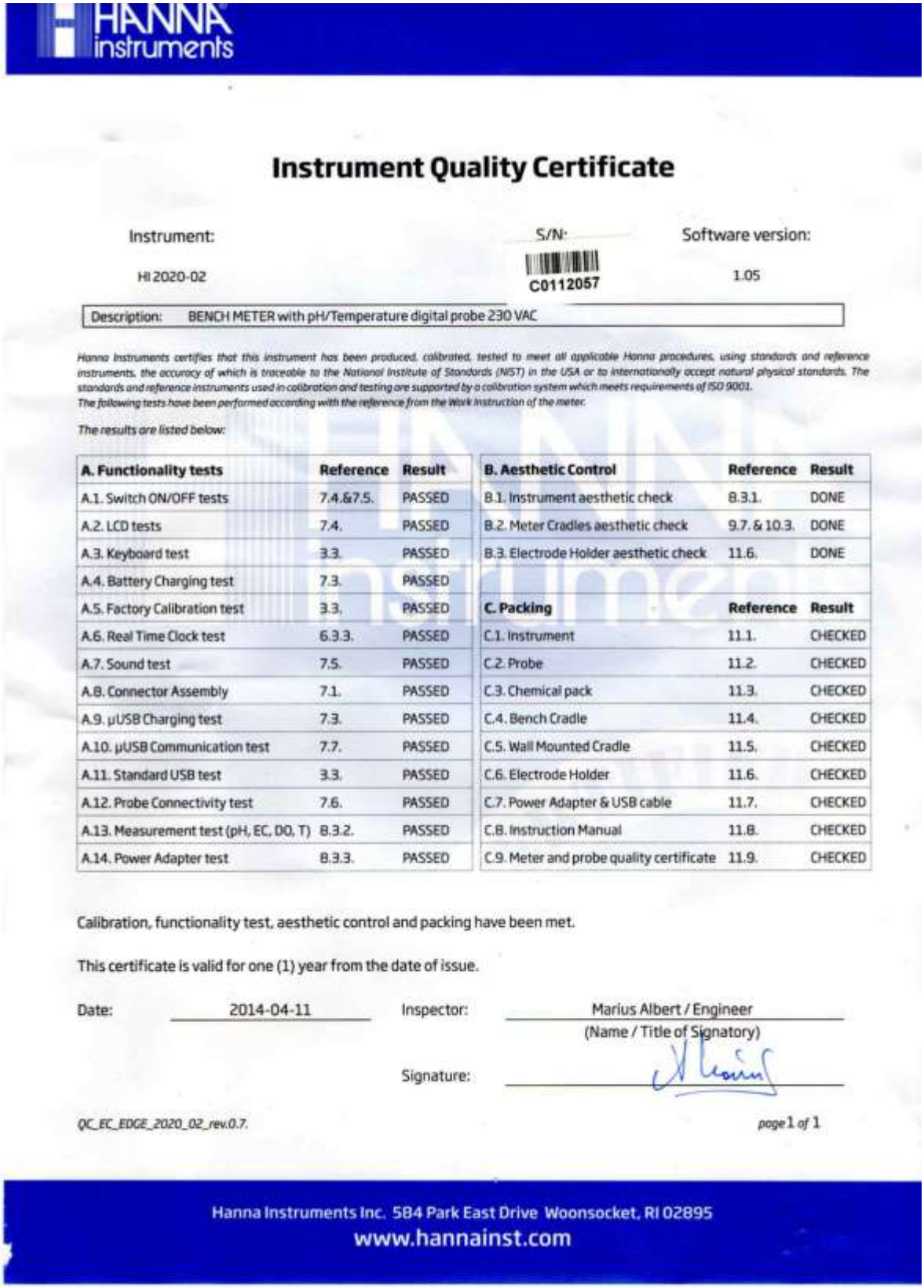


Figure A.3.1.



HANNA instruments

Instrument Quality Certificate

Instrument:	S/N:	Software version:
HI 2020-02	C0112057	1.05

Description: BENCH METER with pH/Temperature digital probe 230 VAC

Hanna Instruments certifies that this instrument has been produced, calibrated, tested to meet all applicable Hanna procedures, using standards and reference instruments, the accuracy of which is traceable to the National Institute of Standards (NIST) in the USA or to internationally accept natural physical standards. The standards and reference instruments used in calibration and testing are supported by a calibration system which meets requirements of ISO 9001.
The following tests have been performed according with the reference from the Work Instruction of the meter.

The results are listed below:

A. Functionality tests	Reference	Result
A.1. Switch ON/OFF tests	7.4.&7.5.	PASSED
A.2. LCD tests	7.4.	PASSED
A.3. Keyboard test	3.3.	PASSED
A.4. Battery Charging test	7.3.	PASSED
A.5. Factory Calibration test	3.3.	PASSED
A.6. Real Time Clock test	6.3.3.	PASSED
A.7. Sound test	7.5.	PASSED
A.8. Connector Assembly	7.1.	PASSED
A.9. µUSB Charging test	7.3.	PASSED
A.10. µUSB Communication test	7.7.	PASSED
A.11. Standard USB test	3.3.	PASSED
A.12. Probe Connectivity test	7.6.	PASSED
A.13. Measurement test (pH, EC, DO, T)	8.3.2.	PASSED
A.14. Power Adapter test	8.3.3.	PASSED

B. Aesthetic Control	Reference	Result
B.1. Instrument aesthetic check	8.3.1.	DONE
B.2. Meter Cradles aesthetic check	9.7. & 10.3.	DONE
B.3. Electrode Holder aesthetic check	11.6.	DONE

C. Packing	Reference	Result
C.1. Instrument	11.1.	CHECKED
C.2. Probe	11.2.	CHECKED
C.3. Chemical pack	11.3.	CHECKED
C.4. Bench Cradle	11.4.	CHECKED
C.5. Wall Mounted Cradle	11.5.	CHECKED
C.6. Electrode Holder	11.6.	CHECKED
C.7. Power Adapter & USB cable	11.7.	CHECKED
C.8. Instruction Manual	11.8.	CHECKED
C.9. Meter and probe quality certificate	11.9.	CHECKED

Calibration, functionality test, aesthetic control and packing have been met.

This certificate is valid for one (1) year from the date of issue.

Date: 2014-04-11 Inspector: Marius Albert / Engineer
(Name / Title of Signatory)

Signature:

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Hanna Instruments Inc. 584 Park East Drive Woonsocket, RI 02895
www.hannainst.com

Figure A.3.2

HANNA instruments

Electrode Quality Certificate

Electrode:	Parameter:	SN:	Firmware:	Recommended for:
HI10530	pH/Temperature	026780	1.04	HI2020

Description: Digital, glass body, double junction, conical tip, pH/temperature electrode

Hanna Instruments certifies that this electrode has been produced, calibrated and tested to meet all applicable Hanna procedures, using standards and reference instruments, the accuracy of which is traceable to the National Institute of Standards (NIST) in the USA or to internationally acceptable national physical standards. The standards and reference instruments used in calibration and testing are supported by a calibration system which meets requirements of ISO 9001.

Standard Reference Materials: pH: 185h, 186g, 187e, 189c, 191d, 2193a [NIST]

External/Internal reference devices*: °C: NTO-031 [NIST Certified Thermometers Set]
KΩ/MΩ: SN#148047ADH [Megohmmeter]

Tests performed using reference devices:

mV (@ 25 °C):	Offset (7.01 pH) [mV]:	0.0			
	Tolerance [mV]:	± 5			
	Reading [mV]:	-1.6			**PASSED**
	Slope (4.01 pH) [mV]:	177.5			
	Tolerance [mV]:	170.4 - 177.5			
	Reading [mV]**:	175.6			**PASSED**
mV response time (4.01 pH → 7.01 pH)***:	Standard time [s]:	< 1			**PASSED**
	Tolerance [s]:	+ 1			
Temperature:	Ref. Temp. [°C]:	5.0	25.0	50.0	
	Tolerance [°C]:	± 0.4	± 0.4	± 0.4	
	Readings [°C]:	5.0	25.0	50.1	**PASSED**
Temperature response time (25 °C → 50 °C)***:	Standard time [s]:	< 45			
	Tolerance [s]:	+ 10			
	Reading [s]:	25			**PASSED**
Glass impedance (@ 25 °C):	Tolerance [MΩ]:	50 - 150			**PASSED**
Reference impedance (@ 25 °C):	Maximum value [KΩ]:	10			**PASSED**

**) All references are periodically checked and are used only if are inside certification interval; NP = not performed.*
***) Offset compensated.*
****) Evaluated for 90 % of step.*

Quality control and testing criteria have been met.

Date: 2016-03-11 Inspector: Jarca Vestița / Engineer
(Name / Title of Signatory)

Signature:

CERTELECT_pH_temp_10530_rev.0.0.2 page 1 of 1

Hanna Instruments Inc. 584 Park East Drive Woonsocket, RI 02895
www.hannainst.com

Figure A.3.3

HANNA instruments

Electrode Quality Certificate

Electrode:	Parameter:	SN:	Firmware:	Recommended for:
HI 11310	pH/Temperature	006289	1.04	HI 2020

Description: Digital, glass body, double junction, pH/temperature electrode

Hanna Instruments certifies that this electrode has been produced, calibrated and tested to meet all applicable Hanna procedures, using standards and reference instruments, the accuracy of which is traceable to the National Institute of Standards (NIST) in the USA or to internationally acceptable national physical standards. The standards and reference instruments used in calibration and testing are supported by a calibration system which meets requirements of ISO 9001.

Standard Reference Materials: pH: 185h, 186g, 187e, 189c, 191d, 2193a [NIST]

External/Internal reference devices*: °C: NTO-031 [NIST Certified Thermometers Set]
KΩ/MΩ: SN#148047ADH [Megohmmeter]

Tests performed using reference devices:

mV (@ 25 °C):	Offset (7.01 pH) [mV]:	0.0			
	Tolerance [mV]:	± 5			
	Reading [mV]:	-1.0			PASSED
	Slope (4.01 pH) [mV]:	177.5			
	Tolerance [mV]:	170.4 - 177.5			
	Reading [mV]**:	173.8			PASSED
mV response time (4.01 pH → 7.01 pH)***:	Standard time [s]:	< 1			PASSED
	Tolerance [s]:	+ 1			
Temperature:	Ref. Temp. [°C]:	5.0	25.0	80.0	
	Tolerance [°C]:	± 0.4	± 0.4	± 0.4	
	Readings [°C]:	5.2	25.2	80.2	PASSED
Temperature response time (25 °C → 50 °C)***:	Standard time [s]:	< 45			
	Tolerance [s]:	+ 10			
	Reading [s]:	40			PASSED
Glass impedance (@ 25 °C):	Tolerance [MΩ]:	100 - 300			PASSED
Reference impedance (@ 25 °C):	Maximum value [KΩ]:	10			PASSED

*) *All references are periodically checked and are used only if are inside certification interval; NP = not performed.*
**) *Offset compensated.*
***) *Evaluated for 90 % of step.*

Quality control and testing criteria have been met.

Date: 2014-01-24 Inspector: Cimpean Vasile / Engineer
(Name / Title of Signatory)

Signature:

CERTELECT_pH_temp_11310_rev.0.1.0

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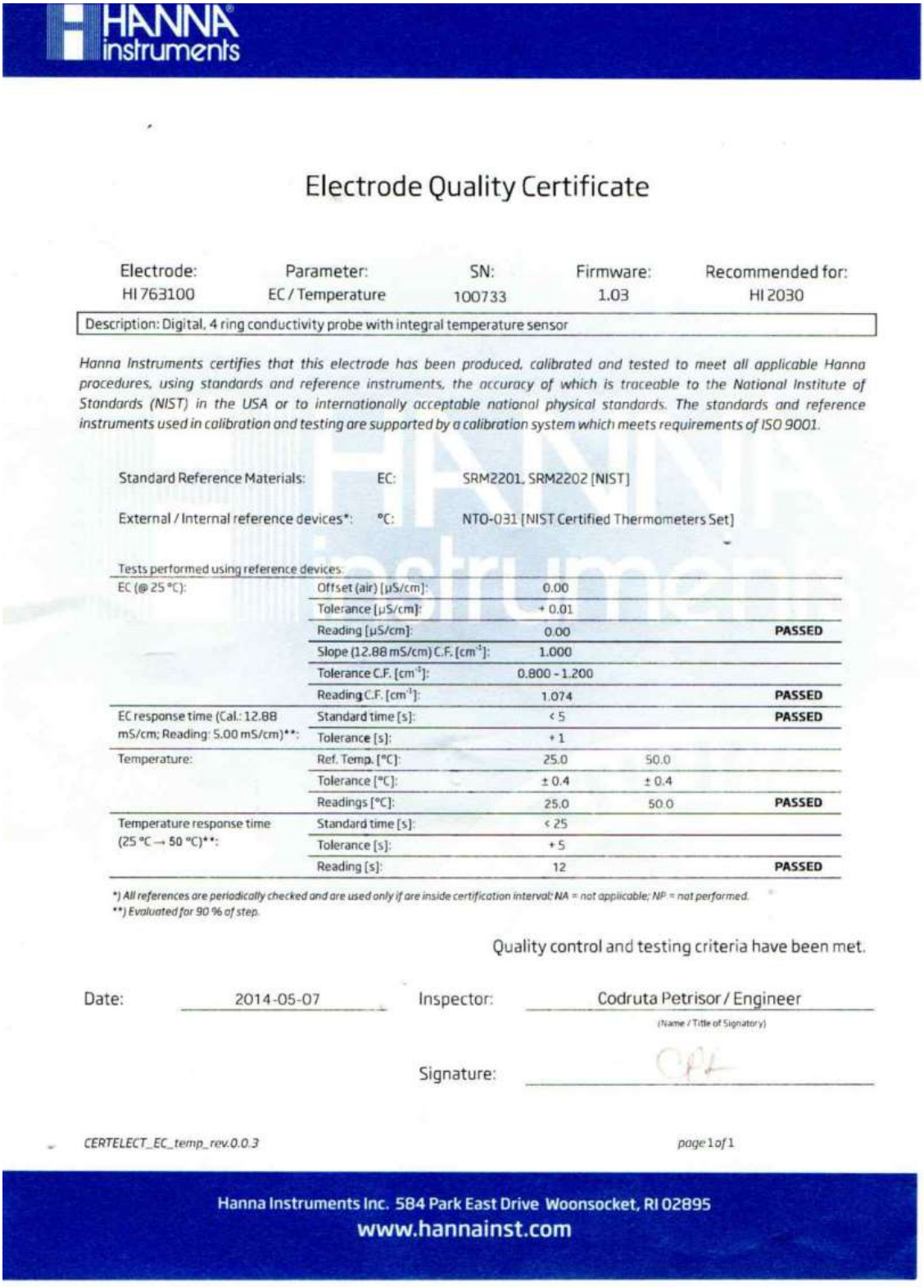
Figure A.3.4



HANNA instruments

Electrode Quality Certificate

Electrode:	Parameter:	SN:	Firmware:	Recommended for:
HI 763100	EC / Temperature	100733	1.03	HI 2030

Description: Digital, 4 ring conductivity probe with integral temperature sensor

Hanna Instruments certifies that this electrode has been produced, calibrated and tested to meet all applicable Hanna procedures, using standards and reference instruments, the accuracy of which is traceable to the National Institute of Standards (NIST) in the USA or to internationally acceptable national physical standards. The standards and reference instruments used in calibration and testing are supported by a calibration system which meets requirements of ISO 9001.

Standard Reference Materials: EC: SRM2201, SRM2202 [NIST]

External / Internal reference devices*: °C: NTO-031 [NIST Certified Thermometers Set]

Tests performed using reference devices:

EC (@ 25 °C):	Offset (air) [µS/cm]:	0.00		
	Tolerance [µS/cm]:	± 0.01		
	Reading [µS/cm]:	0.00		**PASSED**
	Slope (12.88 mS/cm) C.F. [cm^{-1}]:	1.000		
	Tolerance C.F. [cm^{-1}]:	0.800 - 1.200		
	Reading C.F. [cm^{-1}]:	1.074		**PASSED**
EC response time (Cal.: 12.88 mS/cm; Reading: 5.00 mS/cm)**:	Standard time [s]:	< 5		**PASSED**
	Tolerance [s]:	+ 1		
Temperature:	Ref. Temp. [°C]:	25.0	50.0	
	Tolerance [°C]:	± 0.4	± 0.4	
	Readings [°C]:	25.0	50.0	**PASSED**
Temperature response time (25 °C → 50 °C)**:	Standard time [s]:	< 25		
	Tolerance [s]:	+ 5		
	Reading [s]:	12		**PASSED**

*) *All references are periodically checked and are used only if are inside certification interval; NA = not applicable; NP = not performed.*
**) *Evaluated for 90 % of step.*

Quality control and testing criteria have been met.

Date: 2014-05-07 Inspector: Codruta Petrisor / Engineer

(Name / Title of Signatory)

Signature:

CERTELECT_EC_temp_rev.0.0.3 *page 1 of 1*

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Figure A.4

	Rango	Resolución	Calibración
pH	-2 a 16 pH / ±1000 mV	0,01 - 0,001 pH; 0,1 mV	hasta 5 puntos
CE	0,01 µS a 500 mS absoluta	0,01 µS/cm - 0,1 mS/cm	1 punto con patrón a elec
OD	0 a 45 ppm; 0 a 300 %	0,01 ppm; 0,1 % saturación	1 o 2 puntos, 0% y 100%
GLP	Cumplimiento normas GLP		
Registro de datos	Hasta 1000 registros		
Comunicación	Puerto USB para exportar a pen drive		
Sensores	Digitales, conector 3,5 mm, temperatura integrada		

Figure A.5